



ANNUAL PERFORMANCE REPORT

FOR 2014 REPORTING YEAR



September 21, 2015

NOTICE

Data published in the Center for Offshore Safety's (COS) Annual Performance Report for the 2014 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.

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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.

For the 2014 reporting year, the scope of this APR covers COS member wells, projects, and production facilities and operations in the U.S. Outer Continental Shelf (OCS) for SPI data, and areas outside the U.S. for the LFI data. COS operators shared both Operator and Contractor SPI and LFI data relative to activities that occurred on their facilities and within 500 meters of their facilities. COS Contractors and service companies shared 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 February 2015, 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 February 2015, 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 of similar or potentially more severe incidents.

2.0 2014 COS MEMBERS AND PARTICIPANTS

COS MEMBERS

<u>Operators</u>	<u>Rig Contractors</u>	<u>Service Companies</u>	<u>Associations</u>
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	Seadrill Americas	Halliburton	Opito
ConocoPhillips	Transocean	Helmerich & Payne	
ExxonMobil		Oceaneering	
Hess		PetroSkills	
Marathon		Schlumberger	
Murphy E&P		United Fuel Supply	
Noble Energy			
Shell International E&P			
Statoil North America			
TOTAL E&P			

Twelve Operators and eight 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

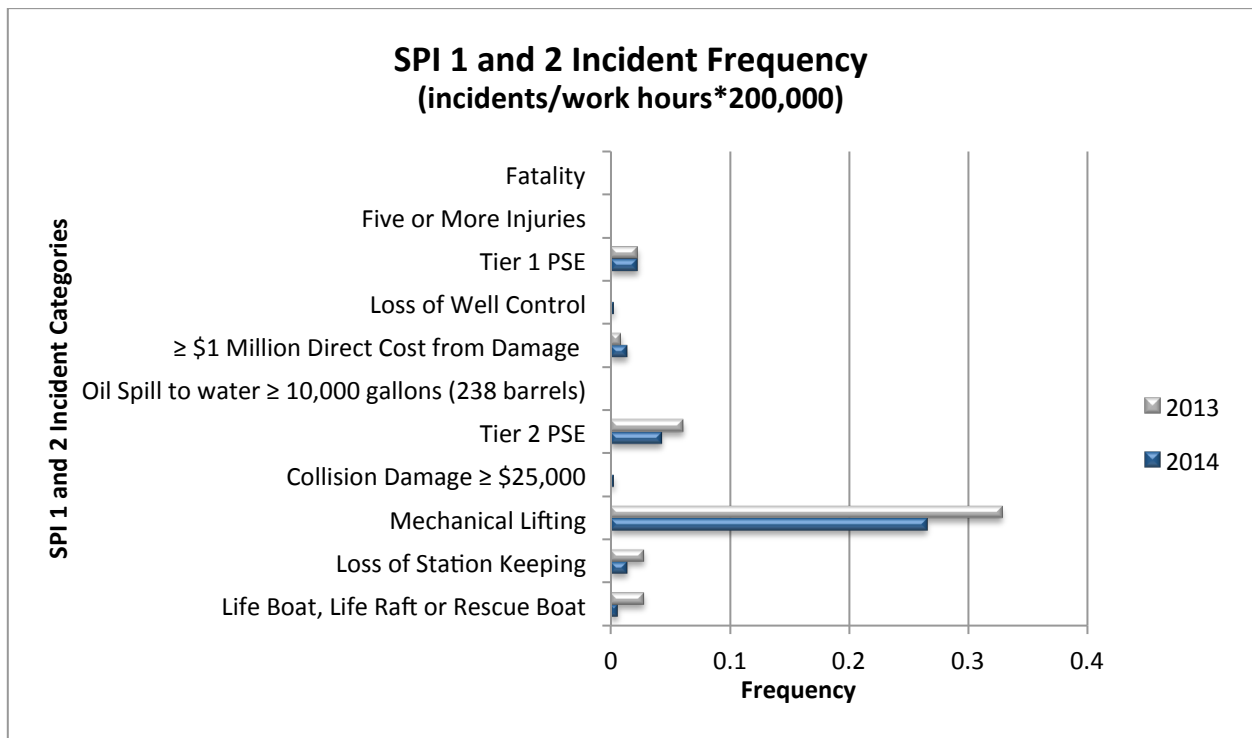
The SPI and LFI Programs began implementation in 2014 reflecting 2013 data. This report provides the associated program information for the 2013 and 2014 reporting years.

No fatalities were reported by participating COS members in 2013 and 2014.

The 2014 SPI data show that no fatalities, no incidents resulting in five or more injuries, and no oil spills to water \geq 10,000 gallons (238 barrels) occurred in the US OCS operations covered by the activity of participating COS members. Participating companies did report eight Tier 1 process safety events, five incidents causing at least \$1 Million direct damage to a facility, vessel, or equipment, and one loss of well control incident.

Participating members reported 15 Tier 2 process safety events and five loss of station keeping incidents resulting in a drive off or drift off. Incidents involving mechanical lifting were reported at the highest frequency for both 2013 and 2014, as compared with other SPI.

The frequency of all SPI 1 and SPI 2 incidents for both 2013 and 2014 are shown below. The frequency of each 2014 SPI decreased or stayed the same from 2013, except for \geq \$1 Million damage incidents.



In 2014, equipment failures were a contributing factor in 46% of the SPI 1 and SPI 2 incidents, which is a decrease from 68% in 2013. The percentage of incidents with failure of lifting equipment decreased. However, the percentage of incidents with failure of pressure relief devices, flares, blowdown system, and rupture disks (PRD/F/BD/RD), and also process equipment, pressure vessels and piping (PE/PV/P) increased in frequency.

Six of the COS participating operator members that owned facilities and equipment reported a combined completion of planned critical maintenance, inspections, and testing (MIT) on time of 99.1%, compared to 96.3% in 2013. Four of the COS participating contractor members reported a combined completion of planned critical maintenance, inspections, and testing on time of 89.3%. This data was reported by contractors for the first time for the 2014 reporting year.

The aggregate DART (days away from work, restricted work, and job-transfer injury and illnesses) and RIIF (recordable injuries and illnesses) for the participating companies was 0.205 and 0.406, respectively. This is a decrease from 0.286 and 0.581 respectively for 2013.

Participating companies reported eight oil spills to water \geq one barrel for 2014. This represents a decrease in frequency of 0.023 versus 0.089 for 2013.

The LFI data included information and learning from 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.

2014 LFI Learnings

A review of the 2014 reporting year incident and HVLE data resulted in the identification of multiple learning opportunities related to the following topics:

- Mechanical Lifting
- Process Safety
- Dynamic Positioning Power and Electrical Systems
- Safety Instrumented Systems

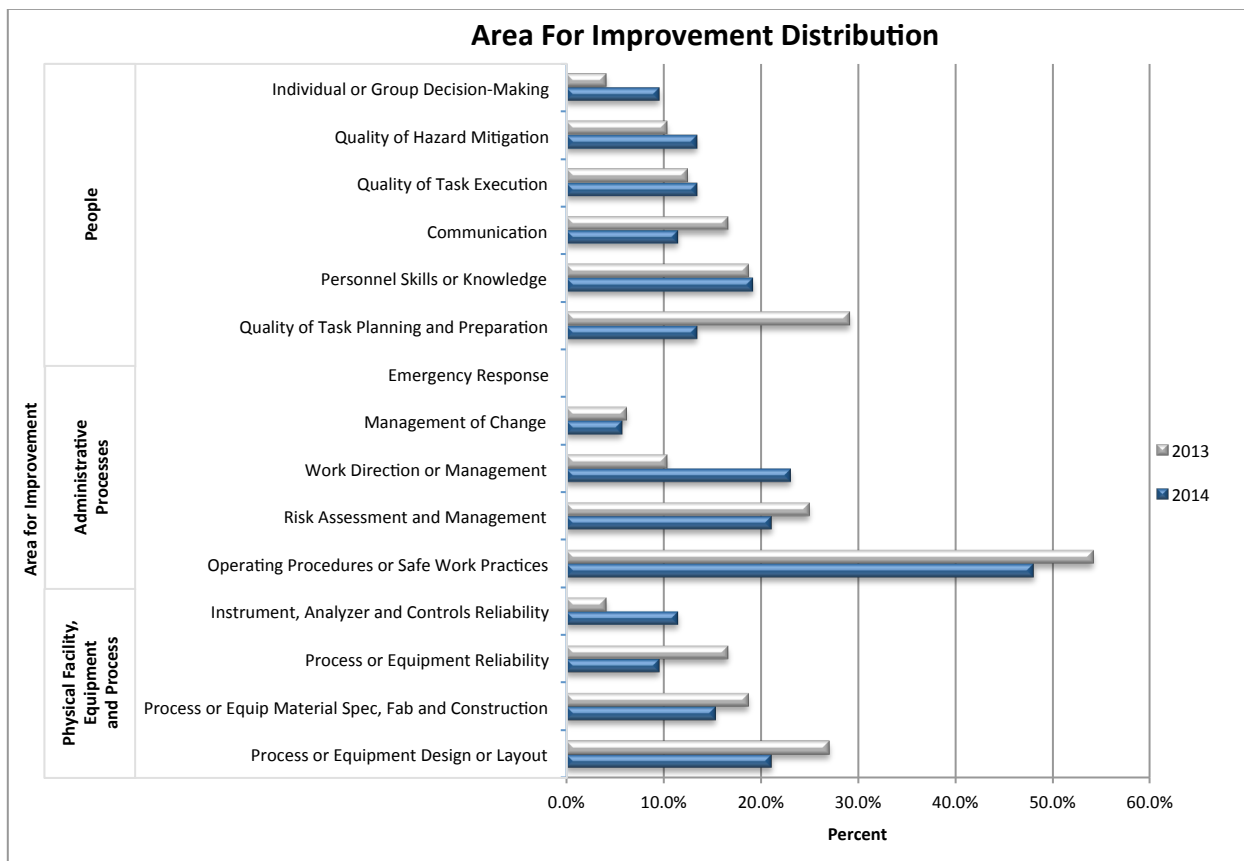
The first three topics listed above were also identified as learning opportunities in 2013. The learnings associated with Mechanical Lifting and Process Safety are the same as those identified in 2013. Operating Procedures or Safe Work Practices was the most commonly identified Area for Improvement for Mechanical Lifting and Process Safety. The Dynamic Positioning learnings are slightly different from 2013, with the focus for 2014 being on power and electrical system reliability rather than task planning and execution.

Safety Instrumented Systems is a new learning topic identified from the 2014 data. Similar to Mechanical Lifting and Process Safety above, Operating Procedures or Safe Work Practices was the most commonly identified Area for Improvement for this learning topic.

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, with a slightly higher occurrence noted in the Administrative category. Among the 15 sub-categories, the most frequently reported improvement areas are indicated below, with the numbers in parenthesis indicates number of times chosen and percentage of reports that selected this improvement area:

- Operating Procedures or Safe Work Practices (25/52 – 48%)
- Work Direction or Management (12/52 - 23%)
- Risk Assessment and Management (11/52 - 21%)
- Process or Equipment Design or Layout (11/52 - 21%)



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 and 52 in 2014). Because the number of AFI exceeds the number of LFI forms, the sum of the percentages can be > 100%.

The selection of Operating Procedures or Safe Work Practices at a ratio > 2:1 over the next closest category supports this as an area of opportunity to strengthen associated prevention and/or mitigation barriers. For 2014, the largest changes in Areas for Improvement selection from the prior reporting year were:

- Work Direction and Management percentages increased from 10% to 23%
- Per the 2014 data as submitted, Quality of Task Planning and Preparation percentage decreased relative to 2013. That said, a review of the 2014 data by LFIC members suggested that Quality of Task Planning was potentially applicable more times than selected.

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

- **SEMS Audit Service Provider (ASP) Accreditation Program**
 - COS Signs MOU with BSEE
 - COS has successfully negotiated and signed a Memorandum of Understanding with BSEE acknowledging COS as an approved Accreditation Body for the purpose of accrediting Audit Service Providers (ASP) to conduct SEMS audits. COS is the first and - at this time - only BSEE acknowledged Accreditation Body for this purpose. For additional information, please visit: <http://www.centerforoffshoresafety.org/SEMSASPAP.html>

- **COS SEMS Audits and Certification Program**
 - Several COS publications are being developed or revised and will be available via the COS website outlining details of this program:
 - *COS-2-03 - Requirements for Third-party SEMS Auditing and Certification of Oil and Gas Operations in the U.S Outer Continental Shelf*
 - *Auditor Guidance for Third-party SEMS Auditing and Certification of Oil and Gas Operations in the U.S Outer Continental Shelf*
 - *Audit Terminology for use in Third-party SEMS Auditing and Certification of Oil and Gas Operations in the U.S Outer Continental Shelf*
 - *COS-2-06 - Report Template for a Third-Party SEMS Audit of Oil & Gas Operations on the U.S Outer Continental Shelf*
 - Since the publication of the 2014 APR, Schlumberger, a COS Contractor member, has earned a COS SEMS Certificate

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 second year that COS members have shared SPI data; therefore, a comparison of year-to-year performance from 2013 to 2014 is now available. 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 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. Loss of well control
- E. \geq \$1 million direct cost from damage to or loss of facility / vessel / equipment
- F. Oil spill to water \geq 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 \geq \$25,000
- C. Crane or personal/material handling operations incident
- D. Loss of station keeping resulting in a drive off or drift off
- E. Life boat, life raft, rescue boat event

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 reserved for future use

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 \geq 1 barrel

SPI 1, SPI 2, SPI 3, and SPI 5 are based on structured assessments of major hazards facing the offshore industry. SPI 7-9 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 \geq \$1 million direct damage cost meets the SPI 1E definition, but also meets the SPI 2B consequence of collision resulting in \geq \$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 and 2014. The 2014 data represents over 69 million operator and contractor work hours in the US OCS compared to 42 million reported in 2013 for GOM deepwater. This is an increase of 63% as the scope of the SPIP expanded to include all US OCS for COS members.

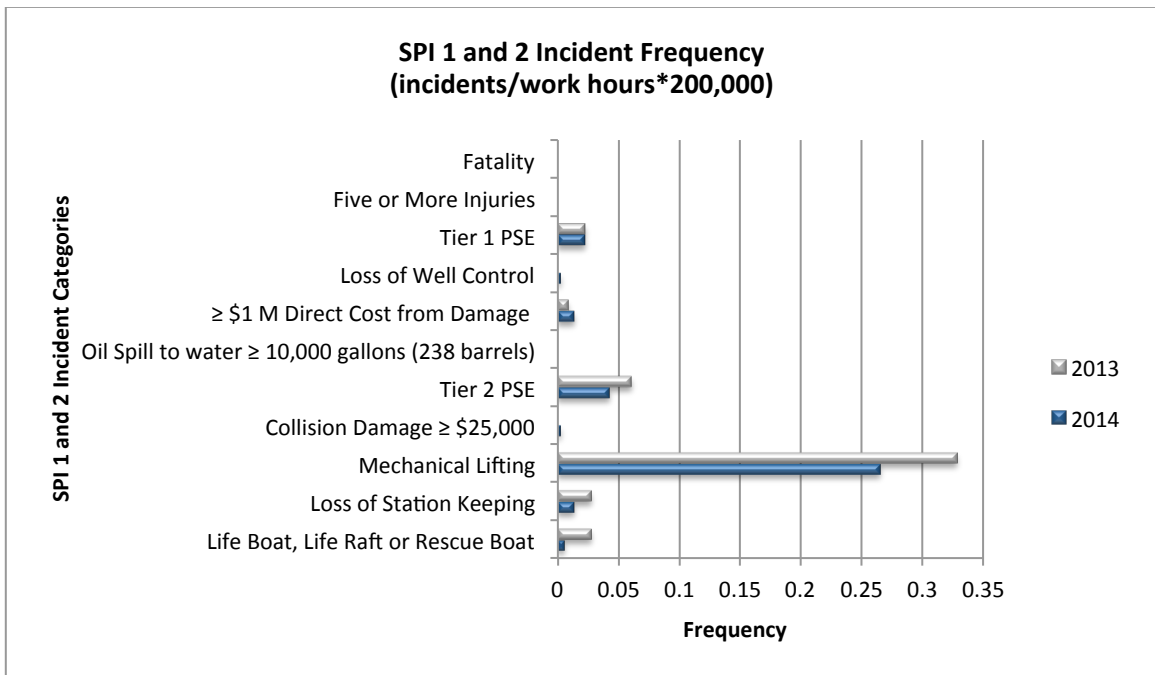
No fatalities were reported by participating COS members in 2013 and 2014.

The 2014 SPI data show that no fatalities, no incidents resulting in five or more injuries, and no oil spills to water \geq 10,000 gallons (238 barrels) occurred in US OCS operations by participating COS members. This is the same performance as 2013.

Participating companies reported eight Tier 1 process safety events, one loss of well control incident and five incidents causing \geq \$1 Million direct damage to a facility, vessel, or equipment.

Participating members also reported 15 Tier 2 process safety events and five loss of station keeping incidents resulting in a drive off or drift off. Incidents involving mechanical lifting were reported at the highest frequency for both 2013 and 2014, compared to other SPI.

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



58 of the 127 (46%) SPI 1 and SPI 2 incidents involved failure of equipment as a contributing factor. This is a decrease from 68% in 2013.

Six Operators shared SPI 5 critical MIT data. Of these, one Operator reported no MIT tasks due to not having ownership of facilities or equipment. Of the five Operators that reported critical MIT data, the combined average for 2014 was 99.1%, ranging from 97.9% to 100.0%. This compares to a combined average of 96.3% for 2013, ranging from 90.5% to 100%. Contractor MIT data was submitted for the first time for 2014. Five Contractors shared SPI 5 critical MIT data. Of these, one Contractor 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 2014 was 89.3%, ranging from 80.4% to 98.6%.

The combined Days Away From Work, Restricted Work and Transfer of Duty Rate (DART) (SPI 7) for COS participating members was 0.205, ranging from 0.000 to 0.650. This is a decrease from the 2013 DART of 0.286. The combined Recordable Injury and Illness Frequency (RIIF) (SPI 8) for COS participating members was 0.406, ranging from 0.000 to 1.767. This is a decrease from the 2013 RIIF of 0.581.

Eight oil spills to water ≥ one barrel (SPI 9) were reported by participating COS members. The oil spill to water frequency was 0.023. This was a decrease from 0.089 in 2013.

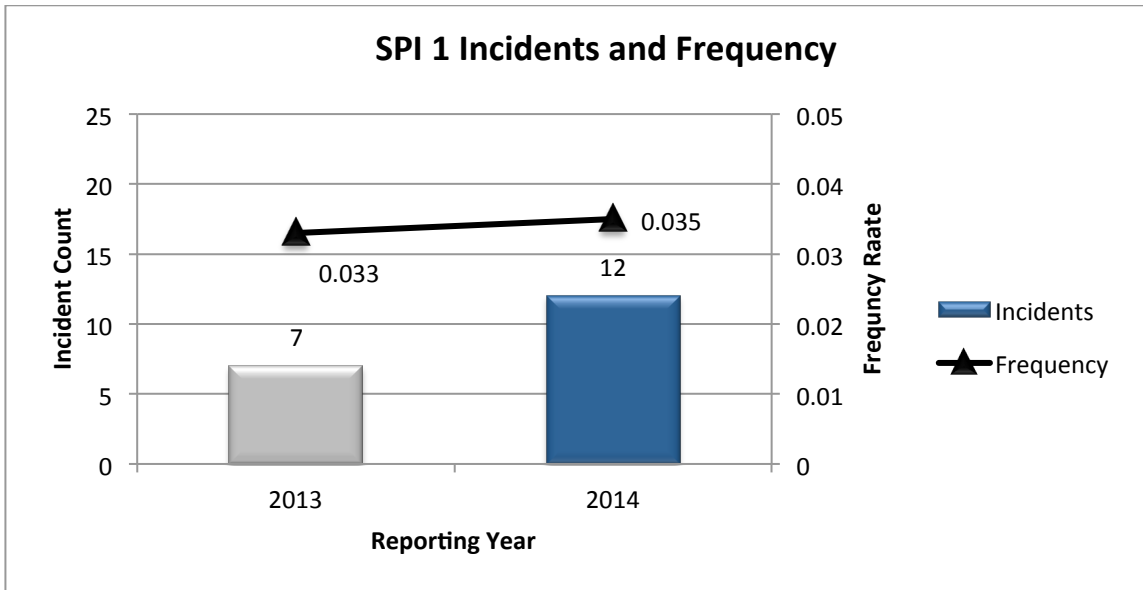
4.3 SPI 1 and 2 Results and Trends

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

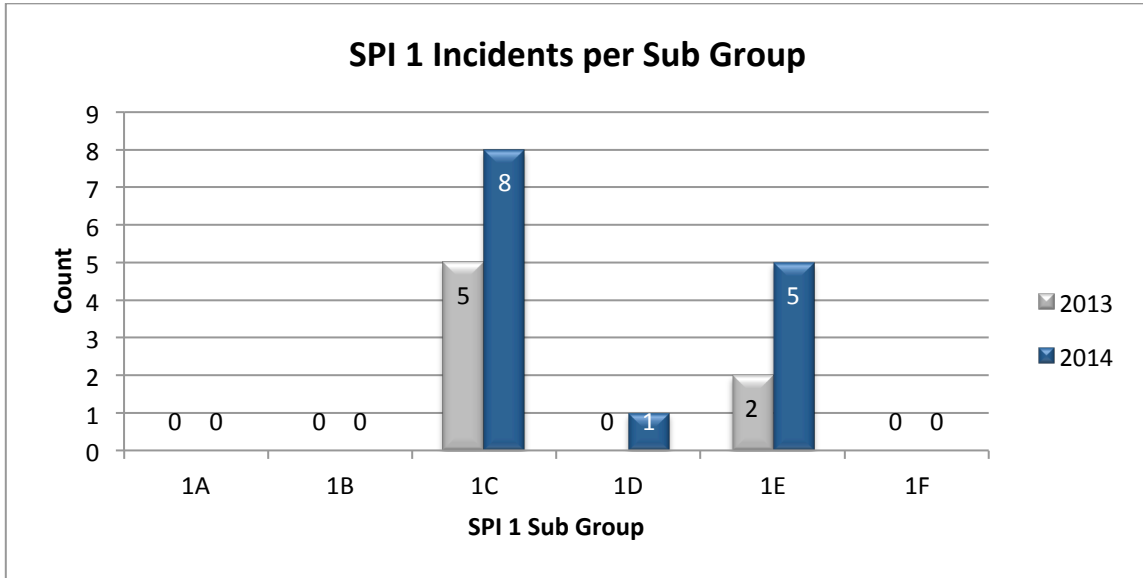
- A. Fatality
- B. Five or more injuries in a single event
- C. Tier 1 process safety event
- D. Loss of well control
- E. \geq \$1 million direct cost from damage to or loss of facility, vessel and/or equipment
- F. Oil spill to water \geq 10,000 gallons (238 barrels)

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 \geq \$25,000
- C. Crane or personal/material handling operations incident
- D. Loss of station keeping resulting in a drive off or drift off
- E. Life boat, life raft, rescue boat event



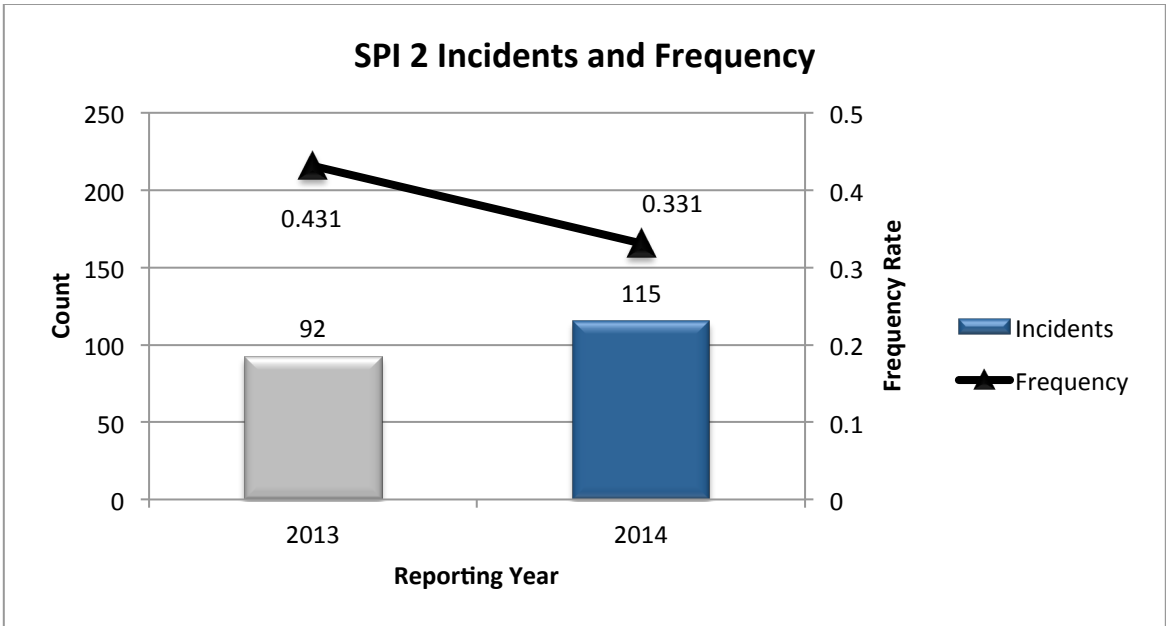
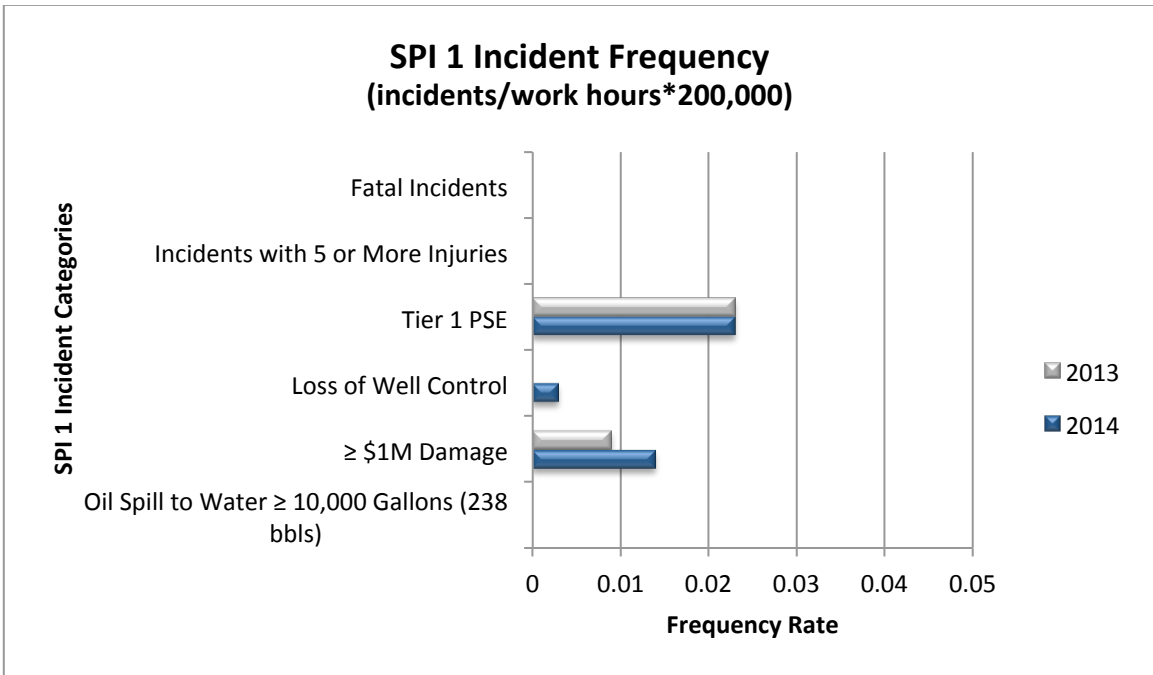
- Twelve SPI 1 incidents were reported at a frequency of 0.035 in 2014. This compares with the 2013 frequency of 0.033.
- All 12 SPI 1 incidents reported in 2014 occurred on a facility or within 500 meters of a facility. Six of seven SPI 1 incidents reported in 2013 occurred on a facility or within 500 meters of a facility.



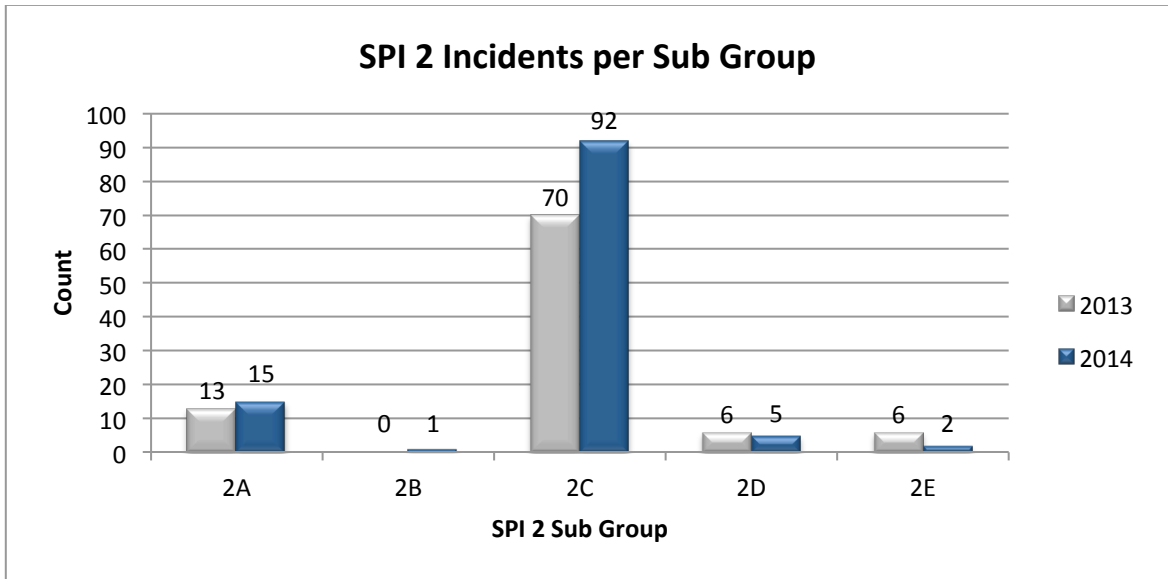
Year	Fatal Incidents (1A)	Incidents with 5 or More Injuries (1B)	Tier 1 PSE (1C)	Loss of Well Control (1D)	≥ \$1M Damage (1E)	Oil Spill to Water ≥ 10,000 Gallons (238 bbls) (1F)
2013	0	0	5	0	2	0
2014	0	0	8	1	5	0

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.

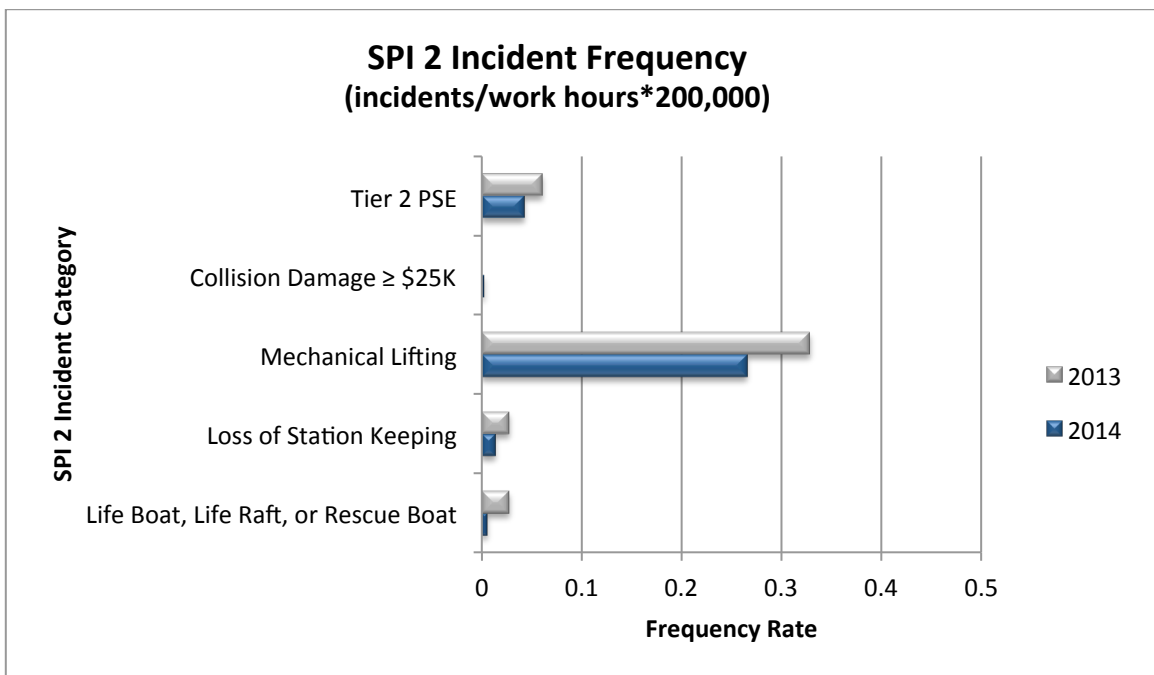
- No incidents were reported that resulted in a fatality (1A), five or more injuries in a single incident (1D), or an oil spill to water ≥ 10,000 gallons (238 barrels) (1F). This is the same performance as 2013.
- Of the 12 SPI 1 incidents reported in 2014, eight were Tier 1 process safety events (1C). The 2014 Tier 1 PSE frequency of 0.023 was unchanged from 2013.
- For loss of well control (1D), there was one incident reported for 2014; zero reported in 2013.
- The frequency of incidents resulting in ≥ \$1M damage increased from 2013 (0.009) to 2014 (0.014).



- A total of 115 SPI 2 incidents were reported in 2014 at a frequency of 0.331. This is a decrease from the 2013 frequency of 0.431.
- For 2014, 111 of 115 (97%) SPI 2 incidents occurred on a facility or within 500 meters of a facility. For 2013, 83 of 92 (90%) SPI 2 incidents occurred on a facility or within 500 meters of a facility.



Year	Tier 2 PSE (2A)	Collision \geq \$25K (2B)	Mechanical Lifting (2C)	Station Keeping (2D)	Life Boat, Life Raft, or Rescue Boat (2E)
2013	13	0	70	6	6
2014	15	1	92	5	2



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.

- Of the 115 SPI 2 incidents reported for 2014, 92 involved mechanical lifting (2C). The mechanical lifting incident frequency was 0.265. This is a decrease from the 2013 frequency of 0.328.

- COS participating members reported 15 Tier 2 Process Safety Events (2A) in 2014, for a frequency of 0.043. This is a decrease from the 2013 frequency of 0.061.
- COS participating members reported five loss of station keeping incidents (2D) in 2014, for a frequency of 0.014. This is a decrease from the 2013 frequency of 0.028.
- One collision resulting in damage \geq \$25K (2B) was reported in 2014; zero reported in 2013.
- COS participating members reported two life boat, life raft, or rescue boat events (2E) in 2014, for a frequency of 0.006. This is a decrease from the 2013 frequency of 0.028.

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. This consequence data is presented below.

Consequence data was collected for seven of the eight Tier 1 PSE shared for 2014. **No fatalities or pressure release device discharges occurred in these seven events.** The combined data did have the following consequences:

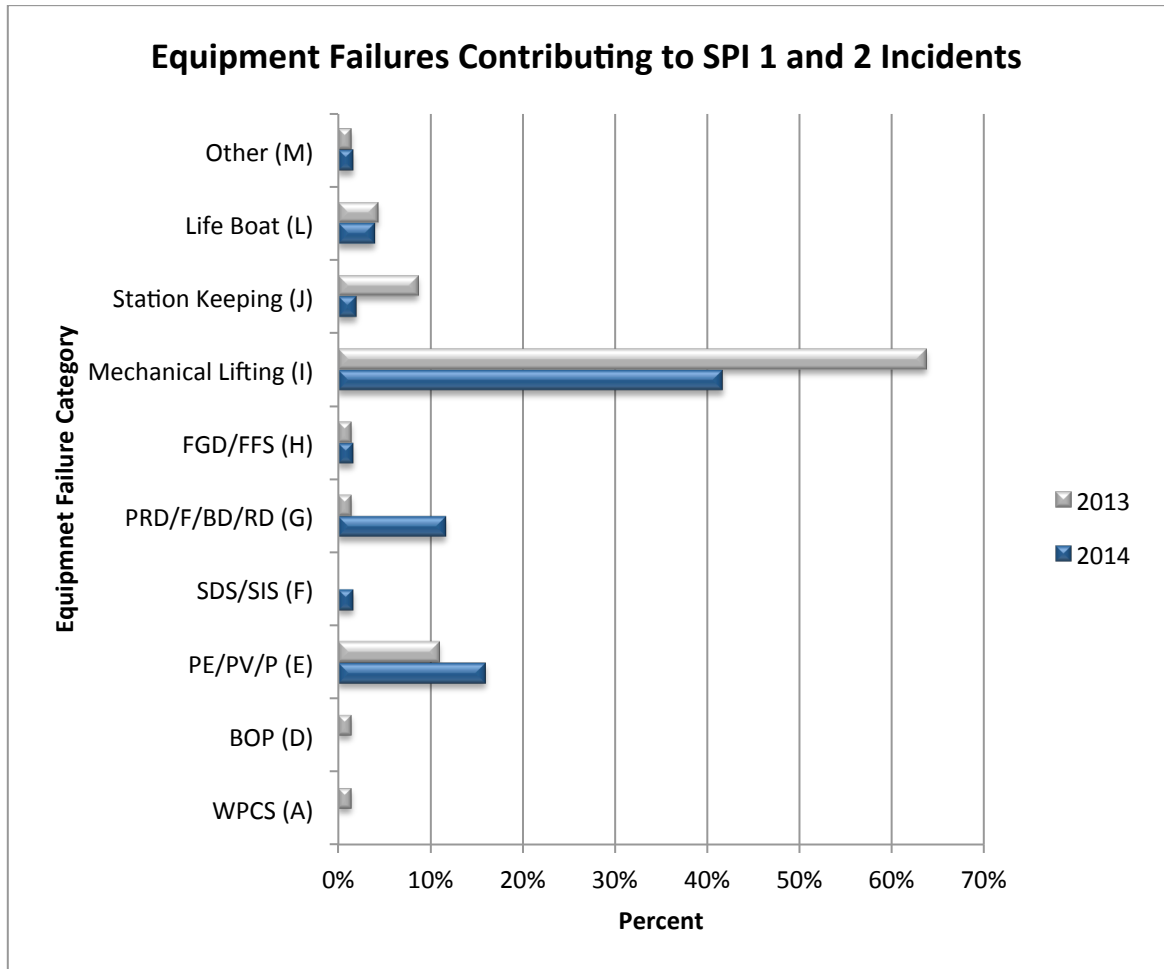
- One days away from work injury
- One fire and explosion causing \geq \$25,000 of direct damage
- Three of the LOPC were non-toxic materials, one was other material and three did not specify a release category.
- Five LOPC were outdoor releases, one was an indoor release, and one did not specify location.

Consequence data was collected on all 15 of the Tier 2 PSE shared for 2014. **No recordable injuries, and no fires or explosions resulting in damage \geq \$2,500, occurred in these 15 events.** The combined data resulted in the following consequences:

- One resulted in a pressure relief device discharge with the consequence of contained liquid carryover.
- All fifteen of the LOPC events were non-toxic materials.
- 11 LOPC events were outdoor releases and four were indoor releases.

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.

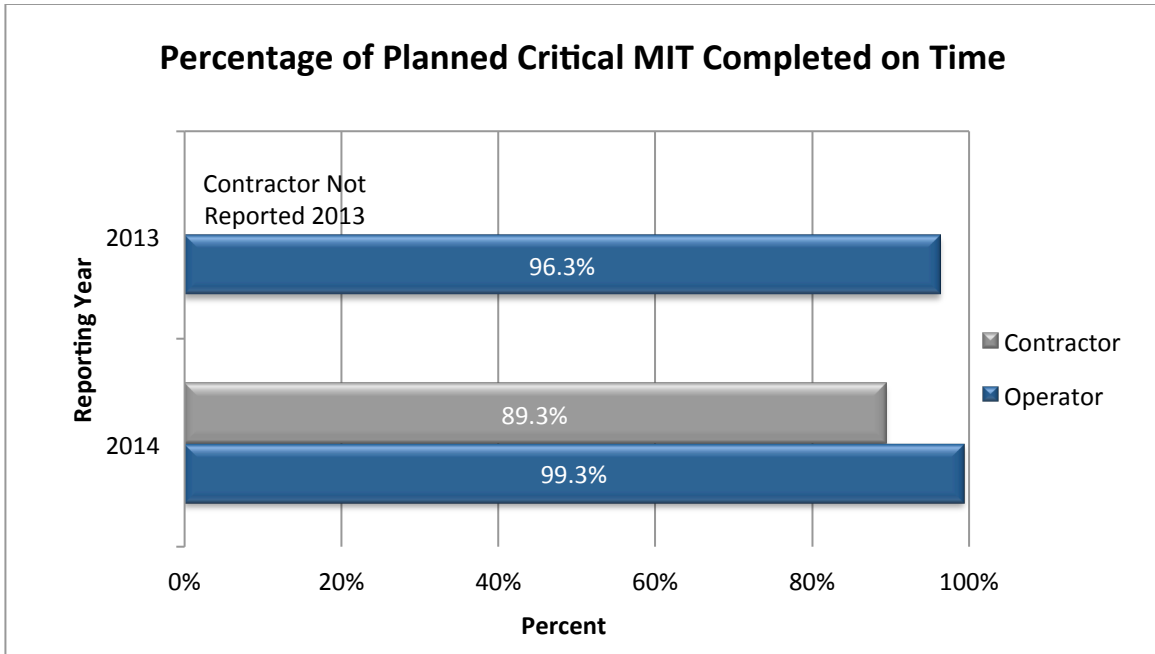


- 45% (57 of the 126) SPI 1 and SPI 2 incidents reported in 2014 involved failure of equipment as a contributing factor. This is a decrease from 68% in 2013.
- 44% (25 of the 57) SPI 3 reported in 2014 involved mechanical lifting equipment. This is a decrease from 64% in 2013.
- 35% (20 of the 57) SPI 3 reported in 2014 involved process equipment, pressure vessels, and piping failures. This is an increase from 16% in 2013.
- 12% (7 of the 57) SPI 3 reported in 2014 involved process relief devices/flares/blowdown/rupture disk failures. This is an increase from 1% in 2013.

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

4.5 SPI 5 Results and Trends

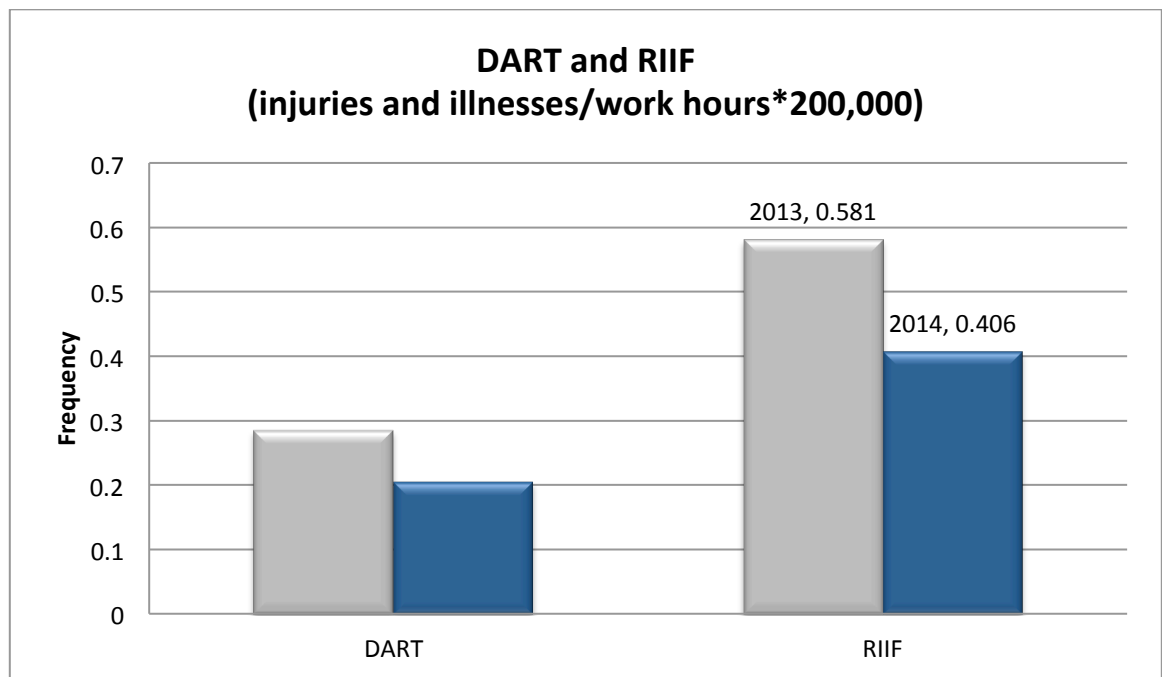
SPI 5 is the percentage of planned critical maintenance, inspection and testing (MIT) completed on time. Planned critical MIT deferred with a formal risk assessment and appropriate level of approval is not considered overdue.



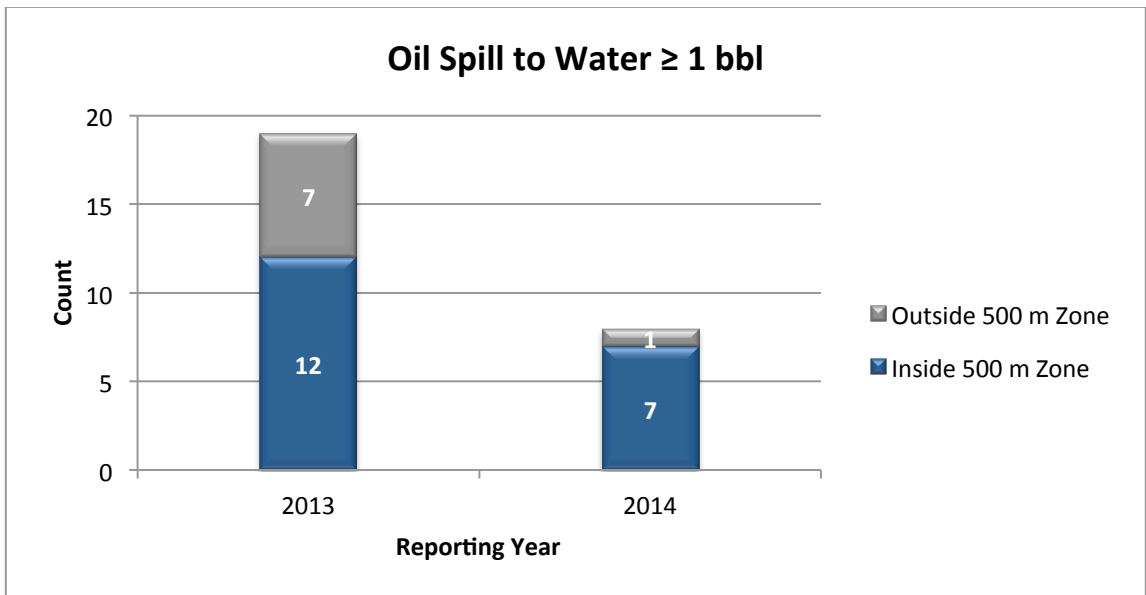
- Five Operators shared SPI 5 critical MIT data. Additionally, one Operator reported no MIT tasks due to not having ownership of facilities or equipment.
- Of the five Operators that reported critical MIT data, the combined average for 2014 was 99.3%, ranging from 97.9% to 100.0%. This compares to 96.3% for 2013, ranging from 90.5% to 100%.
- Contractor MIT data was submitted for the first time for 2014.
- Four Contractors shared SPI 5 critical MIT data. Additionally, one Contractor 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 2014 was 89.3%, ranging from 80.4% to 98.6%.

4.6 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

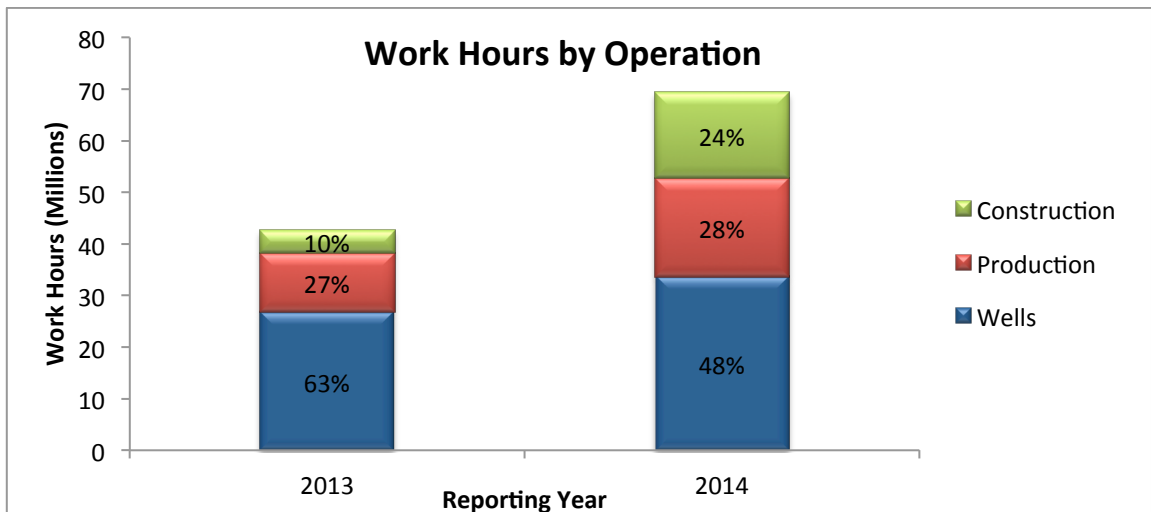


- There were no fatalities (SPI 6) reported by participating COS members in 2014. This is the same performance as 2013.
- The combined DART (SPI 7) for COS participating members was 0.205, ranging from 0.000 to 0.650. This is a decrease from the 2013 DART of 0.286.
- The combined RIIF (SPI 8) for COS participating members was 0.406, ranging from 0.000 to 1.767. This is a decrease from the 2013 RIIF of 0.581.



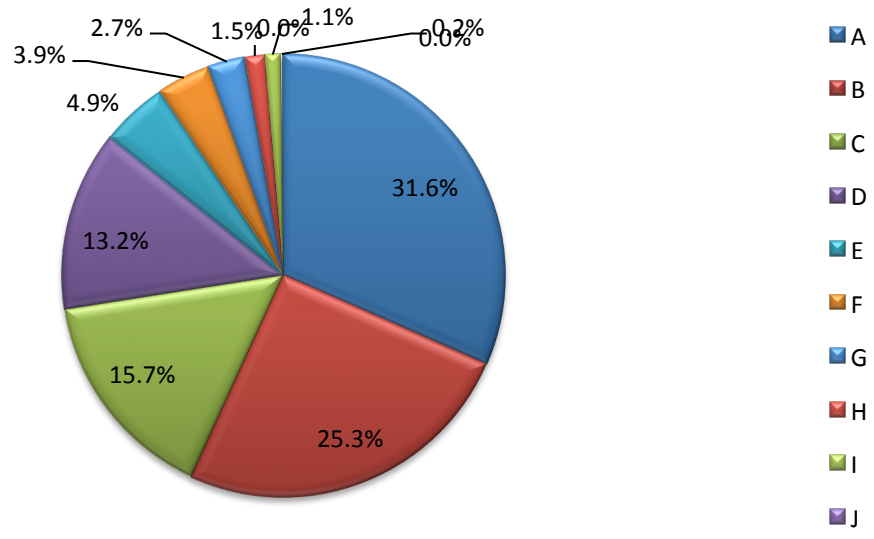
- Eight oil spills to water \geq one barrel (SPI 9) were reported by participating members in 2014. The oil spill to water frequency was 0.023. This was a decrease from 0.089 in 2013.
- Of the eight oil spills reported in 2014, seven occurred on a facility or within 500 meters of a facility.

4.7 Normalization Factor



- The scope of the COS SPIP expanded in 2014 to all of the US OCS vs. deepwater only.
- 69,401,756 work hours were reported by participating COS members in 2014, an increase of 63% over 2013.
- Work hours are reported by the COS member Operator, and include both Operator and Contractor work hours.
- Four operators reported 75.8 % of the work hours represented in the APR.

Work Hours by Company



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 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
- Loss of Well Control
- ≥\$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 crane or personnel/material handling operations
- Loss of station keeping resulting in drive off or drift off
- Life boat, life raft, or rescue boat event

HVLE is defined as, “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. HVLE should meet one or more of the criteria below:”

- 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.

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.

The LFI section provides an analysis and comparison of the SPI 1, SPI 2, and HVLE LFI data submitted for reporting years 2013 and 2014, and includes learnings for COS Members to share within their organizations to potentially prevent recurrence of similar or more severe incidents.

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 within their own organizations.

The LFI data included information and learning from 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.

For the 2014 reporting year, 51 of the 52 reported incidents and HVLE occurred in U.S. waters, with 41 occurring in deepwater locations and 10 occurring in water depths < 1,000 ft. The incidents and HVLE were distributed across multiple operation and facility types, and spanned a variety of consequence categories including personal safety, process safety, environmental impacts, and property damage.

A review of the 2014 reporting year incident and HVLE data resulted in the identification of multiple learning opportunities related to the following topics:

- Mechanical Lifting
- Process Safety
- Dynamic Positioning Power and Electrical Systems
- Safety Instrumented Systems

The first three topics listed above were also identified in 2013. The learnings associated with Mechanical Lifting and Process Safety are the same as those identified in 2013. Operating Procedures or Safe Work Practices was the most commonly identified Area for Improvement for Mechanical Lifting and Process Safety. The Dynamic Positioning learning is slightly revised from 2013, with the focus for 2014 being on power and electrical system reliability rather than task planning and execution.

Safety Instrumented Systems is a new learning topic identified from the 2014 data. Similar to Mechanical Lifting and Process Safety above, Operating Procedures or Safe Work Practices was the most commonly identified Area for Improvement for this learning topic.

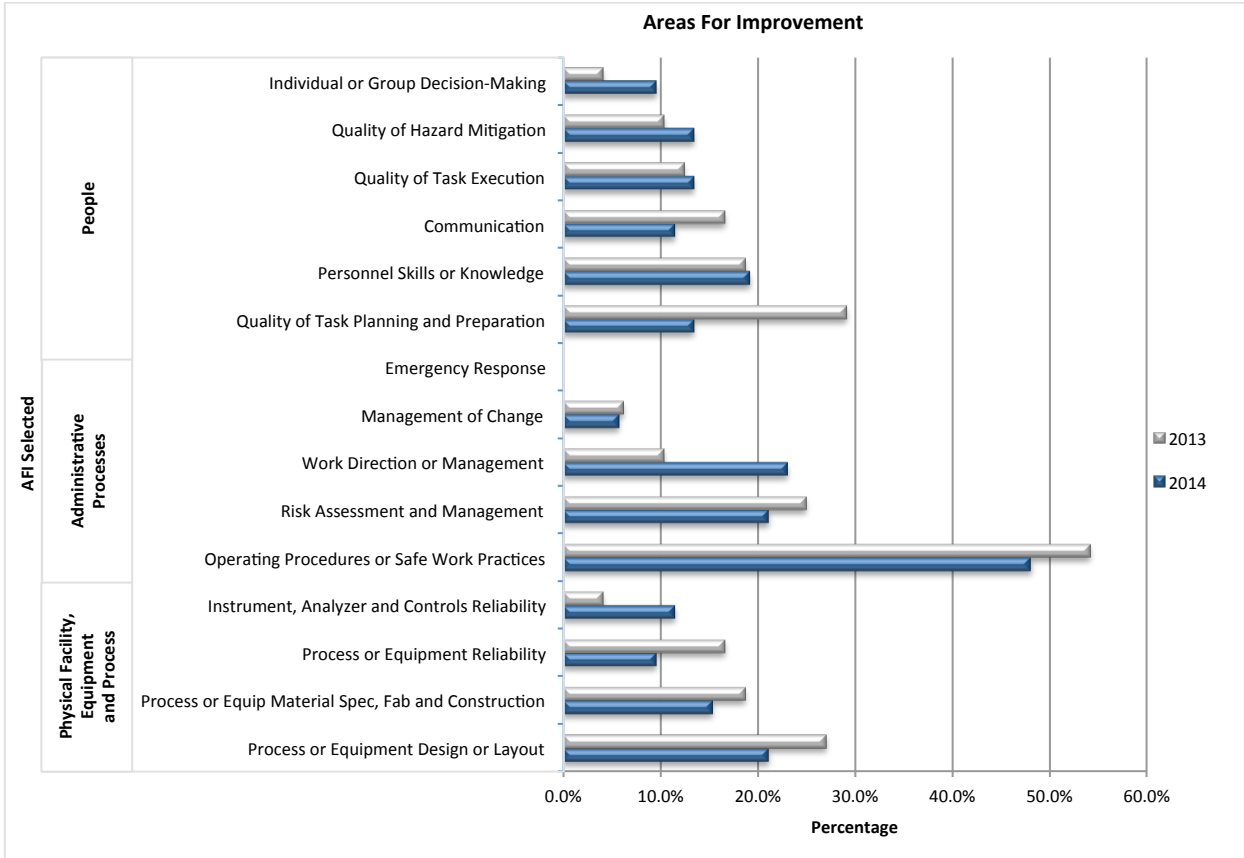
The top four Areas for Improvement (AFI) identified in the 2013 Reporting Year APR remain on the list for the combined 2013/14 reporting years, with Operating Procedures or Safe Work Practices continuing to be identified at a ratio of approximately 2:1 over the next closest category. Refer to Table 1 below.

Table 1 - Top Areas for Improvement – Combined 2013 and 2014 Data Set of 100 Records

Areas for Improvement	2013	2014	% Change
Operating Procedures or Safe Work Practices	26 (54%)	25 (48%)	- 6%
Process or Equipment Design or Layout	13 (27%)	11 (21%)	- 6%
Risk Assessment and Management	12 (25%)	11 (21%)	- 4%
Quality of Task Planning and Preparation	14 (29%)	7 (13%)	- 16%
Work Direction or Management	5 (10%)	12 (23%)	+ 13%

For 2014, the largest changes in Areas for Improvement selection from the prior reporting year were:

- Work Direction and Management percentages increased from 10% to 23%
- Quality of Task Planning and Preparation percentage decreased from 29% to 13%. However, a review of the 2014 data by LFIC members suggested that Quality of Task Planning and Preparation was potentially applicable more times than selected.



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 and 52 in 2014). 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.

5.3 2014 Learnings

A review of the 2014 reporting year incident and HVLE data resulted in the identification of multiple learning opportunities related to the following topics:

- Mechanical Lifting
- Process Safety
- Dynamic Positioning Power and Electrical Systems
- Safety Instrumented Systems

The first three topics listed above were also identified in 2013. The learnings associated with Mechanical Lifting and Process Safety are the same as those identified in 2013. Operating Procedures or Safe Work Practices was the most commonly identified Area for Improvement for Mechanical Lifting and Process Safety. The Dynamic Positioning learning is slightly revised from 2013, with the focus for 2014 being on power and electrical system reliability rather than task planning and execution.

Safety Instrumented Systems is a new learning topic identified from the 2014 data. Similar to Mechanical Lifting and Process Safety above, Operating Procedures or Safe Work Practices was the most commonly identified Area for Improvement for this learning topic.

5.3.1 Mechanical Lifting

As in 2013, SPI 2C – Incident Involving Crane or Personnel/Material Handling Operations was the most frequently identified consequence, in part, due to its lower severity thresholds relative to other SPI, with Operating Procedures or Safe Work Practices cited most frequently as the area for improvement (Refer to Appendix 6, charts 3 and 8). This AFI was closely followed by Risk Assessment and Management, and Personnel Skills and Knowledge to comprise the top three AFI related to SPI 2C. Similar to 2013, mechanical lifting incidents in 2014 involved dropped objects, slinging/rigging failures, and loss of load control. Specific opportunities within each of the three AFI categories are described below:

Operating Procedure or Safe Work Practice was cited in 41% of the mechanical lifting incidents, with the following opportunities noted:

- Lack of procedures or checklists, and
- Procedure needs improvement

Risk Assessment and Management was cited in 31% of the mechanical lifting incidents, with the following opportunities noted:

- Job Safety Analysis was generic or lacked specifics
- Risk Assessment was performed but did not identify all hazards or controls, and
- Post event assessment identified alternative work processes that would reduce risk

Personnel Skills and Knowledge was cited in 28% of the mechanical lifting incidents, with the following opportunities noted:

- Need for competency verification, and
- Inexperience

Note: A review of the mechanical lifting incidents and events suggested that Quality of Task Planning was potentially applicable more times than selected. Moreover, the Risk Assessment and Management opportunities cited above may appear to align more closely with the Quality of Task Planning and Preparation AFI. Regardless of the AFI submitted, the opportunities listed herein are relevant to this learning and represent applicable areas on which to focus to support prevention of future incidents or events.

The following excerpts, taken from the 2014 reporting year LFI submittals, provide more specific information to support these learnings:

- **Example 1** – “The crane operator was moving a set of tongs from the riser bay to the rig floor. Once the load was rigged it was lifted off the deck and while coming up the load made contact with a cross bar damaging the tongs and causing bolts to shear off which fell 20 feet.”
Learnings: “Lifting operations require a risk assessment in which all hazards should be identified and controls put in place to prevent an incident. The position of a flagger is important in correctly gauging clearance of hazards in the lift path. Lift personnel should be verified to have the skills and knowledge to do their assigned job.”
- **Example 2** – “Drill crew was in the process of rigging down cement chocks. The driller lowered the block while the floorman lowered the trolley connected to the chocks. The trolley operator did not descend at the same rate as the block as they traveled on a downward motion resulting in the block out running the trolley which exceeded the safe working load of the sling attached to the chocks. The sling parted and the headache ball became detached from its anchor point but stayed connected to the trolley wire. The counterweight was released and ran free until it made contact with the sheave above.”
Learnings: “Lifting hazards can be eliminated or reduced by more efficient methodologies. In this incident a tandem lift presented hazards that could have been eliminated through a different lift plan.”
- **Example 3** – “Workers began to replace cable on a hull-entry hoist. During change-out workers identified the hoist’s cable guide was seized and could not swivel. In order to complete the installation of the cable a worker guided the wire onto the spool with his right hand using his left hand to control the spool’s rotation. With the left hand resting on the hoist’s control lever the worker attempted to place the new cable into the guide by pushing the cable back and into the guide with the right hand. During this motion the worker’s body weight shifted toward the back of the hoist subsequently pushing the left hand backwards engaging the hoist. The worker’s right hand was pinned between the cable and the hoist’s guide arm resulting in a fracture.”
Learnings: (1) “...The execution of the job and management of hazards seemed to be largely governed by individual perceptions and beliefs based on personal past experiences. The JSA for the task was generically-termed, stating such things as “pinch points” and “watch hand/foot/body placement”. This may have increased the exposure for injury as certain specific hazards at the work site not identified in the JSA.” (2) “Develop a work instruction for future hull column hoist cable replacement. Create a repeating PM work order for inspection and lubrication of asset hull hoists quarterly to be performed by asset maintenance staff.”

5.3.2 Process Safety Events

Process Safety (Tier 1 and Tier 2 PSE) data submitted in 2014 provides opportunity for learnings as in 2013. The information presented in this section covers the four Tier 1 and five Tier 2 Process Safety Events (PSEs), as well as four HVLE, submitted in 2014. While the HVLE did not meet the criteria thresholds to qualify as reportable PSE, these events were included in the analysis as they contain learnings to support process safety. Operating Procedures or Safe Work Practices was cited most frequently as the area for improvement, followed by Process or Equipment Reliability. PSE in 2014 involved equipment isolation and equipment failures. Specific opportunities within each of the two AFI categories are described below:

Operating Procedure or Safe Work Practice was cited in 77% of the process safety events, with the following opportunities noted:

- Procedure needs improvement, and
- Lack of procedures or checklists

Process or Equipment Reliability was cited in 23% of the PSE, with the following opportunities noted:

- Suction valve did not close as designed, and
- Physical stress and corrosion of stainless steel fittings on well production casing

The following excerpts, taken from the 2014 reporting year LFI submittals, provide more specific information to support these learnings:

- **Example 1** – “A closed piping system was being pressure tested to prepare for future operations. After a pressure test cycle a contractor believed that the piping system had been depressurized to 0 psi and unbolted a flanged valve in preparation for removal. The contractor was struck by trapped water pressure causing a personal injury that resulted in days away from work. Investigation later showed that unidentified pressure had been trapped in that section of piping behind a check valve.”
Learnings: “Contractor's Standard Operating Procedure (SOP) was amended to include identifying and mitigating hazards specific to check valves during pressure testing operations.”
- **Example 2** – “After completing installation and verifying alignment to the flare using a valve alignment info tag, personnel attempted to start up Platform Vapor Recovery Unit to verify proper functionality. Over multiple start-up attempts, gas was purged to atmosphere through a 3-way valve connecting the flare system and atmospheric vent piping to the VRU.”
Learnings: “The ... actuator and indicator was removed from the valve but was still giving permissive for the VRU to run. This would allow the VRU to start regardless of 3-way valve alignment and created a bypass scenario. The Valve's Alignment Info Tag displayed that the valve would be aligned to flare when in the horizontal position; however the valve could not be aligned to vent or flare with the stem in the horizontal position. The alignment tag also indicated that a 180 degree turn was not allowed; this gave workers the impression that the valve could ONLY rotate back and forth 90 degrees.”
- **Example 3** – “While drilling into a sand a kick occurred. The well was shut in. The pipe stuck and packed off and mud could not be circulated. A riser mud cap was installed and the well monitored through the choke line. The well was opened and was static. The pipe was freed, circulation was established, and the Driller's Method used to displace the influx from the well. A high gas alarm from the shaker exhaust sensor occurred. Further attempts to kill the well were accompanied by additional

gas alarms. A blind skillet plate was found in the spool piece between the mud gas separator and the main gas vent line and removed. The well kill re-started without further incident.

Learnings: “Risk of recurrence of this incident can be reduced by verifying that temporary blanking flanges or skillets installed during construction or commissioning are removed prior to hand-over to operations; that safety critical third-party equipment is maintained and is functioning as intended; and that personnel are aware of the danger present when gas alarms activate and take appropriate action.”

- **Example 4** – “A stainless steel fitting parted between a well production casing isolation valve and a gas lift check valve causing a loud continuous noise. The well blew the production casing down releasing natural gas in excess of the Tier 1 volume threshold. Stationary gas detection did not trigger an alarm/shutdown (sensors are mounted approximately 40’ above and 25’ away from release point on well bay wall).”

Learnings: “Repeat failures with differing consequences (Tier1 to Tier3) over the last six years with at least one indication of Chloride-induced stress corrosion cracking. Determined that a ball and joint system could be made to fit in the tight confines of the well bay. Took advantage of the re-design to change from a threaded joint connection system to a flanged and welded system where possible.”

5.3.3 Loss of Station Keeping

The LFI Reports received in 2014 included four Loss of Station Keeping incidents. Loss of Station Keeping was identified in 2013 as a learnings topic, and the findings from the 2014 data support a more focused opportunity for learning around the power systems that support dynamic positioning (DP) operations. Instrument, Analyzer and Controls Reliability; Process or Equipment Reliability; and Quality of Task Execution were cited as the areas for improvement. Loss of Station Keeping events in 2014 involved issues with DP power management system software, over-voltage condition related to a battery charger, and plugging of an inverter cooling water supply system.

The following excerpts, taken from the 2014 reporting year LFI submittals, provide more specific information to support these learnings:

- **Example 1** – “Vessel was alongside of the Rig with a hose connected pumping Brine (Calcium). The vessel’s Aft Bow Thruster shut down followed immediately by the Forward Bow Thruster losing command, causing the vessel to lose position and heading. Wind was 21.3 kts 172° T and the Current was 1.7 kts 217° T. Engineers were able to bring the Aft Bow Thruster back online around 1835. With both Bow Thrusters online The Captain was able to move the vessel back alongside the rig in manual. The vessel never came in contact with the rig.”
Learnings: “DP Power Management Software error - voltage software parameters mis-interpreted the DP systems rapid power changes as being over-voltage conditions in the power busses.”
- **Example 2** – “While alongside the rig having completed transferring base oil from the rig to the OSV the OSV lost all propulsion FWD and AFT thrusters due to a power mgmt system failure.”
Learnings: “Automated Power Management System trip and shutdown caused total loss of propulsion.”
- **Example 3** - “A motor vessel was alongside a production facility supporting well operations when it lost electrical power on both the A electrical conductor Bus and the B electrical conductor Bus and controls of all thrusters were lost. The vessel was on dynamic positioning approximately 50-60 feet from facility. The emergency generator was used to regain control and navigate outside the 500 meter zone.”
Learnings: “The failure was the result of an uncommon failure of overvoltage from a battery charger connected to all three generators. Tested protections are normally against under voltage. Additional protections were put in place against overvoltage and battery chargers were rewired so that no one charger feeds all three generators.”
- **Example 4** – “While inside a production facility's 500 meter zone, the motor vessel's Dynamic Positioning Operator (DPO) attempted to change heading for an approaching squall. Wind gusted to 35 knots. Load on all thrusters climbed to 90-100% range to keep vessel on station. Vessel moved away about 10 meters but stabilized. Request was made to reduce load on the T-2 motor due to an inverter cooling water flow alarm. The DPO took auto-sway off to reduce load on thrusters and divert power towards heading change. The T-2 motor shutdown and was kicked out of the DP system. The vessel began moving away from the facility. The T-2 motor was successfully restarted and brought back into the DP system. The vessel exited the 500 meter zone.”
Learnings: “...Sediment was found in the cooling system of the T-2 inverter causing restricted flow. Multiple flushes of the system resolved the problem and future regular checks are in place for future detection...”

5.3.4 Automated Safety Instrumented Systems / Shutdown Systems

Learnings were noted across multiple LFI categories (SPI 1, SPI 2, and HVLE) involving Automated Safety Instrumented System / Shutdown Systems. Analysis of the LFI events highlighted Operating Procedures or Safe Work Practices, Process or Equipment Design or Layout, and Instrument, Analyzer and Controls Reliability as the most frequently cited Areas for Improvement. These incidents also identified opportunities in the following areas: failure of safety device or alarm activation as intended, alarm system operation as intended to prevent or mitigate consequences, disabled or overridden alarms, alarm set point changes, and need to install an alarm.

Operating Procedures or Safe Work Practices were cited in 58% of the events, with the following opportunities noted:

- Procedure needs improvement (lacks details, has confusing format, etc.), and
- Lack of procedures or checklist

Process or Equipment Design or Layout was cited in 33% of the events, with the following opportunities noted:

- Design did not anticipate the conditions and did not consider human factors, and
- Design dependent on administrative controls (procedures and training) to operate properly

Instrument, Analyzer and Controls Reliability were cited in 33% of the events, with the following opportunities noted:

- Sensor device malfunctions, and
- Instrument failure

The following excerpts, taken from the 2014 reporting year LFI submittals, provide more specific information to support these learnings:

- **Example 1** – “During normal filling operations of a biocide storage tank, 150 gallons of biocide were spilled to an open drain from the tank overflow line. The incident happened after the tank was filled with 1100 gallons of biocide until the tank level rose to 81". The filling rate was within the blanket gas regulator capacity and tank pressure increased to 6 oz. as the blanket gas was compressed. Internal tank pressure drove the biocide in the overflow line above the 82.5" overflow height. Once the P-trap seal was broken, the biocide from the overflow line expelled air and liquid from the P-trap leading to the spill.”
Learnings: “Filling of tanks requires appropriately designed and installed process equipment and high-level shut down set points and written procedures or checklists specific to each tank for use by personnel to reduce the risk of tank overflow and loss of primary containment.”
- **Example 2** – “To perform diagnostic testing on FGC-1 (Fuel Gas Compressor) FGC-2 was put online and FGC-1 was shut down. After approx. 15 hours gas was detected within the FGC-1 enclosure. ICS Response Team investigated and found that the suction valve to FGC-1 had not closed as designed. Gas leaked through the compressor seals to the lube oil tank and vented into the compressor enclosure.”
Learnings: "Install a "transition failure" and/or "blow down sequence failure" alarm"
- **Example 3** – “The Crane Operator entered the crane and performed all checks required prior to operation without any issues. The crane crew had performed 8 lifts off the boat without incident. After disconnecting the rigging on the load of casing on deck the Crane Operator began to cable up. As the 17T crane ball approached the tip of the boom the Crane Operator reduced his speed. At this moment the Crane Operator looked down to make sure all of the rigging and tag lines were clear of the

deck. The Crane Upper limit switch failed to activate and the 17T crane ball came into contact with the tip of the crane boom."

Learnings: "The cause of this event was that Knuckle Boom Crane #3 load line prox sensor giving feedback to the counter module was not counting every revolution of the drum of cable, but only counting sporadically. The sensor was replaced, adjusted and tested to ensure that it was counting correctly."

5.4 Areas for Improvement

This section provides a summary of the improvement areas identified for the 52 LFI submittals in reporting year 2014. The following information may be used by COS Members to gain insight into potential improvement opportunities for their own operations.

The LFI reporting process allows COS Members to identify Areas for Improvement associated with reported incidents and HVLE. Submitters chose from three general categories and 15 sub-categories. Multiple Areas for Improvement 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

A total of 122 Areas for Improvement were selected for the 52 incidents and HVLE. 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.

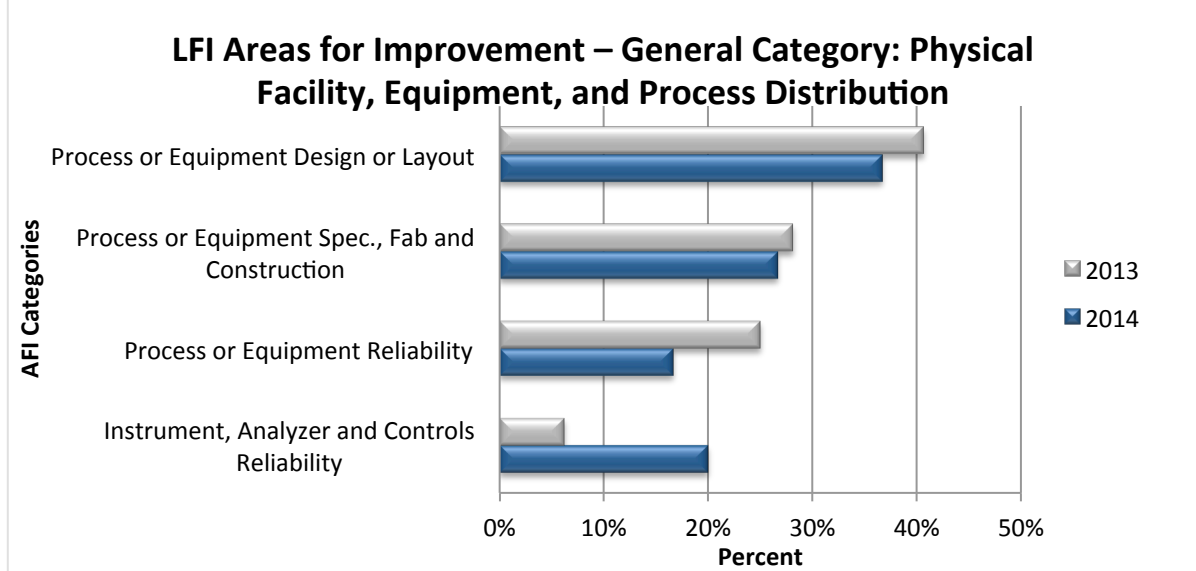
The Areas for Improvement data were distributed across the three general categories listed above, with a slightly higher occurrence noted in the Administrative category. Among the 15 sub-categories, the most frequently reported improvement areas were (numbers in parenthesis indicates number of times chosen and percentage of reports that selected this improvement area):

- Operating Procedures or Safe Work Practices (25/52 – 48%)
- Work Direction or Management (12/52 - 23%)
- Risk Assessment and Management (11/52 - 21%)
- Process or Equipment Design or Layout (11/52 - 21%)

The selection of Operating Procedures or Safe Work Practices at a ratio > 2:1 over the next closest category supports this as an area of opportunity to strengthen associated prevention and/or mitigation barriers.

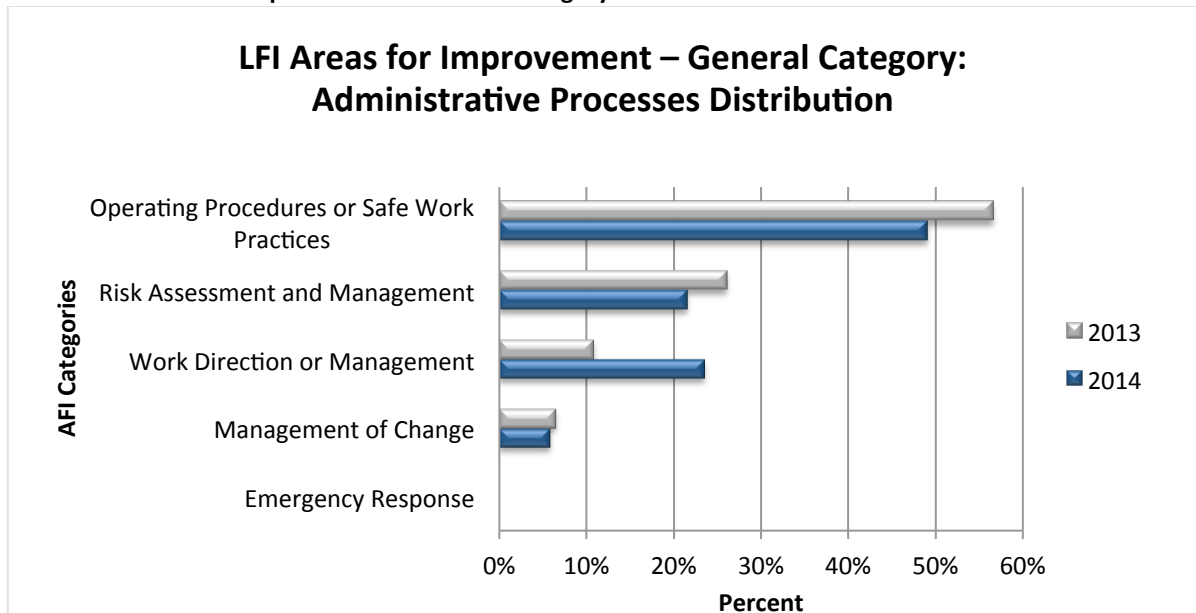
Charts 1 through 3 below graphically represent the specific Areas for Improvement identified under each of the three general categories. As indicated in the following charts, improvement opportunities were cited in every sub-category, with the exception of Emergency Response.

Chart 1 – LFI Areas for Improvement – General Category: Physical Facility, Equipment, and Process Distribution



- # of occurrences represented above (by year): 2013 = 32, 2014 = 30
- Instrument, Analyzer and Controls Reliability increased from 6% in 2013 to 20% in 2014

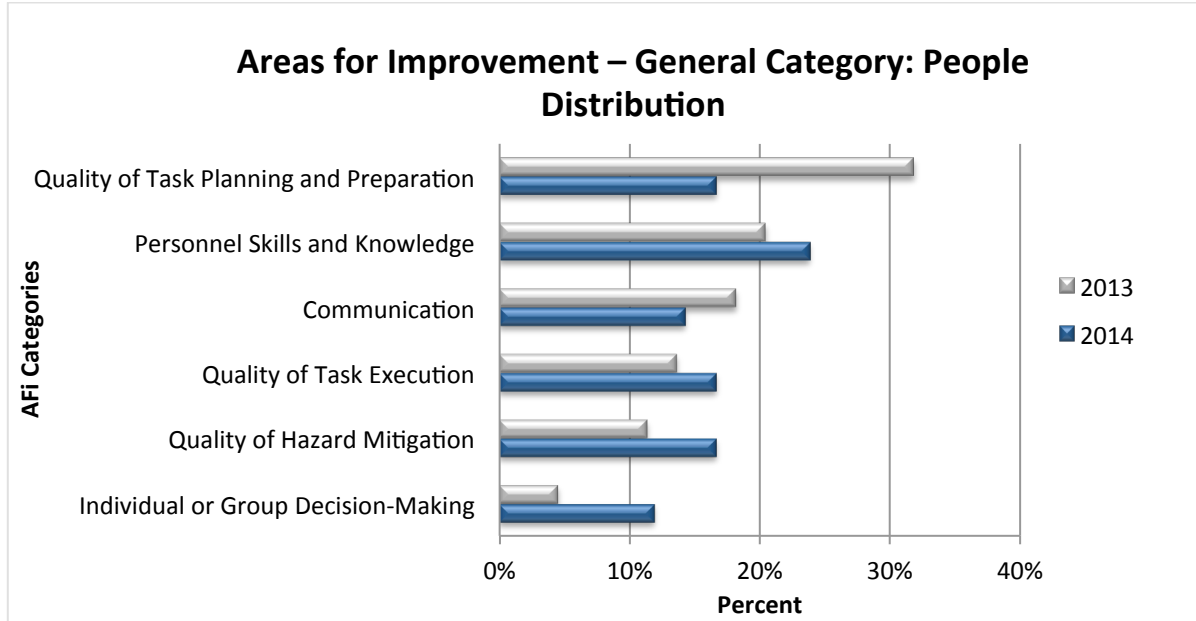
Chart 2 – LFI Areas for Improvement – General Category: Administrative Processes Distribution



¹ The “Operating Procedures or Safe Work Practices” sub-category, listed here as part of the “Administrative Processes” general category, refers to the existence and quality of procedures or practices, and not whether they were followed or executed properly (execution is covered in the “People” category, below).

- # of occurrences represented above (by year): 2013 = 46, 2014 = 51
- Work Direction or Management increased from 11% in 2013 to 23% in 2014
- Emergency Response is the only AFI category that has been zero for both years

Chart 3 – Areas for Improvement – General Category: People Distribution



- # of occurrences represented above (by year): 2013 = 44, 2014 = 42
- Per the 2014 data as submitted, Quality of Task Planning and Preparation percentage decreased relative to 2013. That said, a review of the 2014 data by LFIC members suggested that Quality of Task Planning and Preparation was potentially applicable more times than selected.
- Individual or Group Decision Making increased from 5% in 2013 to 12% in 2014

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.

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

Appendix 3 SPI Definitions and Metrics

SPI Number	SPI Definition	SPI Metric	Reporting Entity
SPI 1	<p>Number of work-related incidents resulting in one or more of the following consequences:</p> <p>A. Fatality: One or more fatalities.</p> <p>B. Injury to 5 or more persons in a single Incident</p> <p>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:</p> <ul style="list-style-type: none"> ○ 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 ≥ \$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: <ul style="list-style-type: none"> ▪ liquid carryover ▪ discharge to a potentially unsafe location ▪ an onsite shelter-in-place ▪ public protective measures and a PRD discharge quantity > the threshold quantities in Table A-C in any one-hour period; or ○ A release of material > the threshold quantities described in Tables A-C in any one-hour period. <p>D. Loss of well control. “Loss of well control” means:</p> <ul style="list-style-type: none"> ○ Uncontrolled flow of formation or other fluids. The flow may be to an exposed formation (an underground blowout) or at the surface (a surface blowout); <ul style="list-style-type: none"> ▪ Flow through a diverter; or ▪ Uncontrolled flow resulting from a failure of surface equipment or procedures. <p>E. ≥\$1 million direct cost from damage to or loss of facility / vessel / equipment (excludes costs associated with downtime or production loss).</p> <p>F. Oil spill to water ≥ 10,000 gallons (238 barrels)</p>	# of SPI 1 incidents/ total work hours * 200,000	<p>COS Operator inside 500 meters</p> <p>COS Contractor owner of vessel / equipment outside 500 meters offshore</p>
SPI 2	<p>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:</p> <p>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:</p> <ul style="list-style-type: none"> ○ An employee, Contractor or Subcontractor recordable injury; ○ A fire or explosion resulting in ≥ \$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: <ul style="list-style-type: none"> ▪ liquid carryover ▪ discharge to a potentially unsafe location ▪ an onsite shelter-in-place ▪ public protective measures and a PRD discharge quantity > the threshold quantity in Tables D-F in any one-hour period; or ○ a release of material > the threshold quantities described in Tables D-F in any one-hour period. <p>B. Collision that results in property or equipment damage ≥ \$25,000</p> <p>C. 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,</p>	# of SPI 2 incidents / total work hours * 200,000	<p>COS Operator inside 500 meters</p> <p>COS Contractor owner of vessel / equipment outside 500 meters offshore</p>

SPI Number	SPI Definition	SPI Metric	Reporting Entity
	<p>shackles, turnbuckles), or the load (e.g., striking personnel, dropping the load, damaging the load, damaging the facility).</p> <p>D. Loss of station keeping resulting in drive off or drift off defined as a malfunction or improper operation of the dynamic positioning system</p> <p>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.</p>		
SPI 3	<p>Number of SPI 1 and SPI 2 incidents that involved failure of one or more of equipment as a contributing factor.</p> <p>COS Equipment categories:</p> <ul style="list-style-type: none"> 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 inside 500 meters COS Contractor owner of vessel / equipment outside 500 meters offshore
SPI 4	Reserved for Future Use	Reserved	Reserved
SPI 5	<p>Number of planned critical maintenance, inspections and tests completed on time.</p> <ul style="list-style-type: none"> • A planned task can be deferred if a proper risk assessment was completed and approved, and a new due date set. • COS Equipment: <ul style="list-style-type: none"> ○ Well pressure containment system ○ Christmas trees ○ Downhole safety valves ○ Blow out preventer and intervention systems ○ Process equipment/pressure vessels, piping ○ Automated safety instrumented systems / shutdown systems ○ Pressure relief devices, flare, blowdown, rupture disks ○ Fire/gas detection and fire-fighting systems ○ Mechanical lifting equipment/personnel transport systems ○ Station keeping systems ○ Bilge/ballast systems ○ Life boat, life rafts, rescue boats, launch and recovery systems ○ 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 inside 500 meters COS Contractor owner of vessel / equipment outside 500 meters offshore
SPI 7	Number of lost time and restricted work day injuries and illnesses	# of LTIs and RWCs / total work hours * 200,000	COS Operator inside 500 meters
SPI 8	Number of recordable injuries and illnesses	Number of recordable injuries and illnesses/ total work hours * 200,000	COS Operator inside 500 meters
SPI 9	Number of spills ≥ 1 barrel that enter the water	Number of spills ≥ 1 barrel / total work hours * 200,000	COS Operator inside 500 meters COS Contractor owner of vessel / equipment outside

SPI Number	SPI Definition	SPI Metric	Reporting Entity
			500 meters offshore
Work Hours	<p>For offshore workers, the hours worked are calculated on a 12-hour work day. Work hours are collected in the following categories:</p> <ul style="list-style-type: none"> • Total deepwater construction workforce hours inside 500 meters • Total deepwater well workforce hours inside 500 meters • Total deepwater production workforce hours inside 500 meters • Total deepwater workforce hours inside 500 meters 		COS Operator inside 500 meters

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. <ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> • liquefied petroleum gas (LPG), • 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. <ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> acrolein (stabilized), bromine 	5 kg (11 lb)	2.5 kg (5.5 lb)
TIH Hazard Zone B materials- includes: <ul style="list-style-type: none"> hydrogen sulphide (H₂S), chlorine (Cl₂) 	25 kg (55 lb)	12.5 kg (27.5 lb)
TIH Hazard Zone C materials- includes: <ul style="list-style-type: none"> sulphur dioxide (SO₂), hydrogen chloride (HCl) 	100 kg (220 lb)	50 kg (110 lb)
TIH Hazard Zone D materials- includes: <ul style="list-style-type: none"> ammonia (NH₃), carbon monoxide (CO) 	200 kg (440 lb)	100 kg (220 lb)
Other Packing Group I Materials – includes: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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. <ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> • liquefied petroleum gas (LPG), • 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. <ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • acrolein (stabilized), • bromine 	0.5 kg (1 lb)	0.25 kg (0.5 lb)
TIH Hazard Zone B materials- includes: <ul style="list-style-type: none"> • hydrogen sulphide (H₂S), • chlorine (Cl₂) 	2.5 kg (5.5 lb)	1.3 kg (2.8 lb)
TIH Hazard Zone C materials- includes: <ul style="list-style-type: none"> • sulphur dioxide (SO₂), • hydrogen chloride (HCl) 	10 kg (22 lb)	5 kg (11 lb)
TIH Hazard Zone D materials- includes: <ul style="list-style-type: none"> • ammonia (NH₃), • carbon monoxide (CO) 	20 kg (44 lb)	10 kg (22 lb)
Other Packing Group I Materials – includes: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • diethylamine (corrosion inhibitor) 	1,000 kg (2,000 lb) or 10 barrels	500 kg (1,000 lb) or 5 barrels

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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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,

Equipment	Equipment Definition
	<p>foam or water. The types of fire detectors commonly used on offshore platforms are as follows:</p> <ul style="list-style-type: none"> 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 Rise Detectors, Fixed Temperature Detectors o Products of Combustion / Smoke Detectors – e.g., Ionization Detector, Photoelectric Detector <ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> o 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. o 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. o 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	<ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> o Boom chords, foot pins, hoist (hydraulics and brakes), lift cylinder, sheave assembly, stops, tip extension or jib, pendant lines o Counterweights o Gantry, mast or A-frame pins o Hook block o Overhaul ball o Main hoist (hydraulics and brakes) o Auxiliary hoist (hydraulics or brakes) o Pedestal or crane base o Load management system (MIPEG, CCM-7000 etc.) o 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	<p>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.</p> <ul style="list-style-type: none"> • 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

Equipment	Equipment Definition
Life Boat, Life Rafts, Rescue Boats and Launch and Recovery Systems	<p data-bbox="472 201 1338 222">and stability.</p> <ul style="list-style-type: none"> <li data-bbox="472 226 1338 279">• Life Boat / Survival craft is a craft capable of sustaining the lives of person in distress from the time of abandoning the ship. <li data-bbox="472 283 1338 304">• Rescue boat is a boat designed to rescue persons in distress and to marshal survival craft. <li data-bbox="472 308 1338 361">• 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. <li data-bbox="472 365 1338 483">• 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.

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 Activities - 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 Activities - 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.

- **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, including:
 - **Process or Equipment Design or Layout:** 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.
 - **Process or Equipment Material Specification, Fabrication and Construction:** 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.
 - **Process or Equipment Reliability:** 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.
 - **Instrument, Analyzer and Controls Reliability:** 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.
- **Administrative Processes:** Enhancements in the quality, scope or structure of administrative processes for managing various aspects of work execution were highlighted for improvement, including:
 - **Risk Assessment and Management:** The process for systematic identification and evaluation of potentially significant risks was identified for improvement. This includes but is not limited to HAZOPS and facility hazard assessments.
 - **Operating Procedures or Safe Work Practices:** The procedures or practices for correctly and safely performing the relevant work were identified for improvement. This includes specific operations, maintenance, testing, contractor selection or other procedures and practices.
 - **Management of Change:** The process for identifying, approving, and managing significant technical, administrative or organizational changes was identified for improvement.
 - **Work Direction or Management:** 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, Job Safety Analyses (JSA) processes and supervision of the area or work team.
 - **Emergency Response:** The capability or processes for responding to a situation to prevent the escalation of incident or event consequences was identified for improvement.
- **People:** Enhancements to the personnel actions linked to the execution of work tasks were highlighted for improvement, including:
 - **Personnel Skills or Knowledge:** Personnel knowledge of the relevant tasks or the ability of personnel to execute the task correctly and safely was identified for improvement.

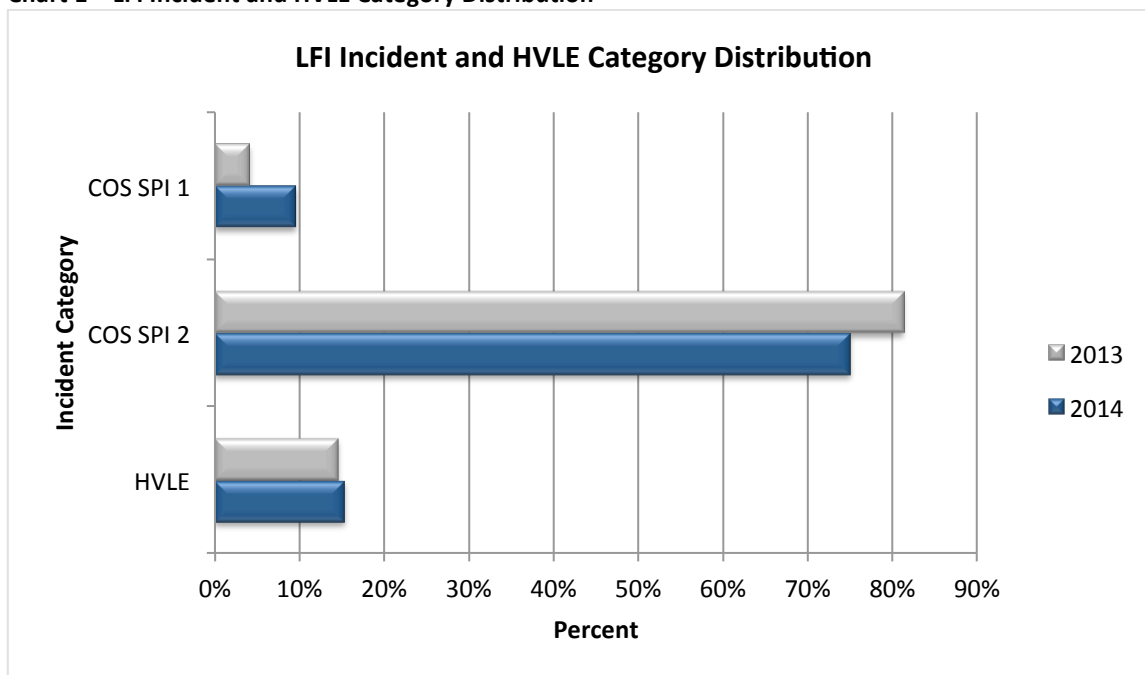
- **Quality of Task Planning and Preparation:** Personnel planning and preparation of the task prior to initiating the activity were identified for improvement, including team actions such as JSA, toolbox talks, or job walkthroughs.
- **Individual or Group Decision-Making:** Decisions made by one or 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.
- **Quality of Task Execution:** 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.
- **Quality of Hazard Mitigation:** 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.
- **Communication:** 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.

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:

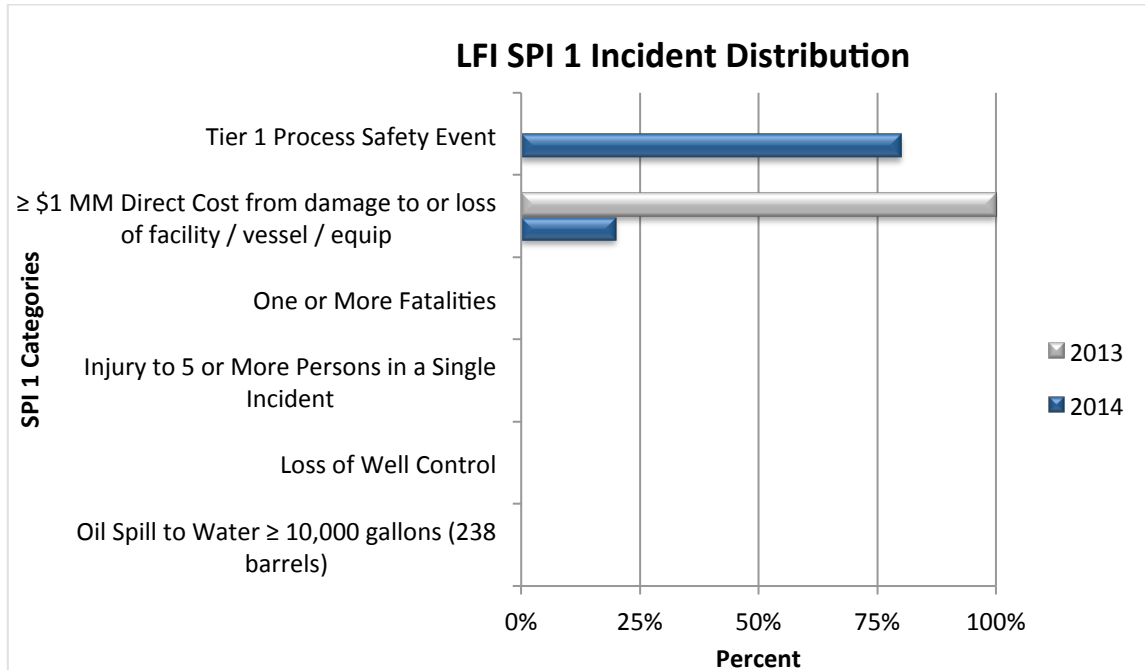
- Chart 1 – LFI Incident and HVLE Category Distribution
- Chart 2 – LFI SPI 1 Incident Distribution
- Chart 3 – LFI SPI 2 Incident Distribution
- Chart 4 – LFI Incident and HVLE Site Type Distribution
- Chart 5 – LFI Incident and HVLE Operation Type Distribution
- Chart 6 – LFI Incident and HVLE Activity Type Distribution
- Chart 7 – LFI HVLE AFI Category Distribution
- Chart 8 – LFI SPI 2C Areas For Improvement Distribution
- Chart 9 – LFI Loss of Station Keeping AFI Category Distribution

Chart 1 – LFI Incident and HVLE Category Distribution



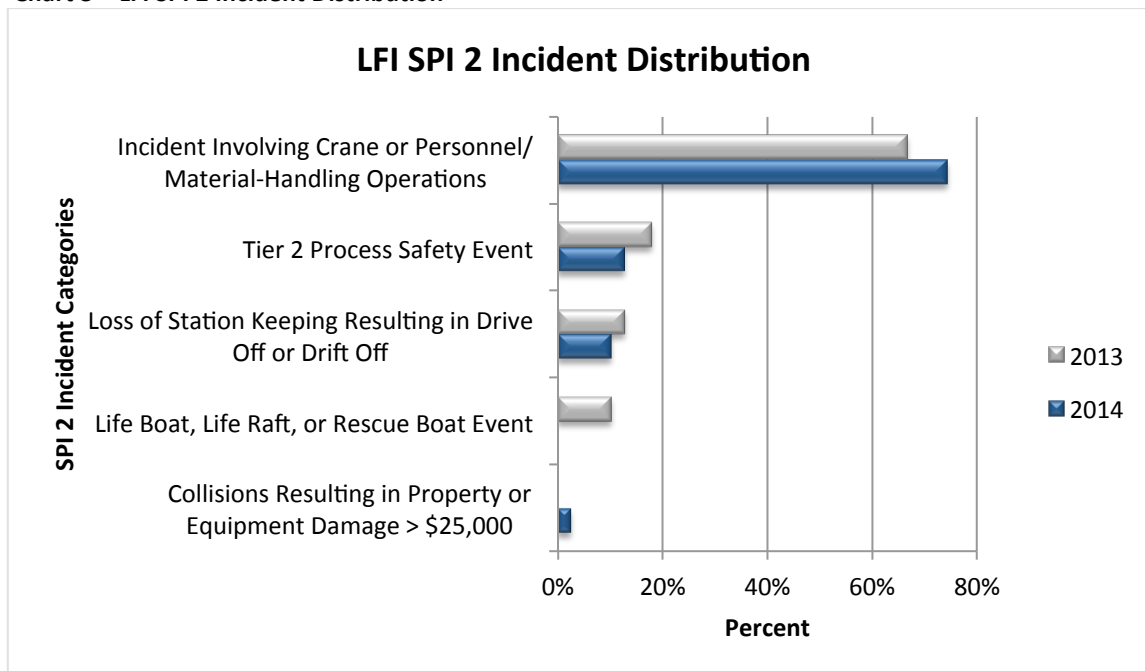
- # of occurrences represented above (by year): 2013 = 48, 2014 = 52
- Reported SPI 1 incidents increased from 4% in 2013 to 10% in 2014

Chart 2 – LFI SPI 1 Incident Distribution



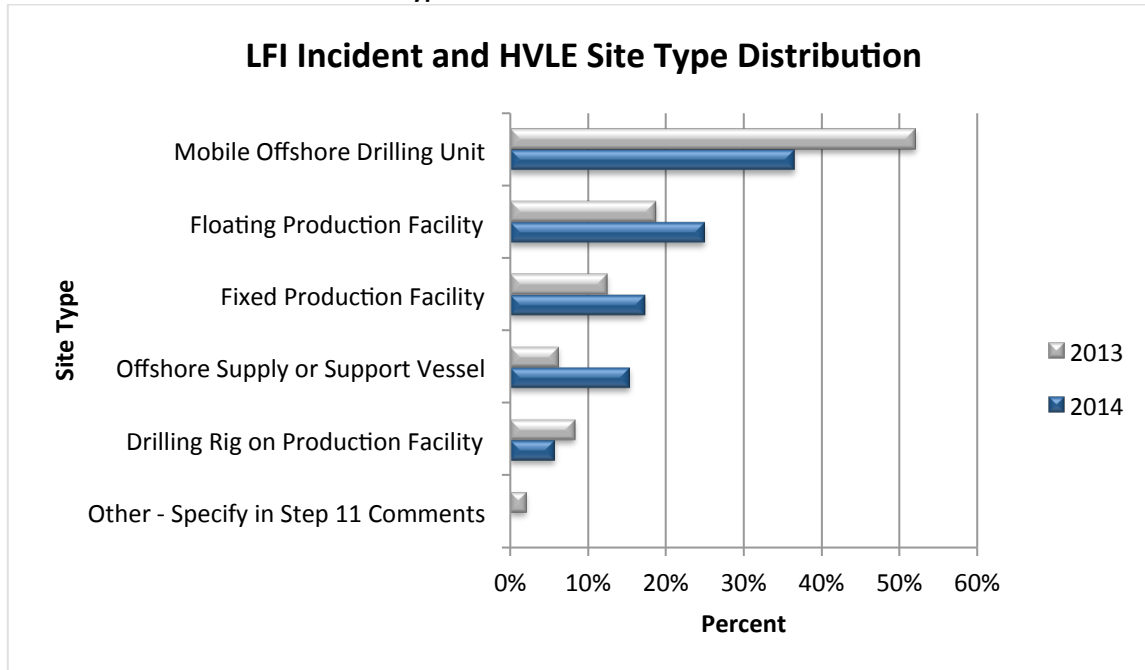
- # of occurrences represented above (by year): 2013 = 2, 2014 = 5
- Four Tier 1 PSEs were reported in 2014, and 0 in 2013

Chart 3 – LFI SPI 2 Incident Distribution



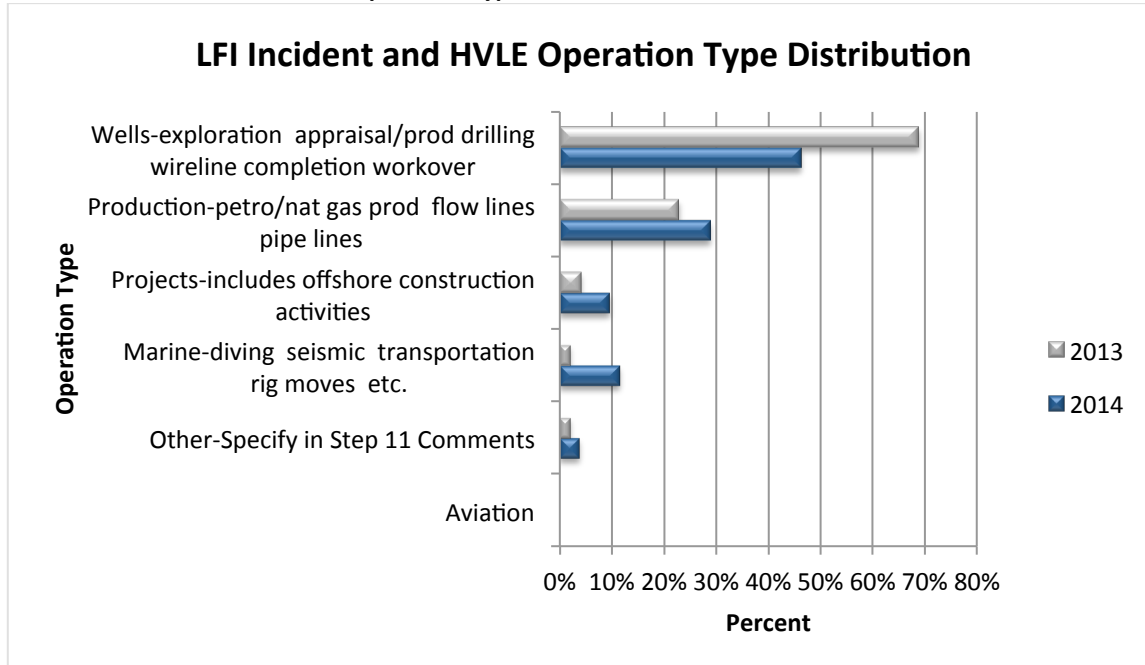
- # of occurrences represented above (by year): 2013 = 42, 2014 = 39. Three of the thirty nine 2013 SPI 2 submittals selected two consequences, bringing the occurrence total to 42.
- “Life Boat, Life Raft...” incidents decreased from 4 in 2013 to 0 in 2014
- One “Collision Resulting in Property or Equipment damage ≥ \$25,000” in 2014, versus 0 in 2013

Chart 4 –LFI Incident and HVLE Site Type Distribution



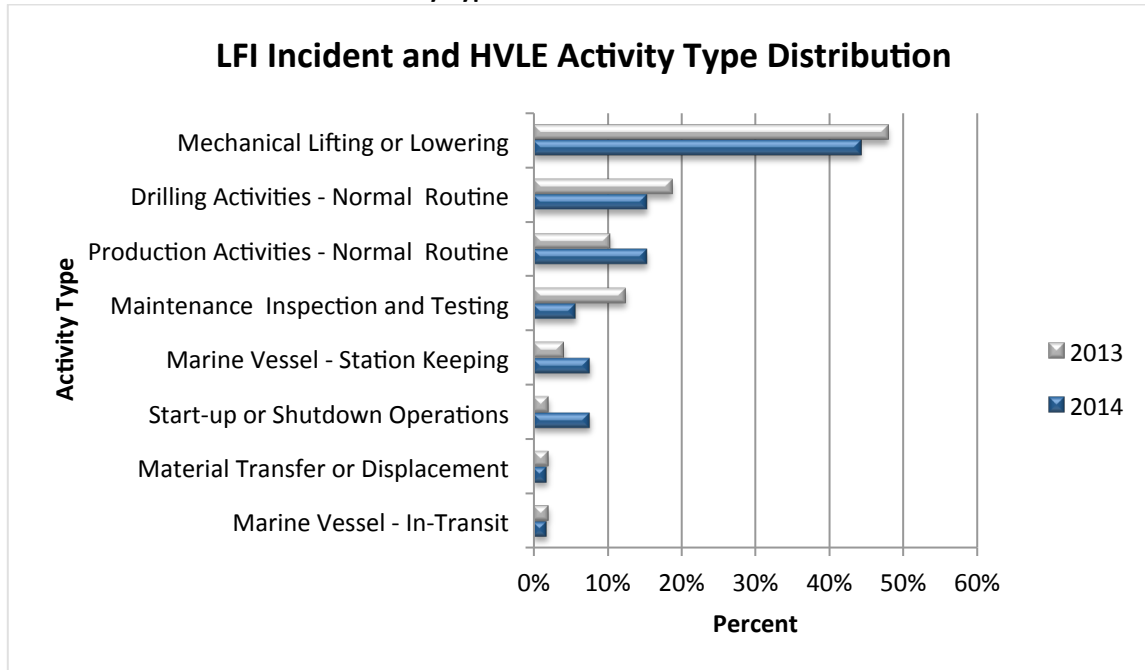
- # of occurrences represented above (by year): 2013 = 48, 2014 = 52
- Slight trend from MODUs to Production Facilities from 2013 to 2014
- Frequency of incidents associated with Offshore Supply or Support Vessels increased from 2013 to 2014

Chart 5– LFI Incident and HVLE Operation Type Distribution



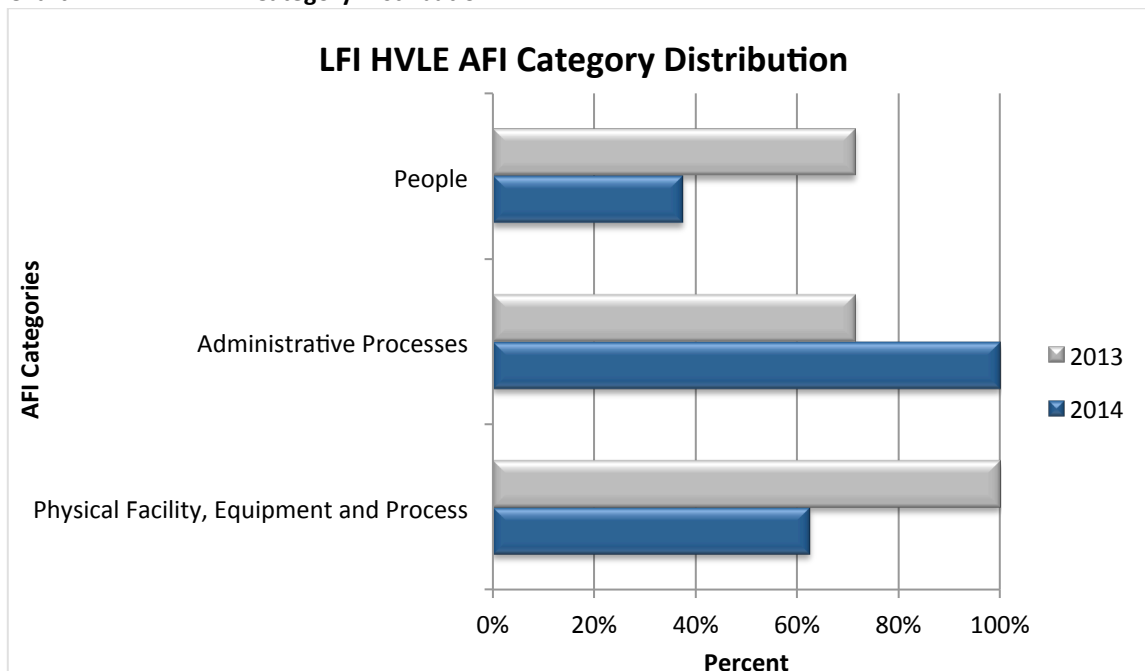
- # of occurrences represented above (by year): 2013 = 48, 2014 = 52
- Both “Projects...” and Marine-diving...” showed increases in 2014 vs. 2013
- “Wells-exploration, appraisal/prod drilling, ...” accounted for nearly one-half of the reported events

Chart 6 – LFI Incident and HVLE Activity Type Distribution



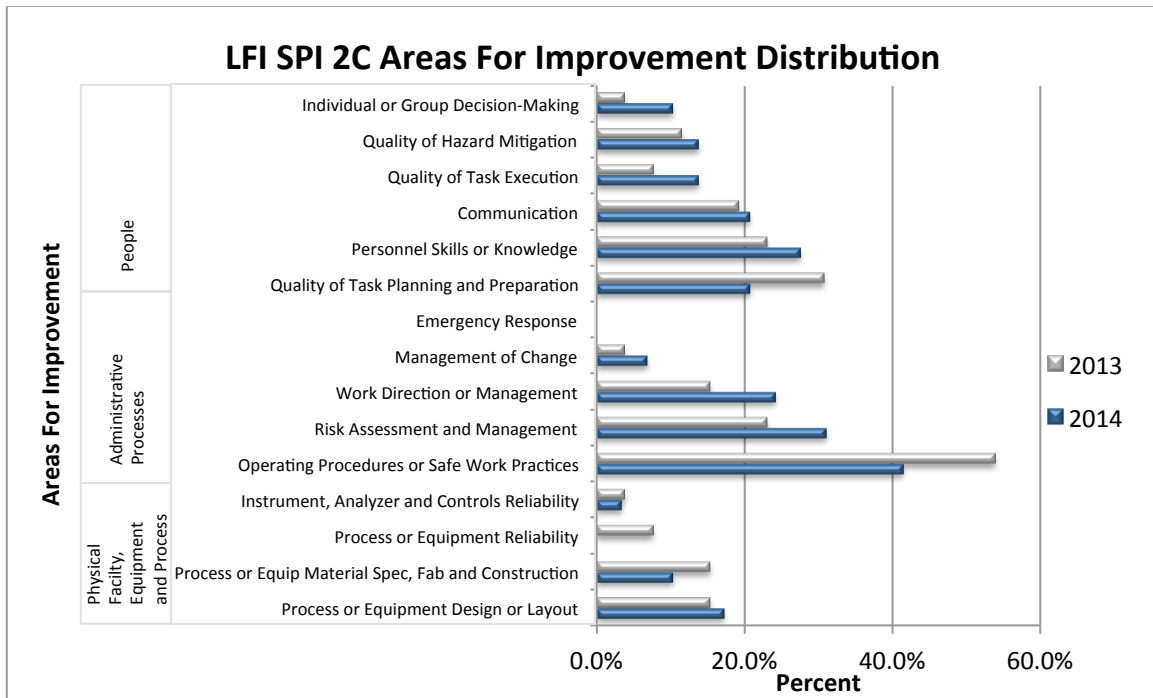
- # of occurrences represented above (by year): 2013 = 48, 2014 = 52
- Frequency of reported events associated with Start-up or Shutdown Operations increased in 2014
- Mechanical Lifting was involved in 44% of the reported incidents and HVLE in 2014

Chart 7 – LFI HVLE AFI Category Distribution



- # of HVLE represented above (by year): 2013 = 7, 2014 = 8
- Administrative Processes increased in 2014, while People and Physical Facility, Equipment and Process showed decreases.

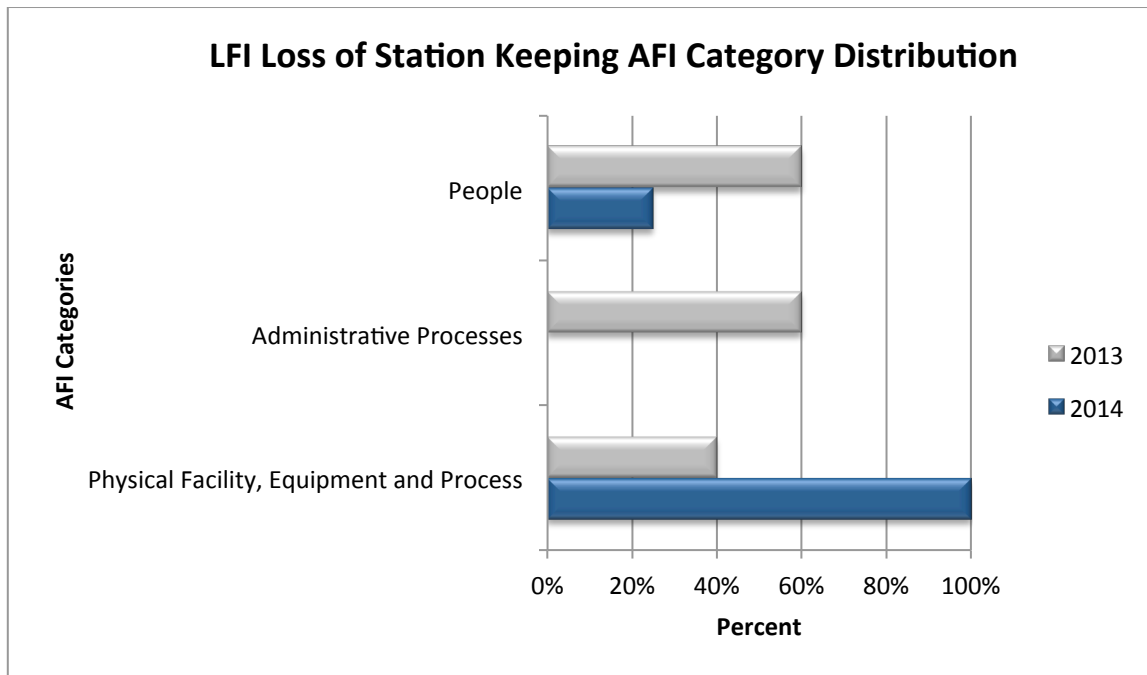
Chart 8 – LFI SPI 2C Areas For Improvement Distribution



¹ SPI 2C is defined as an "Incident involving crane or personnel/material handling operations"

- # of incidents represented above (by year): 2013 = 26, 2014 = 29
- Process or Equipment Reliability dropped from 7% in 2013 to 0 in 2014

Chart 9 – LFI Loss of Station Keeping AFI Category Distribution



- # of incidents represented above (by year): 2013 = 5, 2014 = 4
- Physical Facility, Equipment and Process identified 4 times in 2014 and twice in 2013
- Administrative Processes identified 3 times in 2013 and zero in 2014