2020 ANNUAL PERFORMANCE REPORT

CENTER FOR OFFSHORE SAFETY

OCTOBER 2021

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RUSSELL HOLMES
Senior Director
Center for Offshore Safety

October 2021
Center for Offshore Safety

The Center for Offshore Safety (COS) was established ten years ago to improve safety operations for the offshore oil and gas industry. Our commitment to providing tools and support for companies on the U.S. Outer Continental Shelf stays intact regardless of the obstacles we face.

2020 was a year with unforeseen challenges that tested our resolve. The COVID-19 pandemic has impacted the lives of every person across the globe with a ripple effect that reverberated beyond public health. Not surprisingly, that effect was felt in the oil and gas industry, challenging us to maintain safe operations while adding in new tasks such as virus-testing, quarantining protocols, and contact tracing.

Publishing the 2020 Annual Performance Report with the full participation of eligible COS members is a testament to the industry's ongoing commitment to safety – for its workers, facilities, and the environment – even in the midst of unprecedented challenges.

"Safety first, safety always" is the core value of COS. As our data shows, we have work to do in our mission to help the industry meet its safety and sustainability objectives. While this report focuses on the collective data from across COS membership, I am mindful that each safety statistic represents our colleagues, friends, and family members. Reporting these data demonstrates our commitment to transparency, and a solemn reminder that our work is never done toward achieving a goal of zero incidents.

To that end, COS and its members review data with an eye to identifying areas where action can be taken to improve safety. Over the course of 2021, COS has taken advantage of the virtual environment we all find ourselves in to host a series of webinars to promote the results of this work. Recent webinar and publication topics include Leadership Site Engagement and Guidance on the Development of an Effective Crane Maintenance Tracker. Upcoming events will focus on Process Safety Fundamentals and Verifying Existing Barriers. These are topics and guidance directly related to the data we are receiving from members.

As I look forward to the next decade of COS, I am encouraged by the continued commitment of our members to the COS mission and energized by the prospect of greater data integration and utilization to identify new opportunities for good practices to support the industry. I thank all COS members for their contributions to and participation in this annual report and for their ongoing dedication to continual improvement through safety and environmental management systems.

Sincerely,

Russell Holmes

COS Senior Director

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Center for Offshore Safety Annual Performance Report

1.0 COS MEMBERS AND PARTICIPANTS

COS MEMBERS

Operators

Arena Offshore*

BHP

BP E&P

Chevron USA

Equinor

ExxonMobil

Fieldwood

Hess

Murphy E&P

Occidental Petroleum

Shell International E&P

TOTAL E&P

Rig Contractors

Helmerich & Payne

Valaris

Service Companies

Baker Hughes

Halliburton

Oceaneering

SubSea7

Associations

ASQ

IADC

IMCA

MSRC

NOIA

OMSA

OOC

OPITO

For this APR, 100% of eligible COS Members (11 Operators, two Rig Contractors, and four Service Companies) shared SPI and/or LFI data for the 2020 Reporting Year.

*One additional Operator, Arena Offshore, became a member of COS after the data collection cycle was closed for this APR. Arena Offshore will submit data beginning with 2021 Reporting Year data.

COS members listed above as Associations do not provide data.

Center for Offshore Safety Annual Performance Report

2.0 INTRODUCTION

The Center for Offshore Safety (COS) 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 learnings. In the context of this report, the term safety is inclusive of personal safety, process safety, health, security, and environmental safety.

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

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

The COS member data provided through the LFI and SPI programs enable continual improvement of performance-based management systems.

The SPI originated from high-level bow-tie risk models of major hazards, developed within COS, that cover both process safety and personal safety. The information can be used for driving improvement and, when effectively acted upon, contribute to reducing risk of major incidents by identifying weaknesses in barriers intended to prevent the occurrence or recurrence of incidents and mitigate consequences. The scope of the SPI data covers COS member wells, projects, and production facilities and operations in the U.S. Outer Continental Shelf (OCS).

The data collected via the SPI program ranges from **SPI 1** (fatality, injury to five or more from a single incident, loss of well control, etc.) and **SPI 2** (injury to four or less from a single incident, direct damage ≥ $25,000, etc.) to **SPI 10** (dropped objects potential results). The full list of SPI collected by COS can be found in section 4 of this report.

The LFI program covers the same scope, but also allows for the submittal of data for incidents and events which occur outside the U.S. OCS. The main objective of the LFI 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 High Value Learning Events (HVLE).

Publication of SPI and LFI Program data began in 2014, reflecting 2013 performance. Reporting is voluntary and data confidentiality is maintained through a process administered by the API Statistics department.

3.0 EXECUTIVE SUMMARY

ABOUT THE REPORT

The Center for Offshore Safety (COS) Annual Performance Report (APR) for 2020 provides an accounting of safety-related incidents and events at facilities operating in the U.S. Outer Continental Shelf (OCS).

Members voluntarily present data for the APR to support COS' mission to provide the highest level of safety for the U.S. offshore oil and gas industry. Through the analysis of data, COS strives to identify areas for improvement in the management of risk through safety management systems for the operation of offshore wells, projects, and production facilities in the U.S. OCS.

Member data in the report comes from two key COS programs: the Safety Performance Indicators program, or SPI, and the Learning from Incidents and Events program, or LFI. Both programs identify and monitor areas where the industry can improve safety in the U.S. OCS. While COS began collecting this data in 2013, the data presented in this APR reflects the most recent 5-years – 2016-2020.

This yearly performance report is an example of COS' commitment to open communication and transparency of safety information, building collaboration, communication, and sharing regarding safety between the industry, regulators, and the public.

KEY FINDINGS FROM 2020 DATA

- There were four work-related fatalities for the U.S. OCS in 2020; two were from incidents reported by COS member companies.
- Eighty-two percent (82%) of COS Operators reported zero Tier 1 Process Safety Events (PSE) and one or zero Tier 2 PSE. A total of eight Tier 1 Process Safety Events and 23 Tier 2 PSEs were reported for 2020.
- Ten out of 11 eligible COS Operators (91%) reported zero Level 1 Well Control Incidents. Similarly, ten out of 11 (91%) reported zero Level 2 Well Control Incidents. There was a total of one Level 1 and two Level 2 well control incidents reported.
- The 25 reported **SPI 2** mechanical lifting incidents was a marginal increase from the 23 reported in 2019.
- The frequencies for DART and RIIF (**SPI 7** Days Away from Work, Restricted Work or Transfer and **SPI 8** Recordable Injury and Illness Frequency) were the lowest reported to COS since data collection started in 2013.
- Of the 70 **SPI 1** and **SPI 2** incidents reported, 11 incidents (16%) included failure of equipment as a contributing factor.
- For the 24 U.S. OCS incidents reported to the LFI program, the three areas most frequently identified for improvement were: Operating Procedures or Safe Work Practices (63%); Process or Equipment Design or Layout (33%); and a three-way tie between Quality of Task Planning and Preparation, Individual or Group Decision Making, and Communication (29% each).
- Primarily due to the impact of the global pandemic, work hours reported for 2020 were down 23% compared to 2019.

Year	2016	2017	2018	2019	2020
COS U.S. OCS Work Hours (Millions)	45	37	41	44	34

3.1 SPI AND LFI DATA AT-A-GLANCE

FIGURE 3.1: SPI 1 and SPI 2 Frequency

For details of SPI and LFI data, see sections 4 and 5 of this report.

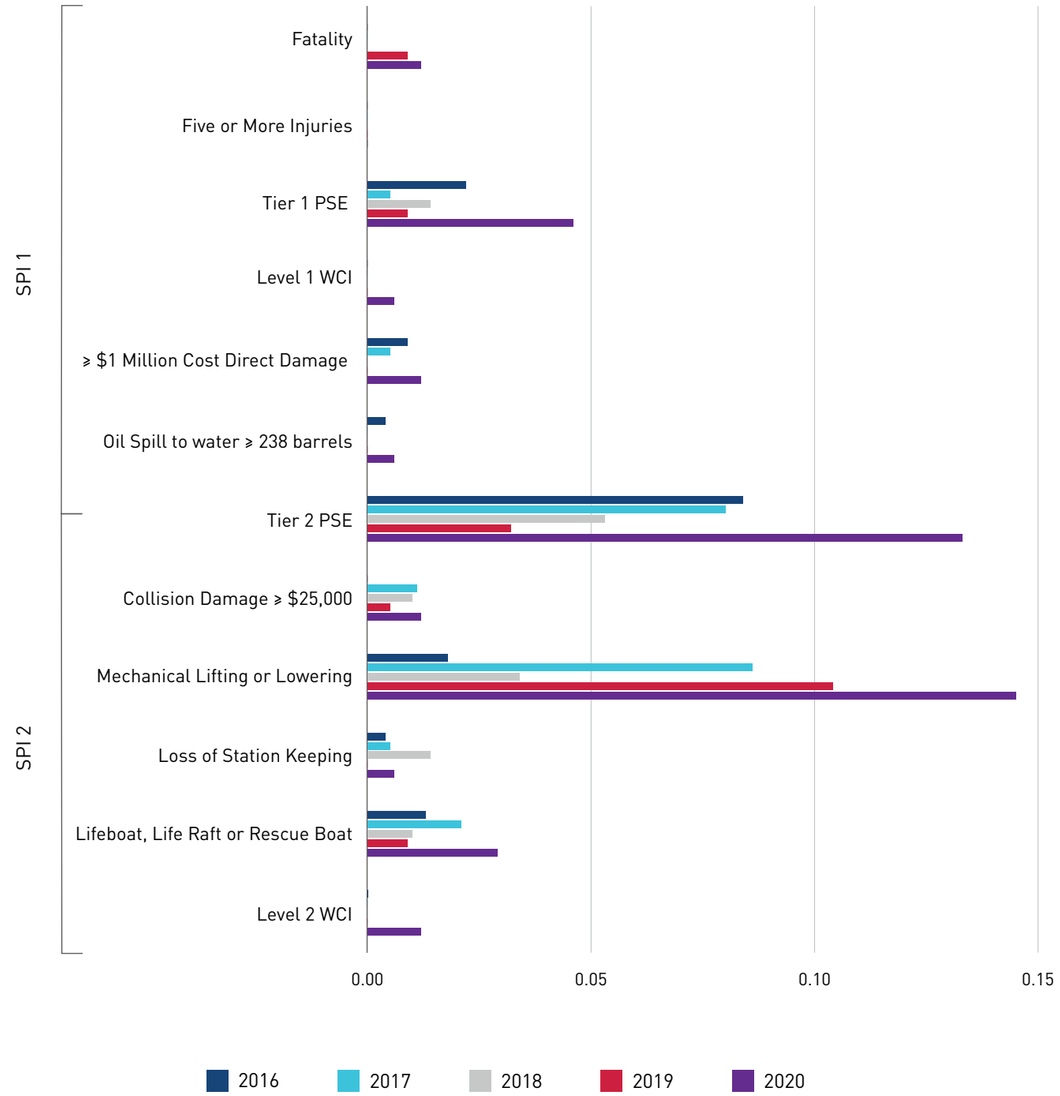
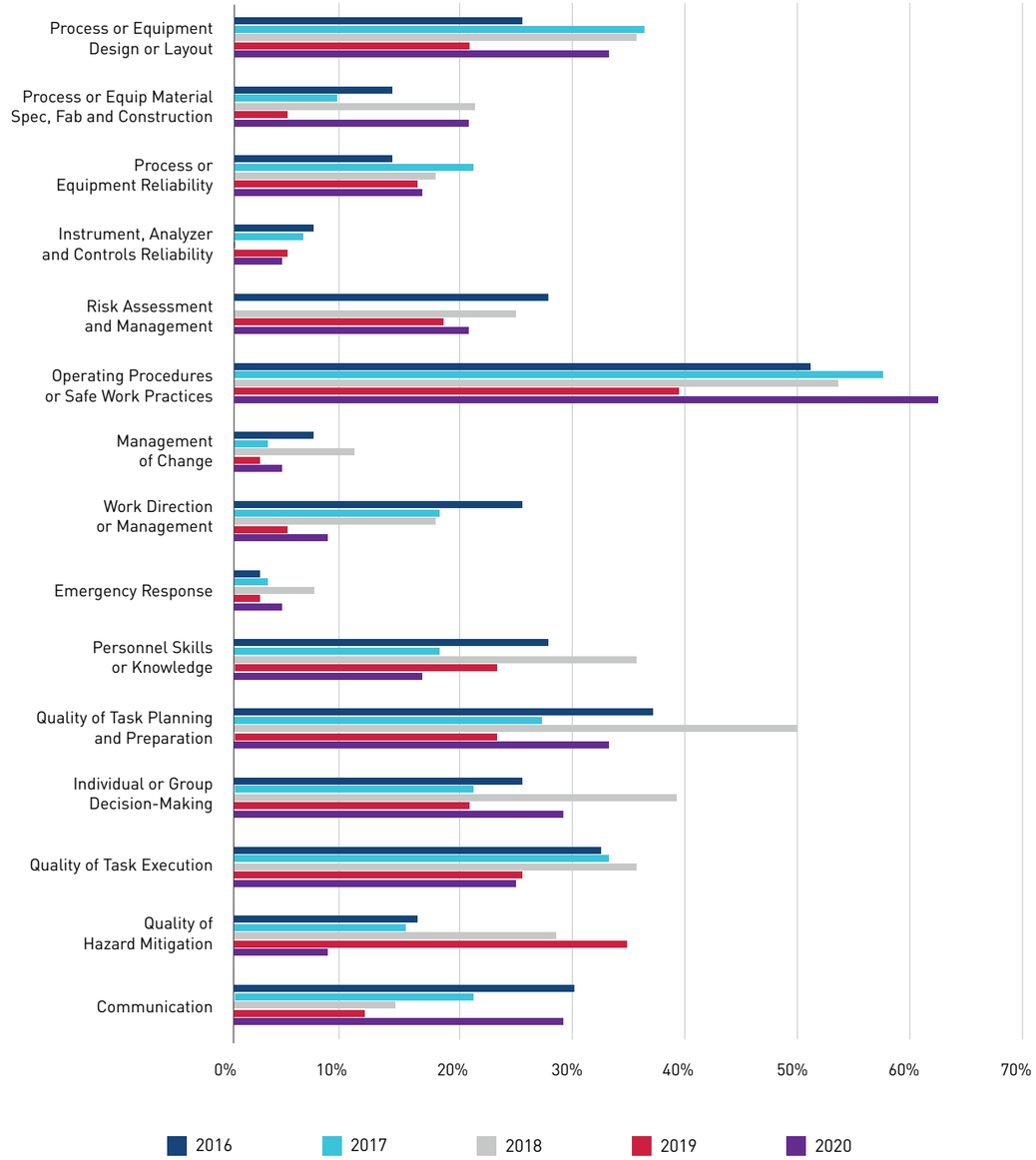


FIGURE 3.2: SPI 1 and SPI 2 Counts

		2016	2017	2018	2019	2020
SPI 1	Fatality	0	0	0	2	2
	Five or More Injuries	0	0	0	0	0
	Tier 1 PSE	5	1	3	2	8
	Level 1 WCI	0	0	0	0	1
	>$1 Mil Direct Damage	2	1	0	0	2
	Oil Spill ≥238 bbl	1	0	0	0	1
SPI 2	Tier 2 PSE	19	15	11	7	23
	Collision Damage ≥$25k	0	2	2	1	2
	Mechanical Lifting or Lowering	4	16	7	23	25
	Loss of Station Keeping	1	1	3	0	1
	Lifeboat, Life Raft or Rescue Craft	3	4	2	2	5
	Level 2 WCI	0	0	0	0	2

FIGURE 3.3: LFI Areas for Improvement (U.S. OCS Only)



NOTE - LFI submittals typically identify more than one AFI for any given incident. The graph above illustrates the percent of times an AFI was identified relative to the number of LFI forms submitted for U.S. OCS. Because the number of AFI exceeds the number of LFI forms, the sum of the percentages will be > 100%.

4.0 SAFETY PERFORMANCE INDICATORS

4.1 INTRODUCTION

COS members share Safety Performance Indicator (SPI) data with COS through the SPI program. Reporting is voluntary and data confidentiality is maintained through a process administered by the API Statistics department before submittal to COS. COS maintains a full record of anonymous data collected beginning with 2013 data. The data reported in this APR represents the five most recent years – 2016-2020. A normalization factor of work hours is utilized to enable year-to-year comparisons. A list of SPI collected is presented in Figure 4.1 below.

FIGURE 4.1: Safety Performance Indicators (SPI)

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 incident
C. Tier 1 Process Safety Event
D. Level 1 Well Control Incident - Loss of well control
E. ≥ $1 million direct cost from damage to or loss of facility / vessel / equipment
F. Oil spill to water ≥ 10,000 gallons (238 barrels)

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

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

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

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

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

SPI 6 is number of work-related fatalities.

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

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

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

SPI 10 is the severity potential of incidents involving a dropped object.

SPI 1 – **SPI 5** are based on structured assessments of major hazards facing the offshore industry. **SPI 6-9** are indicators historically reported by industry and are not directly related to the structured assessment work. **SPI 10** was introduced for the 2019 reporting year and is based on the severity-potential calculator developed by DROPSOnline.[1]

Certain characteristics of the data reported for **SPI 1** and **SPI 2** incidents limit some aspects of the analysis and trending. An incident may have consequences that meet both **SPI 1** and **SPI 2** definitions but are not counted in both classifications. The higher consequence drives the classification. For example, a collision that results in ≥ $1 Million Direct Damage Cost meets the **SPI 1E** definition, but also meets the **SPI 2B** consequence of Collision Resulting in ≥ $25,000 in damage. However, to prevent the duplication of data, 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 report will not necessarily match regulatory data due to this report being based on COS member company data and not all companies operating in the U.S. OCS.

4.2 SUMMARY

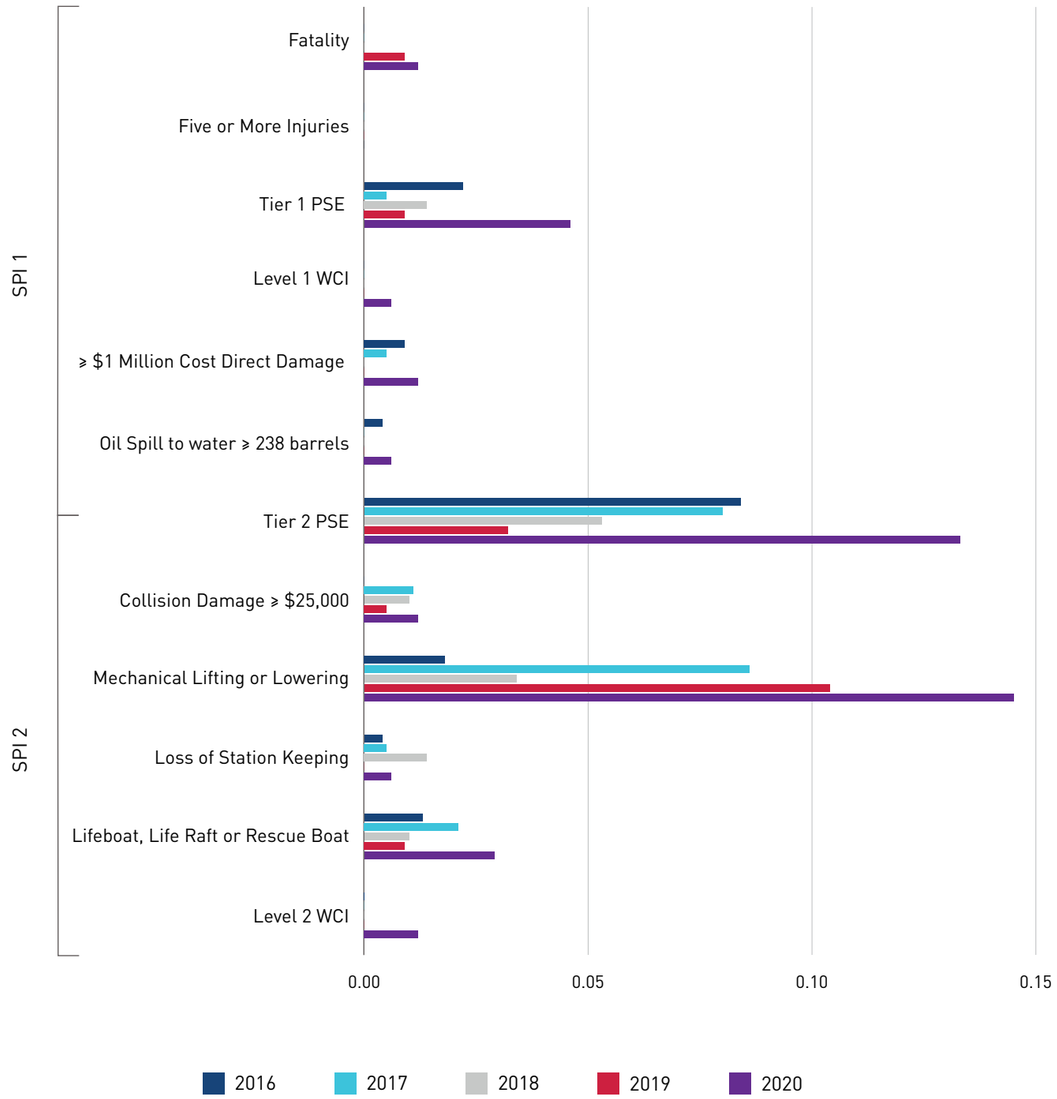
This report provides COS member data for 2016-2020. The data reported for 2020 represents over 34-million Operator and Contractor work hours in the U.S. OCS. Work hours are reported only by Operators for work occurring within 500 meters of their facilities.

Reporting Year	COS OCS Work Hours (Millions)
2016	45
2017	37
2018	41
2019	44
2020	**34**

The frequency of all **SPI 1** and **SPI 2** incidents are shown below in Figure 4.2; specific definitions for the SPI are presented in Appendix 1.

[1] *Dropped Objects Prevention Scheme Online* www.dropsonline.org

FIGURE 4.2: SPI 1 and SPI 2 Incident Frequency



Operator members reported 14 **SPI 1** incidents for 2020. The 14 **SPI 1** were two incidents involving Fatalities **(SPI 1A)**, eight incidents that were Tier 1 Process Safety Events (PSE) **(SPI 1C)**, one Level 1 Well Control Incident (WCI) **(SPI 1D)**, one Oil Spills to Water ≥ 238 barrels of crude oil (BBL). **(SPI 1F)**, two ≥ $1 Million Cost Direct Damage **(SPI 1E)** incidents, and zero incidents involving ≥ Five Injuries in a Single Incident **(SPI 1B)**.

Operator members also reported 56 **SPI 2** incidents for 2020, as compared to 33 for 2019. For the 56 reported incidents, the consequences were 23 Tier 2 PSE **(SPI 2A)**, two incidents resulting in Collision Damage ≥ $25,000 **(SPI 2B)**, 25 Mechanical Lifting or Lowering Incidents **(SPI 2C)**, one incident resulting in a Loss of Station Keeping **(SPI 2D)**, five Lifeboat, Life Raft, or Rescue Boat Events **(SPI 2E)**, and two Level 2 WCI **(SPI 2F)**.

The 23 Tier 2 PSE **(SPI 2A)** reported in 2020 was an increase from seven reported in 2019.

The two incidents involving Collision Damage ≥ $25,000 **(SPI 2B)** was up from one reported in 2019.

There were 25 incidents involving Mechanical Lifting or Lowering **(SPI 2C)**; a slight increase from the 23 incidents reported in 2019.

There was one Loss of Station Keeping Resulting Drive Off or Drift Off **(SPI 2D)** incident for 2020, up compared to the zero reported in 2019.

The five Lifeboat, Life Raft, or Rescue Boat Events **(SPI 2E)** was the highest reported since 2015.

Prior to the one Level 1 Well Control Incident **(SPI 1D)** and two Level 2 Well Control Incidents **(SPI 2F)** reported in 2020, there have only been two other Well Control Incidents reported by COS members. Previously reported Well Control Incidents were a Level 1 reported in 2014 and a Level 2 in 2015.

Of the 70 total **SPI 1** and **SPI 2** incidents reported by Operators for 2020, 11 involved Failure of Equipment as a Contributing Factor **(SPI 3)**, or 16%.

The 2020 frequency of Incidents Involving Cranes or Personnel/Material Handling **(SPI 4)** was 0.945, compared to 0.620 for 2019 and 0.187 for 2018. The increase from 2018 to 2019 may, in part, be explained by a change in reporting parameters following a Notice to Lessees (NTL) issued by the Bureau of Safety and Environmental Enforcement (BSEE) in December 2019.[2] For clarification, work hours are used to determine frequency.

For Operators' **SPI 5** data (Percentage of Planned Critical Maintenance Completed on Time), the combined average for 2020 was 90.45%. This is a decrease from the average of 93.84% reported for 2019.

Additionally, for Contractors that shared **SPI 5** data (4 out of 7), the combined average for 2020 was 96.83%, which represents a decrease from the average of 98.19% reported for 2019.

Two Fatalities **(SPI 6)** were reported for 2020.

The combined Days Away from Work, Restricted Work and Transfer of Duty Rate (DART) **(SPI 7)** reported for 2020 was 0.157 which is a decrease as compared to the 0.244 reported for 2019. This rate is the lowest reported since 2013.

The combined Recordable Injury and Illness Frequency (RIIF) **(SPI 8)** reported for 2020 was 0.278, the lowest rate reported since 2013.

COS members reported nine Oil Spills to Water ≥ One Barrel **(SPI 9)** for 2020, compared to one for 2019 and five for 2018. The frequency was 0.052 for 2020, an increase when compared to 0.005 in 2019 and 0.024 in 2018.

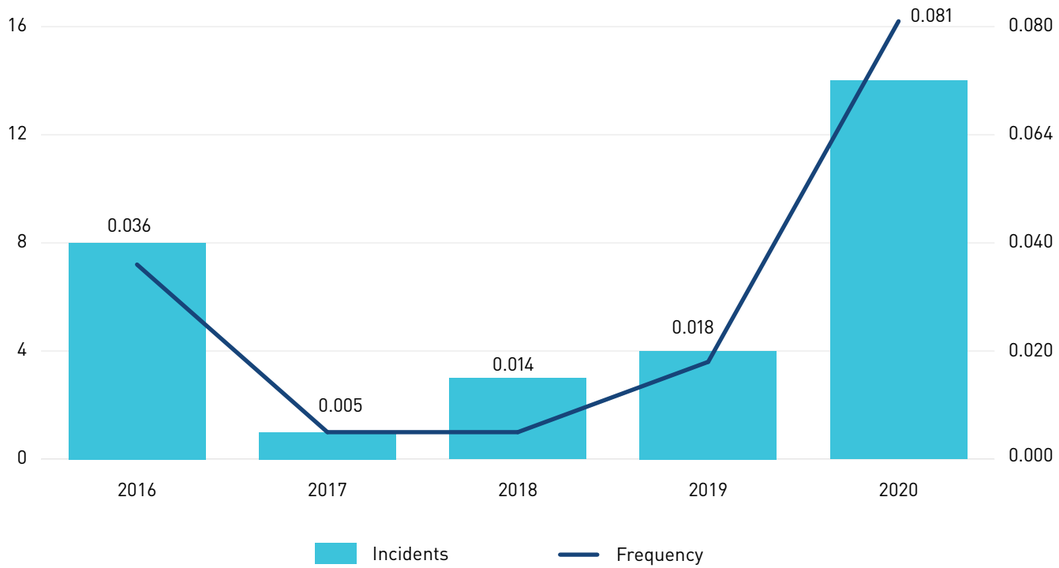
[2] *BSEE NTL No. 2019-N05 Incident and Spill Reports*

4.3 SPI 1 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 incident
C. Tier 1 Process Safety Event
D. Level 1 Well Control Incident - Loss of Well Control
E. ≥ $1 million direct cost from damage to or loss of facility/vessel/equipment
F. Oil Spill to Water ≥ 10,000 gallons (238 barrels)

FIGURE 4.3: SPI 1 Count and Frequency



- Participating Operator members reported 14 **SPI 1** for 2020, as compared to four for 2019.
- The increased number of **SPI 1** incidents combined with the decreased work hours resulted in a frequency of 0.081 for 2020.

FIGURE 4.4: SPI 1 Incident Count per Sub-Group

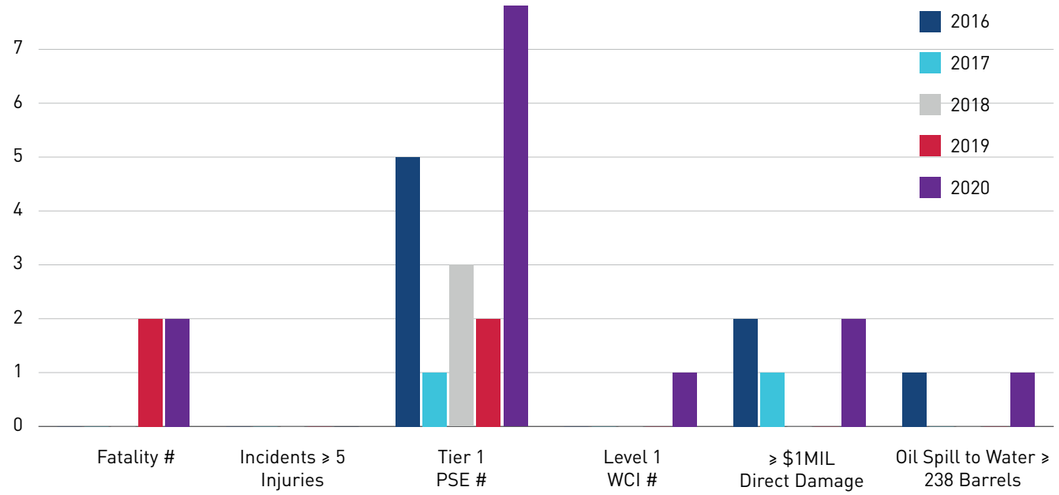
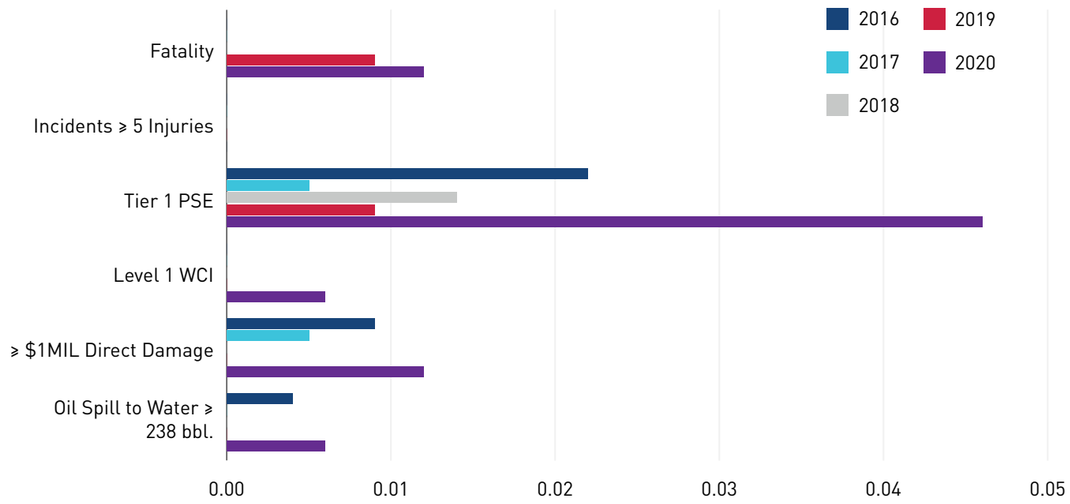


FIGURE 4.5: SPI 1 Incident Frequency per Sub-Group



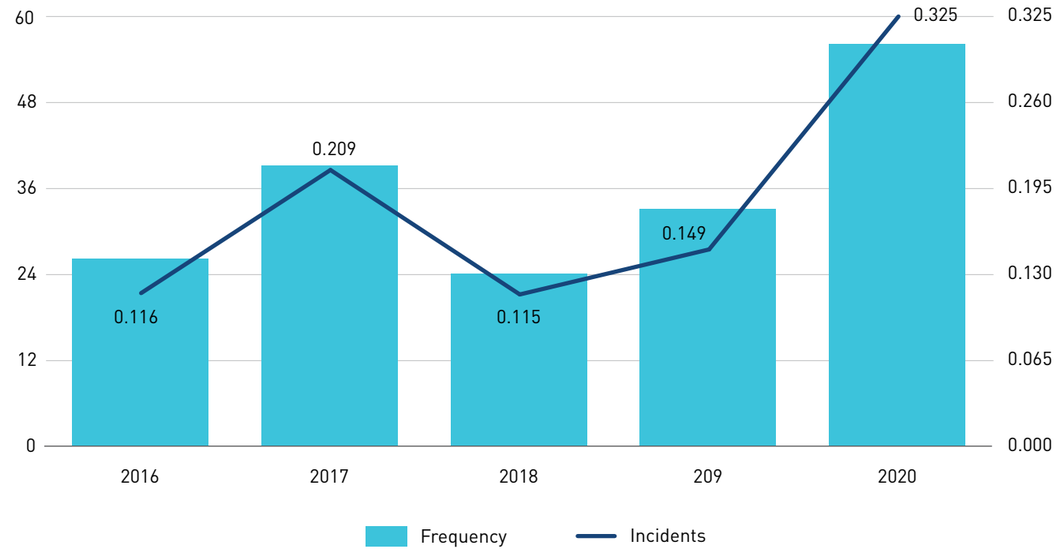
- The 14 **SPI 1** incidents were two incidents involving a Fatality **(SPI 1A)**, eight incidents resulting in a Tier 1 PSE **(SPI 1C)**, one Level 1 Well Control Incident **(SPI 1D)**, two incidents resulting in > $1 Million Direct Costs Damage **(SPI 1E)**, and one incident resulting in Oil Spill to Water ≥ 238 barrels **(SPI 1F)**.
- Zero **SPI 1** incidents involving ≥ 5 Injuries in a Single Incident **(SPI 1B)** were reported for 2020.
- 2020 marks the first time in six years that COS Operators reported a Level 1 Well Control Incident **(SPI 1D).**

4.4 SPI 2 RESULTS AND TRENDS

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

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

FIGURE 4.6: SPI 2 Count and Frequency



- Participating members reported 56 **SPI 2** for 2020, as compared to 33 for 2019, and 24 for 2018.

FIGURE 4.7: SPI 2 Count per Sub-Group

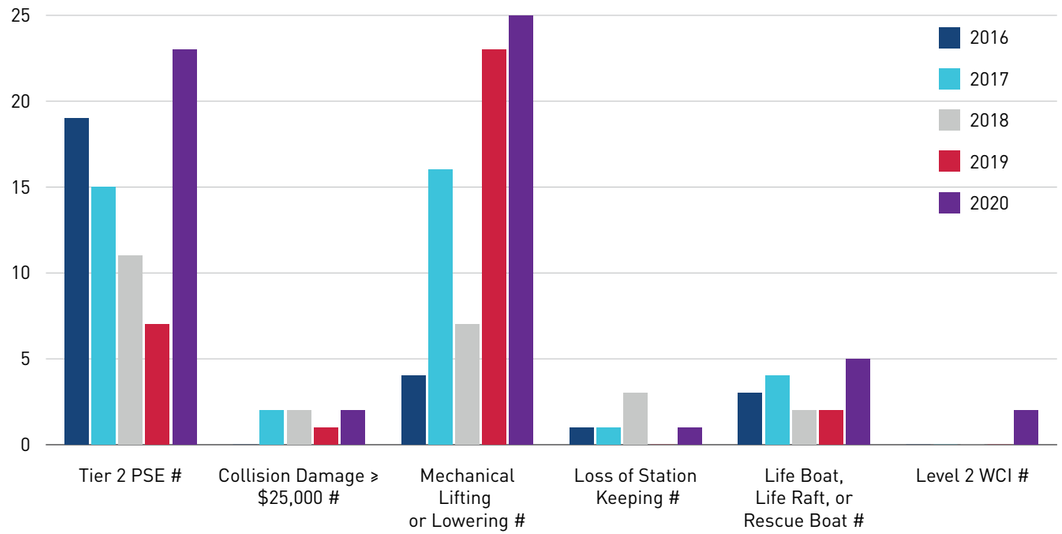
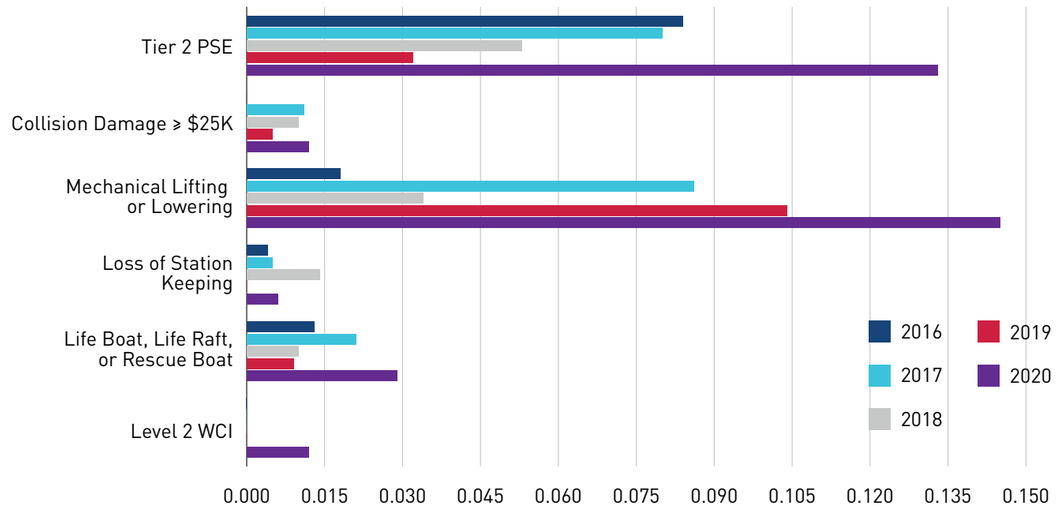


FIGURE 4.8: SPI 2 Frequency per Sub-Group



- Of the 56 **SPI 2** reported for 2020, the consequences were 23 Tier 2 PSE **(SPI 2A)**, two incidents resulting in Collision Damage ≥ $25,000 **(SPI 2B)**, 25 Mechanical Lifting or Lowering Incidents **(SPI 2C)**, one Loss of Station Keeping incident **(SPI 2D)**, five Lifeboat, Life Raft, or Rescue Boat Events **(SPI 2E)**, and two Level 2 Well Control Incidents **(SPI 2F)**.
- The 23 Tier 2 PSE **(SPI 2A)** reported for 2020 is up from the seven reported in 2019 and 11 in 2018.
- The two incidents reported for 2020 involving Collision Damage ≥ $25,000 **(SPI 2B)**, was up from one reported for 2019.
- The 25 incidents involving Mechanical Lifting or Lowering **(SPI 2C)** reported for 2020 was a slight increase from the 23 reported for 2019. Of the 25 incidents reported for this SPI, 16 (64%) were reported by a single Operator.
- Five Lifeboat, Life Raft, or Rescue Boat Events **(SPI 2E)** were reported for 2020.

4.5 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 1). 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 to help industry learn from incidents.

Consequence data was collected for the eight Tier 1 PSE **(SPI 1C)** shared for 2020, with the following consequences:

- Two Resulting in a Non-Toxic Material Release
- Six Resulting in a Toxic Material Release
- Two Resulting in an Outdoor Release

Consequence data was collected for the 23 Tier 2 PSE **(SPI 2A)** reported for 2020, with the following consequences:

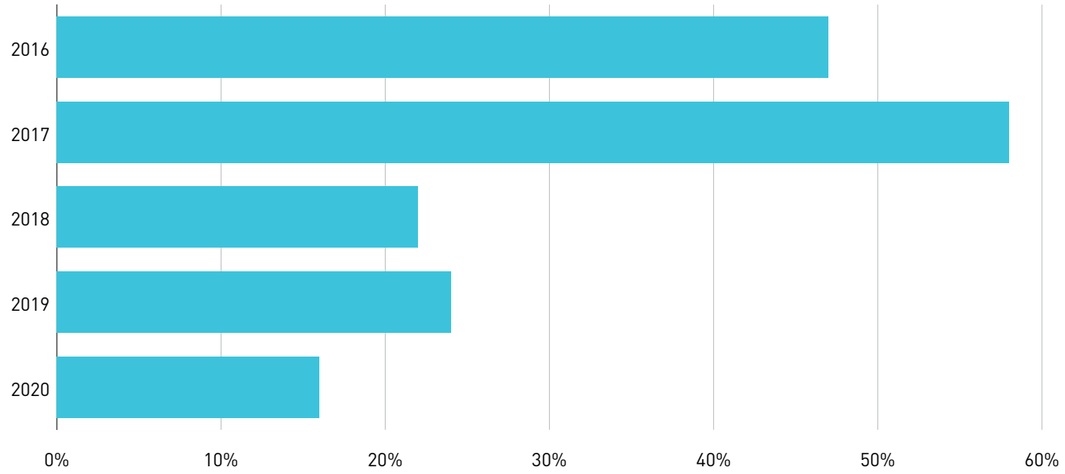
- One Resulting in a Fire ($2,500 to $25,000 Direct Cost Damage)
- Six Resulting in a Non-Toxic Material Release
- 16 Resulting in a Toxic Material Release
- Two Resulting in an Indoor Release
- Four Resulting in an Outdoor Release

NOTE – The total count of PSE consequences may be greater than the number of incidents reported, as one incident can have multiple consequences

4.6 SPI 3 RESULTS AND TRENDS

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

FIGURE 4.9: SPI 3 % Equipment Failure as a Contributing Factor



- Of the 70 **SPI 1** and **SPI 2** incidents reported for 2020, 11 involved failures of equipment as a contributing factor **(SPI 3)**, or 16%. This is a slight decrease over the 24% reported for 2019.

FIGURE 4.10: Figure 4.10: SPI 3 Failure Rates by Equipment Category

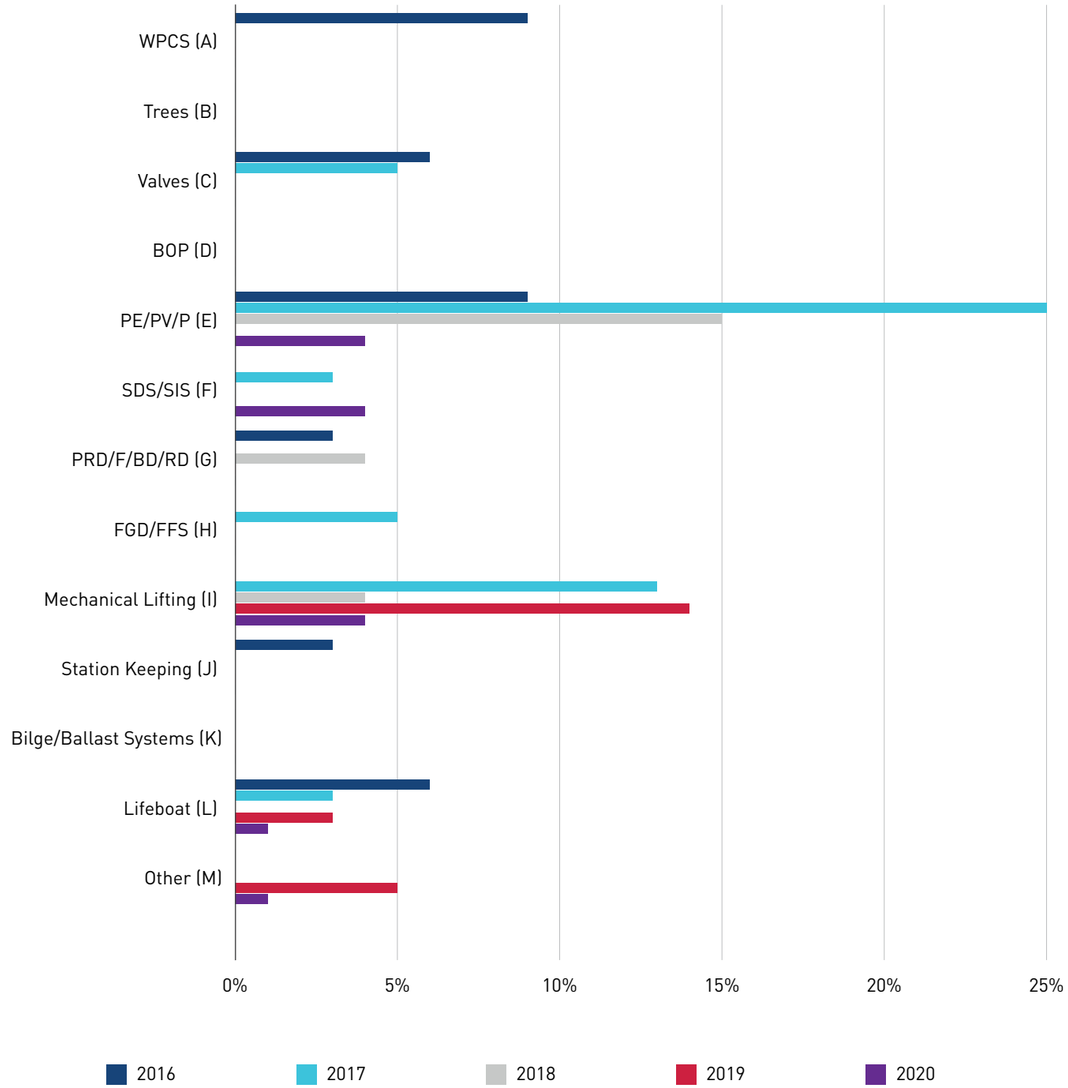


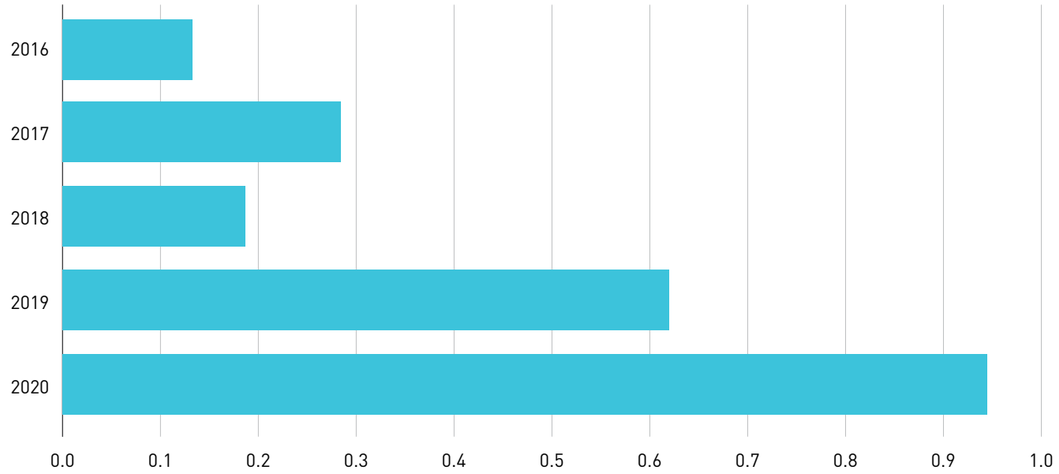
FIGURE 4.11: SPI 3 Incident Counts by Equipment Category

Equipment	2016 Failures (Count)	2017 Failures (Count)	2018 Failures (Count)	2019 Failures (Count)	2020 Failures (Count)
A - Well Pressure Containment System (WPCS)	3	0	0	0	0
B - Christmas Trees	0	0	0	0	0
C - Downhole Safety Valves (Valves)	2	2	0	0	0
D - Blowout Preventers and Intervention Systems (BOP)	0	0	0	0	0
E - Process Equipment/Pressure Vessels/Piping (PE/PV/P)	3	10	4	0	3
F - Shutdown Systems/Automated Safety Instrumented Systems (SDS/SIS)	0	1	0	0	3
G - Pressure Relief Devices/Flares/Blowdown/ Rupture Disks (PRD/F/B/RD)	1	0	1	0	0
H - Fire/Gas Detection and Fire Fighting Systems (FGD/FFS)	0	2	0	0	0
I - Mechanical Lifting Equipment/Personnel Transport Systems	0	5	1	5	3
J - Station Keeping Systems	1	0	0	0	0
K - Bilge/Ballast Systems	0	0	0	0	0
L - Life Boat/Life Raft/Rescue Boat/Launch and Recovery Systems	2	1	0	1	1
M - Other	0	0	0	2	1

4.7 SPI 4 RESULTS AND TRENDS

SPI 4 is a crane or personnel/material handling operations incident.

FIGURE 4.12: SPI 4 Crane or Personnel / Material Handling Frequency



- The 2020 frequency of incidents Involving Cranes or Personnel/Material Handling **(SPI 4)** was the highest reported from 2016-20. This may, in part, be explained by the changed reporting requirements put in place by BSEE as outlined in an NTL published in late 2019.[3]
- 163 incidents Involving Cranes or Personnel/Material Handling **(SPI 4)** were reported for 2020; an increase from the 137 reported for 2019 and 39 reported for 2018.

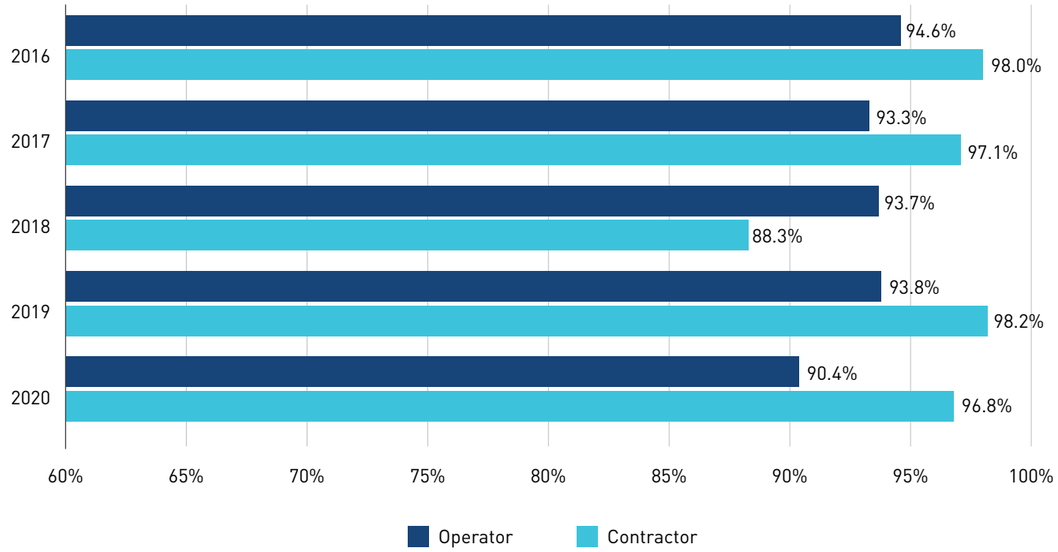
	2016	2017	2018	2019	2020
Count	30	53	39	137	163
Rate	0.133	0.284	0.187	0.620	0.945

[3] *BSEE NTL No. 2019-N05 Incident and Spill Reports*

4.8 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.

FIGURE 4.13: SPI 5 % Planned Critical MIT Completed on Time



- For Operators' **SPI 5** data (Percentage of Planned Critical Maintenance Completed on Time), the combined average for 2020 was 90.4%, ranging from 75.9% to 98.6%. This is a decrease from the data reported for 2019 (average 93.8%, ranging from 72.7% to 100.0%).
- For Contractors, the combined average for 2020 was 96.8%, ranging from 95.3% to 100%, which represents a decrease from the data reported for 2019 (average 98.2%, ranging from 94.6% to 100%).
- **SPI 5** data, when combined for Operators and Contractors, was 92.58% for 2020, which represents a slight decrease compared to 94.92% reported for 2019.

NOTE – each company defines what maintenance, inspection and testing tasks qualify as "critical".

4.9 SPI 6–9 RESULTS AND TRENDS

SPI 6 is the number of work-related fatalities

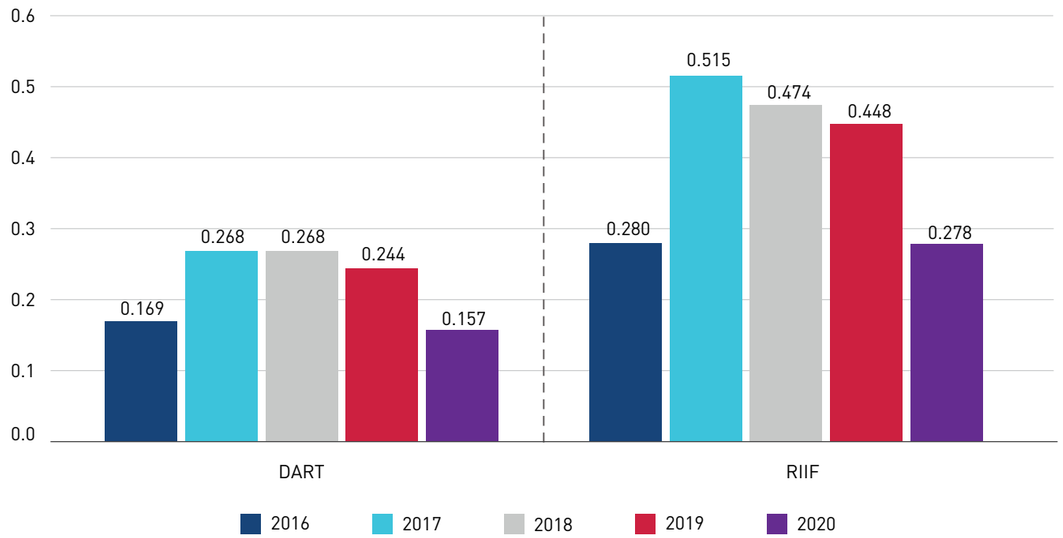
SPI 7 is the frequency of days away from work, restricted work, and job-transfer injury and illnesses (DART)

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

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

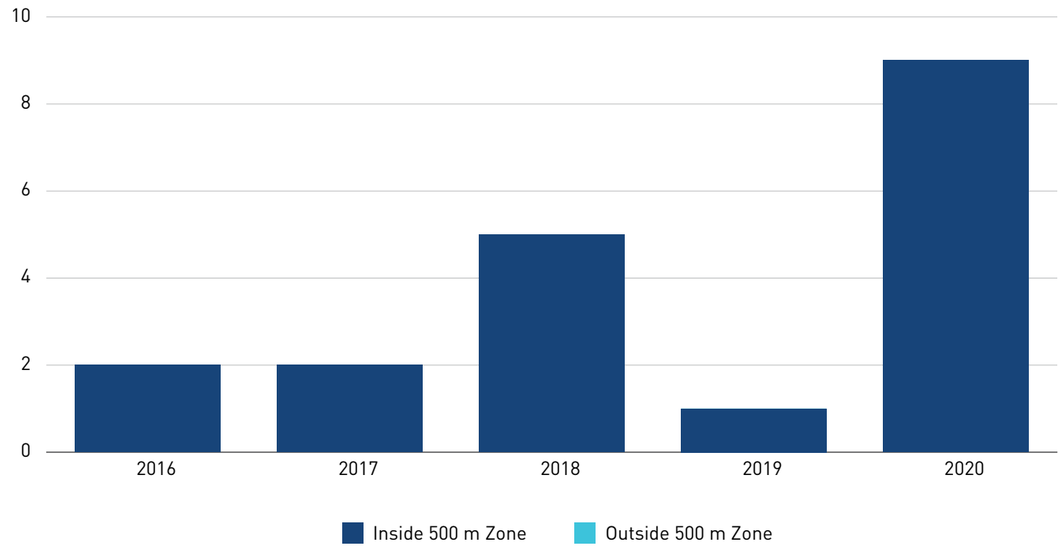
SPI 10 is the severity potential of incidents involving a dropped object

FIGURE 4.14: SPI 7 DART and SPI 8 RIIF Rates



- Two Fatalities **(SPI 6)** were reported for 2020. A total of six Fatalities have been reported to COS in the eight years of reporting.
- The combined Days Away from Work, Restricted Work and Transfer of Duty Rate (DART) **(SPI 7)** reported for 2020 was 0.157 which is a decrease from 0.244 reported in 2019. This is the lowest DART rate reported since data collection began in 2013.
- The combined Recordable Injury and Illness Frequency (RIIF) **(SPI 8)** reported for 2020 was 0.278 which is a decrease from 0.448 reported in 2019. This is the lowest RIIF reported since data collection began in 2013.

FIGURE 4.15: SPI 9 Count of Oil Spills to Water ≥ One Barrel

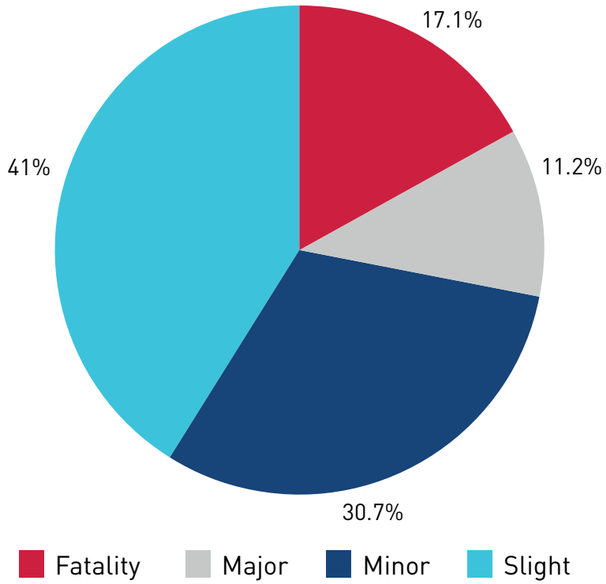


- Nine Oil Spills to Water ≥ One Barrel **(SPI 9)** were reported for 2020, compared to one in 2019 and five in 2018.
- The frequency was 0.052 for 2020, a significant increase when compared to 0.005 in 2019 and 0.024 in 2018.

4.10 SPI 10 RESULTS

SPI 10 is the severity potential of incidents involving a dropped object

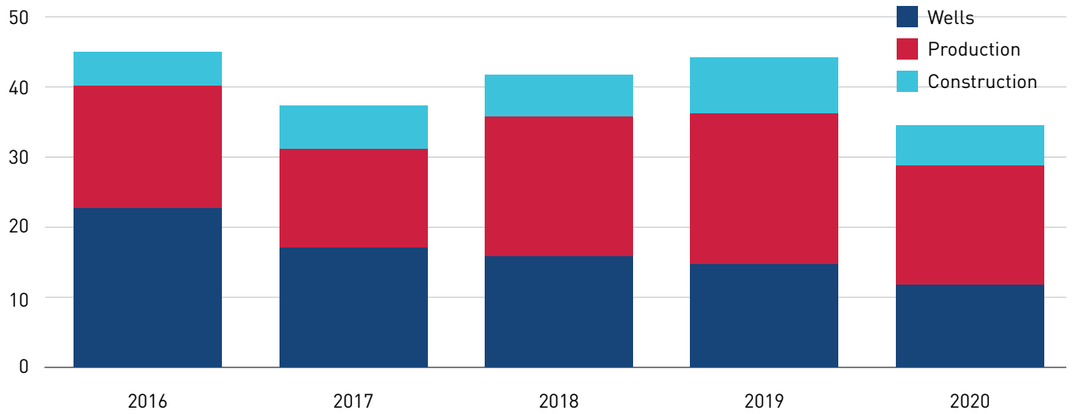
FIGURE 4.16: SPI 10 Dropped Objects ***Potential***



- Based on observations in previous COS annual reports, COS began collecting Dropped Object Potential (**SPI 10**) information from members for the first time for the 2019 reporting year. For the 2020 reporting year, COS added a fifth data point asking how many of the dropped objects reported resulted in zero harm.
- **SPI 10** represents the ***potential*** - ***not actual*** - results of incidents involving a dropped object. A total of 251 reported dropped object incidents were reported for 2020. Of these 251 incidents, 17% had the ***potential*** to result in a fatality, 11% had the ***potential*** to result in a major injury, 31% had the ***potential*** to result in a minor injury, and 41% had the ***potential*** to result in a slight injury.
- Of the 251 dropped objects incidents, 185 resulted in zero harm.
- The definitions for potential fatality, potential major, potential minor, and potential slight are based on those developed by the *DROPSOnline* network. Additional details can be found in Appendix1.

4.11 NORMALIZATION FACTOR (WORK HOURS)

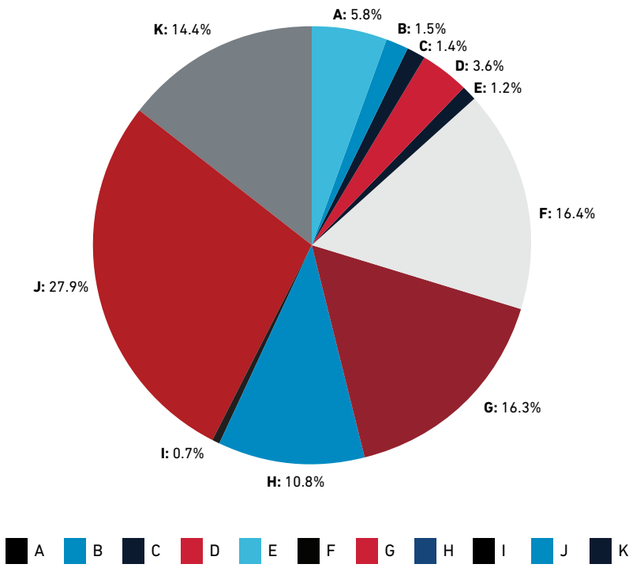
FIGURE 4.17: Work Hours (Millions) by Operation Type



- The data reported for 2020 represents more than 34-million Operator and Contractor work hours in the U.S. OCS. This is a significant decrease over hours reported for 2019 and 2018.
- Work hours, for both Operators and Contractors, are reported only by Operators for work occurring within 500 meters of their facilities.

Year	2016	2017	2018	2019	2020
COS U.S. OCS Work Hours (Millions)	45	37	41	44	34

FIGURE 4.18: 2020 Work Hours per COS Operator



- Five COS Operators accounted for 86% of the total work hours reported by COS members.

5.0 LEARNING FROM INCIDENTS AND HIGH-VALUE LEARNING EVENTS

5.1 INTRODUCTION

The Learning from Incidents and Events (LFI) Program was established to provide a means for COS members to share and learn from incidents and High Value Learning Events (HVLE) that occur in offshore operations. Reporting is voluntary and data confidentiality is maintained through a process administered by the American Petroleum Institute Statistics department before submittal to COS.

While COS maintains a full record of data collected beginning with 2013 data, the data reported in this APR represents the five most recent years. The LFI section of this report provides an analysis and comparison of the **SPI 1**, **SPI 2**, and HVLE LFI data submitted for reporting years 2016-2020 and includes learnings from the 2020 reporting year data that can be shared within companies to potentially prevent recurrence of similar or more severe incidents.

The data are comprised of the reported learnings from **SPI 1** and **SPI 2** incidents, as well as those from HVLE. A summary of the definitions for **SPI 1**, **SPI 2**, and HVLE are presented in Figure 5.1 below.

FIGURE 5.1: Safety Performance Indicator

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 incident
C. Tier 1 Process Safety Event
D. Level 1 Well Control Incident - Loss of well control
E. ≥ $1 million direct cost from damage to or loss of facility / vessel / equipment
F. Oil spill to water ≥ 10,000 gallons (238 barrels)

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

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

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

LFI data submittals include 3 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 (AFI):** 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.

Within the AFI fields, submitters choose from three general categories and 15 sub-categories. Multiple AFI can be selected for a single incident or event. The three general categories are:

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

5.2 SUMMARY

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

- Timely sharing of quality information from incidents and HVLE that meet the reporting criteria; and
- Reviewing submitted incidents and HVLE, along with other data in this report, to identify and implement applicable learnings appropriate to different levels and functions within their own organizations.

The LFI data presented in this report includes information from 32 LFI submittals received for the 2020 reporting year, with 24 of the reported incidents and HVLE occurring in the U.S. OCS, three occurring in U.S. Onshore/State Waters, and five occurring at International locations.

Due to the voluntary nature of the LFI program, this is not an all-inclusive list of incidents or HVLE which have occurred in any given year. COS members use their discretion in selecting which incidents or HVLE to share via this program. Given this, while the data below is displayed as a comparison of data submitted for each of the last five years, the percent increase or decrease from year-to-year is not necessarily indicative of an incident trend.

FIGURE 5.2: Count of LFI Reports by Location

Location	2016	2017	2018	2019	2020
U.S. OCS	43	33	27	43	**24**
U.S. Onshore / State Waters*	1	12	4	4	**3**
International	17	8	0	5	**5**
TOTAL	61	53	31	52	**32**

NOTE - The U.S. Onshore/State Waters category was new for 2017 data reporting. U.S. Onshore/State Waters statistics for prior years were generated from submittal content.

FIGURE 5.3: Count of LFI Reports by Incident or Event Category

Year	2016	2017	2018	2019	2020
COS SPI 1	5	0	2	1	**7**
COS SPI 2	17	8	11	10	**6**
HVLE	21	25	14	32	**11**
TOTAL	43	33	27	43	**24**

A review of the 2020 reporting year LFI data (U.S. OCS only) identified the top reported activity types as:

- Mechanical Lifting or Lowering (28%)
- Maintenance, Inspection and Testing (25%)
- Production Operations – Normal, Routine (13%)
- Drilling Operations – Normal, Routine (13%)

In addition to the topics mentioned above, the top three AFI identified for 2020 were:

- Operating Procedures or Safe Work Practices (63%)
- Process or Equipment Design or Layout (33%)
- Quality of Task Planning and Preparation (29%); Individual or Group Decision Making (29%); and Communications (29%)

Across all eight reporting years, Operating Procedures or Safe Work Practices was the most frequently identified AFI. However, the 63% reported for 2020 is the highest for the eight years of COS LFI data.

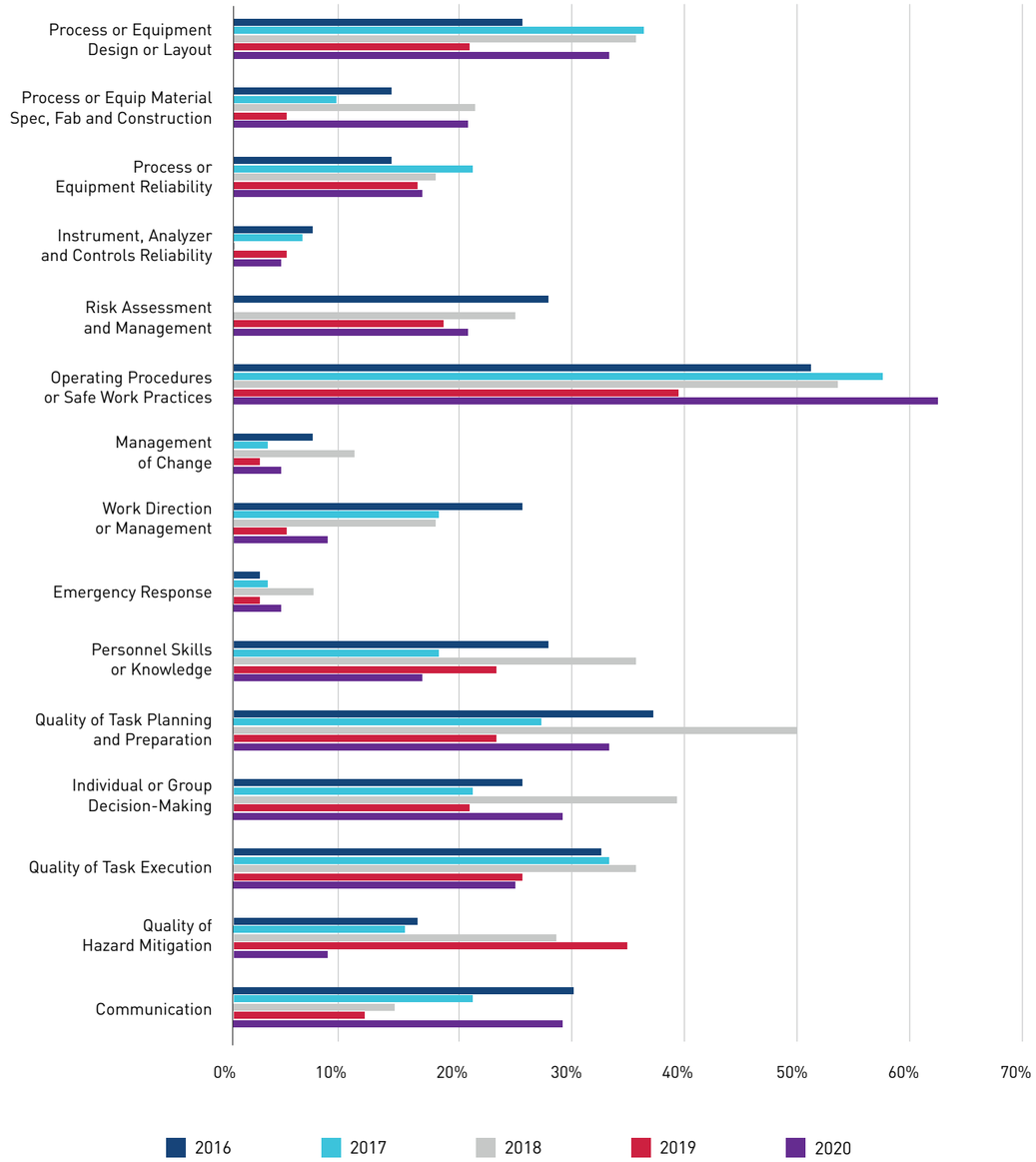
Additional review of the 2020 data identified the following as common threads through many of the LFI submittals:

- Mechanical Lifting or Lowering
- Dropped Objects
- Process Safety Events
- Communication

FIGURE 5.4: Area for Improvement Distribution (U.S. OCS Only)

Area for Improvement	2016	2017	2018	2019	2020	5-yr Avg
Operating Procedures or Safe Work Practices	51.2%	57.6%	53.6%	39.5%	62.5%	**52.9%**
Quality of Task Planning and Preparation	37.2%	27.3%	50.0%	23.3%	33.3%	**34.2%**
Quality of Task Execution	32.6%	33.3%	35.7%	25.6%	25.0%	**30.4%**
Process or Equipment Design or Layout	25.6%	36.4%	35.7%	20.9%	33.3%	**30.4%**
Individual or Group Decision-Making	25.6%	21.2%	39.3%	20.9%	29.2%	**27.2%**
Personnel Skills or Knowledge	27.9%	18.2%	35.7%	23.3%	16.7%	**24.3%**
Communication	30.2%	21.2%	14.3%	11.6%	29.2%	**21.3%**
Quality of Hazard Mitigation	16.3%	15.2%	28.6%	34.9%	8.3%	**20.6%**
Risk Assessment and Management Process	27.9%	0.0%	25.0%	18.6%	20.8%	**18.5%**
Process or Equipment Reliability	14.0%	21.2%	17.9%	16.3%	16.7%	**17.2%**
Work Direction or Management Process	25.6%	18.2%	17.9%	4.7%	8.3%	**14.9%**
Process or Equipment Material Specification, Fabrication and Construction	14.0%	9.1%	21.4%	4.7%	20.8%	**14.0%**
Management of Change Process	7.0%	3.0%	10.7%	2.3%	4.2%	**5.4%**
Instrument, Analyzer and Controls Reliability	7.0%	6.1%	0.0%	4.7%	4.2%	**4.4%**
Emergency Response Process	2.3%	3.0%	7.1%	2.3%	4.2%	**3.8%**

FIGURE 5.5: Areas for Improvement Distribution (U.S. OCS only)



NOTE - LFI submittals typically identify more than one AFI for any given incident. The graph above illustrates the percent of times an AFI was identified relative to the number of LFI forms submitted for U.S. OCS. Because the number of AFI exceeds the number of LFI forms, the sum of the percentages will be > 100%.

5.3 2020 LEARNINGS

As noted in Section 5.2, Mechanical Lifting or Lowering, Dropped Objects, Process Safety Events and Communication were sited in many of the incidents and events reported in the 2020 LFI submittals. Selected learnings from these submittals are excerpted below.

The charts and graphs earlier in this section reflected data for U.S. OCS incidents and HVLE only. In addition to these U.S. OCS LFI submittals, the following sections may include learnings from U.S. Onshore / State Waters and International incidents and HVLE.

5.3.1 MECHANICAL LIFTING OR LOWERING

Nine of the 32 LFI submittals (seven U.S. OCS and two International) listed the primary activity type at the time of the incident or HVLE as Mechanical Lifting or Lowering for 2020. For these incidents, the most frequently cited AFI were:

- Operating Procedures and Safe Work Practices – 6 of 9 (67%)
- Process or Equipment Design or Layout – 5 of 9 (56%)
- Risk Assessment and Management Process, Task Planning and Preparation, and Communication – 4 of 9 (44% each)

The following incident descriptions and learnings are excerpted examples relating to Mechanical Lifting or Lowering:

Incident Description – A rigger was pulling on tagline lodged between basket and equipment and was secured to the crane stinger hook. As he was pulling the tag line came free and caused the stinger hook to swing which was behind the other rigger. He turned and the stinger hook struck him in the mouth causing a small cut on the lip and chipped two teeth. There was little bleeding, no swelling and no need for first aid or sutures however two teeth were chipped.

Learnings:

***AFI – Personnel Skills or Knowledge**: Motorhand recognized that the tagline was stuck and decided to attempt to free it. If he had used [Stop Work Authority], specifically, "What has changed?" he would have recognized that the crane was in motion and granted himself the opportunity to stop the job and find a way to free the tag line without creating, or exposing anyone to, additional hazards.*

***AFI – Quality of Task Planning and Preparation:** Procedure available, but not used: The crew did not plan correctly for this lift. The tagline should have been removed if the intent was to use the taglines already attached to the work basket. If the intent was to use the tagline that had previously been used it should have been attached to the load, not the stinger.*

***AFI – Communication:** Lack of/ late communication: The Crane Operator knew that it was a short swing to pick up the two-legged sling and swung the crane towards the IE [injured employee] without letting him know that the boom was in motion. The IE was the flagger for the crane, but never flagged the crane to move.*

Incident Description – A Plug & Abandon crew was attempting to test a downhole cement plug using a tension packer connected to a 1500' work-string attached to the platform crane. While setting the tension packer the 50K shear ring failed unexpectedly at 26K resulting with an immediate decrease in load weight to 9K resulting in a shockload of the crane. The 50K shear ring capacity, per manufacturer specifications, is a one pull value requiring the shear ring to be replaced after a failed setting attempt. The investigation revealed that three prior attempts were made to set the tension packer, thus weakening the shear ring value with each attempt resulting in metal fatigue and the undesirable event.

Learnings:

***AFI – Personnel Skills or Knowledge**: Operating procedure for setting packers into well bore has been changed to require packers to only be set with alternative means other than platform cranes, such as casing jacks.*

***AFI – Quality of Task Planning and Preparation:** Tension packers use of the shear ring type was discontinued as preferred packer. Alternative "multi use" inflatable packers was determined to be most suitable for work task.*

***AFI – Communication:** The manufacturer's recommendation for setting the shear type tension packer was in place but not reviewed or followed prior to task initiating.*

Incident Description – While in the process of skidding the derrick to the desired position, the rig catwalk, which was suspended and connected to the starboard crane with a two-part sling, the crane boomed down suddenly which caused the load to slew uncontrolled. This resulted in some damage to the structure of the catwalk. Skidding operations was stopped immediately and the crane operator was advised by the Toolpusher to place the load safely back on the deck. There were no injuries as a result of this incident.

Learnings:

***AFI – Personnel Skills or Knowledge**: There is no process currently to ensure that "critical" lessons learned (After Action Reviews) are incorporated as steps, hazards, and/ or controls within applicable Job Safety Analysis (JSA).*

Allocate window of opportunity (time) for personnel to undertake updates to JSAs when "critical" lessons learned are identified during tasks to enable continuous improvement of JSAs within Steps: Event; Potential Incidents/ Hazards; and/ or Methods to Eliminate/ Control Hazards.

***AFI – Quality of Task Planning and Preparation:** Crane lifts associated with Transverse Skidding Operations are classified as a general lift, in contrast to the increased risk and level of control required.*

Recategorize Transverse Skidding Operations as a complicated lift, requiring development of an associated lift plan.

***AFI – Communication:** For skidding operations, there is no crane crew involved in the review of the safework plan, and/ or combined prestart undertaken to ensure all involved personnel are aware of all hazards and controls necessary to execute the task safely.*

Require all involved crews (e.g., drilling and crane Crews, etc.) collectively be involved in communication of the plan.

5.3.2 DROPPED OBJECTS

Eleven of the 32 LFI submittals (seven U.S. OCS, two US Onshore/State Waters, and two International) included Dropped Objects as an actual or potential consequence for 2020. For these incidents, the most frequently reported Activities at the time of the Drop were:

- [illegible]ance, Inspection and Testing – 5 of 11 (45%)
- Drilling Operations – Normal, Routine – 2 of 11 (18%)
- Mechanical Lifting or Lowering – 1 of 11 (9%)
- Start-Up or Shut Down Operations – 1 of 11 (9%)

The two remaining incidents which included a Dropped Object listed "Other" as the Activity Type.

For these 11 incidents which included a Dropped Object, the most frequently sited AFI were:

- Operating Procedures and Safe Work Practices – 7 of 11 (64%)
- Process or Equipment Design or Layout – 3 of 11 (27%)
- Individual or Group Decision Making – 3 of 11 (27%)

The following incident descriptions and learnings are excerpted examples of learnings for Dropped Objects:

Incidents Description – A crew member was working on the west crane mezzanine deck. After placing a box containing a 59 lb swing/slew brake down on the boom's catwalk, the crew member started walking to grab the second brake. They turned around to place the second brake on the catwalk and saw the first brake roll off the cat walk and fall through a section between the catwalk's toe board and ladder. The brake landed 28ft 8in below on the main deck. Another crew member on the mezzanine deck was within red barricade tape when brake landed 20 ft away.

Learnings:

***AFI – Design or Layout of a Facility or Individual Piece of Equipment**: There was no barrier that physically prevented the brake from rolling off of the platform*

- *On the crane boom platform, evaluate the efficacy of installing a toeboard intended to prevent objects from being able to roll over the exposed edge*
- *Where it is not practicable to install a toeboard, implement an alternative means in consideration of the hierarchy of controls that prevents objects from being able to roll off the platform (e.g., prohibiting equipment movement via the boom platform, transportation/ mechanical aides such as lifting/ containment box or bag, tying off equipment, containment netting, etc.)*

***AFI – Risk Assessment and Management Process:** There is no documented procedure (and associated training) that outlines the process steps necessary to achieve protection of personnel from objects that have the potential to be dropped or fall from height, including barrier and barricading requirements, alternative access/ egress routing, zone delineation, zone guidance, all-stop work requirements etc.*

- *Document the procedure and training requirements necessary to achieve adequate protection of all personnel from objects that have the potential to be dropped or fall from height, including barrier and barricading requirements, alternative access/ egress routing, zone delineation, zone guidance, all-stop work requirements etc.*

***AFI –Quality of Task Execution:** There are gaps in the verification approach that confirms key elements of the permit to work process are standardized and being adhered to. For example, walk down the job and verify controls in the safe work plan are in place, permit users are communicated and understand*

Learnings:

***AFI – Facility or Equipment Material Specification, Fabrication and Construction, or Quality Control:** For new carbon steel designs ensure compliance the requirements for Marine environment and intermittent service:*

the hazards being controlled and the permit conditions to be met, and controls in the safe workplan are verified as in place, including pre-requisite controls required to be in place prior to commencement of work.

Incident Description – Employee finished making a gauge run, the employee lowered the 2.60" inverted gauge and removed the gauge from the tool string. Employee picked up the tool string back into lubricator and latched into the head catcher and then stabbed the lubricator back onto well. The employee left the tool string as is and was off tower for approximately seven hours. On [following day], the employee was called to continue operations. The employee unstabbed the lubricator at quick test sub, and lowered tool string to install 2" impression block. Once impression block was installed, employee began to pick tools up into lubricator and the tool string un-swiveled at the detent jars and fell approximately 18' to rig floor. The tool string weighed 83 lbs. A Red Zone was established on rig floor and there were no personnel in the area.

Learnings:

***AFI – Design or Layout of a Facility or Individual Piece of Equipment**: Checklist / Procedure not sufficient for the task. A pre-run checklist is in place for inspecting tools, but the checklist does not have an identified prompt or hold point to perform a complete inspection after the tools have been suspended for an extended period of time.*

***AFI – Risk Assessment and Management Process:** Anytime work is completed outside a procedure, shoreside management is to be contacted and a formal risk assessment completed. This would have prompted a discussion between the onshore team and rig team.*

***AFI –Quality of Task Execution:** The tool string was not laid down to complete the pre-run checklist which would include a full inspection prior to installing the lead impression block.*

Incident Description – At approximately 1915 noise was heard by deck pusher from his office. He investigated and discovered the windsock from antenna platform level laying on heli-deck outside heli-lounge. It was determined that the windsock fell from its installed location platform above the heli-fuel wind wall on the starboard side. Although the windsock decent may have been affected by wind resistance, the bracket maintained significant energy in flight, striking the deck leaving obvious marks. The windsock weighed 5.05 kgs (11 lbs) fell 7.9 m (26 ft) and risk ranked as high potential for serious injury or greater.

***AFI – Facility or Equipment Material Specification, Fabrication and Construction, or Quality Control**: The windsock bracket had corrosion on the pipe that fitted in the lower floor mounted section of the frame. The bearing that allowed the windsock to rotate had heavy corrosion, wear and tear. There was inadequate maintenance of the windsock mast; not regularly inspected and maintained through a documented process.*

***AFI – Operating Procedures or Safe Work Practices:** Develop Preventive Maintenance for all windsock assemblies on the rig.*

5.3.3 PROCESS SAFETY EVENTS (PSE)

Four of the 32 LFI submittals (three U.S. OCS and one International) described PSE (three Tier 1 PSE and one Tier 2 PSE) and listed either Production Operations or Maintenance, Inspection & Testing as the primary activity type at the time of the incident or HVLE for 2020. For these incidents, the most frequently reported AFI were:

- Operating Procedures and Safe Work Practices – 3 of 4 (75%)
- Process or Equipment Design or Layout – 2 of 4 (50%)

The following incident descriptions and learnings are excerpted examples of learnings for PSE:

Incident Description –Operators were returning a Vapor Recovery Unit (VRU) compressor back to service. While returning the isolation points back to their normal state, a 3-way valve was transitioned from the vent (maintenance) position back to the flare (normal) position. The 3-way valve is of a "trans-flo" design meaning all three ports are in communication during transitioning from one position to another. During the 3-way valve transition, the platform was flaring gas from another location which imposed approximately 8 pounds per square inch (psi) of pressure on the flare system. When the valve was near the 35% position, gas from the flare system traveled through the 3-way valve and exited the VRU maintenance vent pole above the production deck. Wind then blew the vented gas back toward the platform where it was measured by two separate gas detectors. The safety system registered the gas levels from two separate detectors and took action to close all shutdown valves, sound the muster alarm, and open all blowdown valves. Then the muster alarm sounded, the personnel operating the 3-way valve left it at the 35% transit position and moved to their assigned muster location and the remainder of the volume vented. The blowdown valves are designed to de-pressure the platform and send all process gas to flare. When the blowdown occurred the 3-way valve was in transit and had an open path to the vent pole. The additional flow path allowed a large volume of gas to escape through the VRU vent pole during the blowdown event.

Learnings:

***AFI – Design or Layout of a Facility or Individual Piece of Equipment:** Consider possible mechanical changes to isolate compressor flare and vent systems:*

- *Remove vent pole*
- *Remove 3-way valve and install gear operated valves, interlocked with compressor run status, isolating flare and vent*
- *Add an additional valve isolating from the flare system*

***AFI – Operating Procedures or Safe Work Practices:** Develop procedures for compressor Lock out Tag Outs (LOTOs) which include stepwise order of operations for isolation and deisolation and train operations staff doing this work.*

- *If platform has a "trans-flo" style 3-way valve, consider impact of manipulating while actively flaring.*
- *If available, use isolation points other than the 3-way valve to isolate flare and vent.*

***Additional Comments:** The order that valves are listed in a LOTO is not necessarily meant to be the order in which the valves have to be manipulated in the field.*

- *When copying an existing design to mitigate one hazard (i.e., prevention of air entry into the flare system after maintenance), the potential to create other unforeseen hazards exists (i.e., connect enclosed flare system with atmospheric vent system).*
- In practice a vent pole is not seen as equivalent to a bleed point; this normalizes the risk of leaving the vent pole open during de-isolation.

Incident Description –Around 01:00 AM, a deck operator working on Vapor Recovery Unit (VRU) 2 heard an abnormal noise. He first investigated his direct surroundings to locate the source of the noise but was unable to do so and called upon another operator to help find the source. The team moved to the top deck (deck 6) and identified the noise was coming from an air-cooled heat exchanger on the second stage discharge side of Field Gas Compressor (FGC) 2. The operators went down to the compressor deck and initiated an emergency stop on FGC 2. This action shut down the compressor, depressurized the equipment and as a result the noise stopped. After the equipment was shut in, Operations found a single ruptured tube, located on the tube side of the inlet header box of air-cooled heat exchanger. Based on the operating conditions (1250 psi and 305°F) and the estimated duration of the event it was determined to be a Tier 1 gas release.

- *A minimum of 60 mils (1.6 mm) of corrosion allowance should be included for carbon steel tubes*
- *The exposed ends of carbon steel and low alloy steel tubes shall be "metallized" with aluminum, or galvanized (zinc or nickel-zinc).*

AFI – Facility or Equipment Reliability: *External corrosion caused the wall thickness of the air-cooled heat exchanger cooler tubes on the inlet (hot) end, bottom row, to be significantly reduced. This corrosion was not anticipated and not detected by the inspections that were performed on this air cooler. The inspection program covers both external as well as the internal inspections. The external inspections were performed while the air-cooled heat exchanger was online and, as such, only the parts visible 'from the outside' were inspected. Tube thickness measurements were not included as part of the external inspections. The internal inspection program was based on the Risk Based Inspection (RBI) approach and only identified internal wet CO2 corrosion as a damage mechanism. External corrosion of the tubes and tube ends was not identified as a potential damage mechanism in the RBI inspection model.*

Incident Description – Gas detectors activated on starboard side near drain tank dump valve and alarms initiated a facility emergency shut down (ESD) / muster and a system blow-down. 10" dump valve on drain tank found open ~5mm with corrosion around seat. Attempted to fully close valve but unable to establish a seal. Initiated manual venting of blanket gas to reduce tank pressure; reestablished water seal in u-tube below dump valve. Release occurred as blanket gas pressure increased to 1.6 psi over atmosphere: blanket gas volume equivalent to 146k m3 (>900k bbls equivalent) due to interconnected system across drain, slop and crude oil tanks. Analytics on volumes/ pressure changes indicate ~3700 kg release over 77 minutes.

AFI – Design or Layout of a Facility or Individual Piece of Equipment: *Crude oil heaters not performing to design given plate cooler refurbishment and steam system reliability; modelling suggests entrained gas breakout 6x higher than design in tanks consistent with pressure; Reid Vapor Pressure analysis on oil stabilization not performed. Found leak rate across shut down valve (SDV) downstream of oil coolers during ESD to exceed design criteria.*

AFI – Facility or Equipment Reliability: *Primary seal to be maintained through U-tube water trap; water seal assumed lost and/or overcome by increasing pressure, likely due to evaporation or loss of U-tube integrity.*

AFI –Risk Assessment and Management Process: *Assess interconnecting systems; understand process safety risks and mitigations. Review equipment strategy on crude oil heaters; recommission or MOC (management of change) if changing from design standard.*

AFI –Operating Procedures or Safe Work Practices: *Update PMs to confirm U-tube water seal (bi-weekly); complete U-tube integrity inspections on next entry. Assess manual venting processes and confirm procedures fit-for-risk. Review SDV leak testing procedures and frequency; confirm SDV integrity. Conduct Reid Vapor Pressure analysis downstream of separator on oil stabilization.*

Additional Comments: *Never underestimate the energy associated with low-pressure high-volume systems (e.g., cargo tanks). Perceived Low Impact incidents require appropriate and timely investigation to avoid surprises. Ensure Marine Systems Integrity have same level of scrutiny and attention similar to other topside systems. Step-up on Facility Marine and Survivability systems knowledge and competencies. Site type: Incident occurred on a FPSO (Floating Production, Storage, and Offloading) Facility.*

5.3.4 COMMUNICATIONS

Eleven of the 32 LFI submittals (seven U.S. OCS, one US Onshore/State Waters, and three International) sited Communications as an Area for Improvement. For these incidents, the most frequently reported Activities at the time of the incident or HVLE were:

- Maintenance, Inspection and Testing – 5 of 11 (45%)
- Mechanical Lifting or Lowering – 4 of 11 (36%)

The following incident descriptions and learnings are excerpted examples of learnings for Communications:

Incident Description – An operations deck operator was stationed at the L.A.C.T. (Lease Automatic Custody Transfer) unit on the production module testing PAGA (Public Address and General Alarm) alarm push button stations with a designated control room operator. The operations team members were utilizing a compliant JSA (Job Safety Analysis) and three-way communication for the task.

While en route to the East crane, a maintenance team member observed the operations team testing push button stations near the L.A.C.T. unit on the production module (NOTE: the east crane pedestal and L.A.C.T. unit are in proximity of each other on the production module). The maintenance team member was not clear which stations were being tested - PAGA or ESD stations. While ascending the east crane pedestal stairs, the maintenance team member identified PAGA alarm and ESD push button stations located on an elevated deck area of the crane pedestal. The maintenance team member then attempted to verbally communicate to the deck operator below by yelling from the elevated deck of the crane pedestal instead of using his radio. The maintenance team member's intent was to offer service to help the deck operator. The deck operator interpreted that the maintenance team member was asking if there were stations on the crane pedestal to be tested and responded "yes." The maintenance team member interpreted that the operations team member was giving approval to test the push button station so he pushed the ESD switch station and caused a facility shutdown.

Learnings:

AFI – Individual or Group Decision Making *: Inadequate verbal communication. Individual failed to establish three-way communication with operations team members both on deck and in the control room.*

AFI – Communication: *Inadequate verbal communication. Individual failed to establish three-way communication with operations team members both on deck and in the control room.*

Incident Description –Components of a fire and gas control system were removed for upgrades from a control van while cold stacked at the shipyard. The main supply was locked out, however the ends of the wires were not secured and left exposed within the explosion-proof enclosure. A new crew that was not a part of the original work arrived onsite to perform maintenance, unaware that components of the fire and gas control system were previously removed. As rig power was restored to the control van, a ground fault picked up the active power and faulted out. Rig power was re-isolated. Inspection of the enclosure revealed arc points from open ended wires.

Learnings:

AFI – Quality of Task Execution*: The lockout/tagout process was not executed. No lock and tag applied. No information/tag identified the system as unsafe for power up or that the fire and gas control system was removed. The load side of the wires remained connected to the source side (breaker) and wire ends were not secured and left exposed.*

AFI – Communication: *The incoming crew was not aware of the maintenance performed before their arrival.. No handover notes or communication were available in LOTO logs, system logs, or factory acceptance testing (FAT) logs. No physical handover meeting or communication took place.*

Incident Description – A load test utilizing water bags, standard rigging, and a contractor's remote load cell was performed on the starboard A-frame installed on a marine vessel. The A-frame was being tested to 150% of the Safe Working Load (SWL) posted on the A-frame (14,000lbs) in the outboard position. At approximately 19,500lbs, the upper portions of the A-frame's arms separated from the lower portions and landed on the dock. This incident was classified as a HiPo near hit.

Learnings:

AFI – Operating Procedures or Safe Work Practices*: Vessel-specific procedures for A-frame load testing were not written. A vessel-specific procedure was created for load testing A-frames. After implementation, the crew successfully tested the stern A-frame.*

AFI – Quality of Task Planning and Preparation: *1) A JSEA and risk assessment was not performed for this task. A vessel-specific risk assessment was created for load testing A-frames. In addition, risk assessments for each asset that involves mechanical lifting have been put into place. 2) Personnel did not review or refer to the Lifting Policy that stated of requirement that A-frames (of the size involved in the incident) are to be tested to 125% of the Safe Working Load (SWL). By not completing that review, the A-frame was inadvertently being tested to 150% of the Safe Working Load (SWL) as stamped on the A-frame.*

AFI – Individual or Group Decision Making: *OEM drawings indicate the A-frame must be tested in the vertical position. The personnel conducting the testing tested the A-frame in an outboard position.*

AFI – Communication: *A specific lifting policy was not clearly identified and communicated to some of the personnel from other internal groups and may have led to confusion. It was assumed that all parties were aware of the lifting policy in place. The lifting policy will be included in future work packages.*

APPENDIX 1 SPI DEFINITIONS & METRICS

SPI No.	SPI Definition	SPI Metric	Reporting Entity
SPI 1	Number of work-related incidents resulting in one or more of the following consequences: A. Fatality: One or more fatalities. B. Injury to five or more persons in a single Incident C. Tier 1 Process Safety Event: (API RP 754/IOGP Report 456 Tier 1 Process Safety Event) An unplanned or uncontrolled release of any material, including non-toxic and non-flammable materials (e.g., steam, hot condensate, nitrogen, compressed CO2, compressed air), from a process that results in one or more of the consequences listed below: ▪ an employee, contractor or subcontractor "days away from work" injury and/or fatality; ▪ a hospital admission and/or fatality of a third-party; ▪ an officially declared community evacuation or community shelter-in-place; ▪ a fire or explosion resulting in greater than or equal to $25,000 of direct cost to the Company; ▪ a pressure release device (PRD) discharge to atmosphere whether directly or via a downstream destructive device that results in one or more of the following four consequences: ▪ liquid carryover ▪ discharge to a potentially unsafe location ▪ an onsite shelter-in-place ▪ public protective measures ▪ and a PRD discharge quantity greater than the threshold quantities in IOGP Report 456 Part E in any one-hour period; or ▪ A release of material greater than the threshold quantities described in IOGP Report 456 Part E in any one-hour period. D. Level 1 Well Control Incident: Loss of well control ▪ Uncontrolled flow of formation or other fluids resulting in: ▪ Seabed/surface release. ▪ Underground communication to another formation or well. ▪ Includes shallow water flows that result in damage or loss of facilities/equipment E. $1 million or greater direct cost from damage to or loss of facility / vessel / equipment (excludes costs associated with downtime or production loss). F. Oil spill to water > or equal to 10,000 gallons (238 barrels)	# of SPI 1 incidents/ total work hours* 200,000	COS Operator for all incidents within the 500-meter zone and for incidents to direct employees while offshore COS Contractor for incidents outside the 500-meter zone while offshore

SPI No.	SPI Definition	SPI Metric	Reporting Entity
SPI 2	Frequency of work-related incidents that do not meet the definition of a SPI 1 incident but have resulted in one or more of the following: A. Tier 2 Process Safety Event: (API RP 754/IOGP Report 456 Tier 2 Process Safety Event) An unplanned or uncontrolled release of any material, including non-toxic and non-flammable materials (e.g., steam, hot condensate, nitrogen, compressed CO2, compressed air), from a process that results in one or more of the consequences listed below and is not reported as a Tier 1 PSE: ▪ An employee, contractor or subcontractor recordable injury; ▪ A fire or explosion resulting in greater than or equal to $2,500 of direct cost to the Company; ▪ A pressure release device (PRD) discharge to atmosphere whether directly or via a downstream destructive device that results in one or more of the following four consequences: ▪ liquid carryover ▪ discharge to a potentially unsafe location ▪ an onsite shelter-in-place ▪ public protective measures ▪ and a PRD discharge quantity greater than the threshold quantity in IOGP Report 456 Part E in any one-hour period. B. Collision that results in property or equipment damage ≥ $25,000 C. Incident Involving Mechanical Lifting A mechanical lifting (or lowering) incident that results in one or more of the following consequences. Mechanical lifting includes lifts of an asset or personnel (personnel transfer and man-riding) ▪ Consequences ▪ Four or less recordable injuries in a single incident that occurs during the lift ▪ Between $25,000 and $1 million direct damage to or loss of an asset (including the load itself) ▪ A loss of primary containment of a material meeting a Tier 2 Process Safety Event threshold quantity ▪ A dropped load that strikes live process equipment ▪ Not Included ▪ Lifting incident resulting only in a first aid injury ▪ Lifting incident resulting only in direct damage to an asset (including the load itself) < $25,000 ▪ Lifting incident resulting only in a slipped load ▪ Dropped load or object into the water valued at < $25,000 ▪ Manual lifting incidents D. Loss of station keeping resulting in drive off or drift off defined as a malfunction or improper operation of the dynamic positioning system E. Life boat, life raft, or rescue boat event that resulted in a recordable injury or equipment damage or malfunction during lifeboat, life raft, or rescue boat operations or that take it out of service. F. Level 2 Well Control Incident. One barrier system within the well design failed and other barrier system(s) either failed or were challenged beyond design capacity resulting in an influx without uncontrolled flow.	# of SPI 2 incidents / total work hours * 200,000	COS Operator for all incidents within the 500-meter zone and for incidents to direct employees while offshore COS Contractor for incidents outside the 500-meter zone while offshore

SPI No.	SPI Definition	SPI Metric	Reporting Entity
SPI 3	Number of SPI 1 and SPI 2 incidents that involved failure of one or more of equipment as a contributing factor. COS Equipment categories: A. Well pressure containment system B. Christmas Trees C. Downhole safety valves D. Blow out preventer and intervention systems E. Process equipment/pressure vessels, piping F. Automated safety instrumented systems / shutdown systems G. Pressure relief devices, flare, blowdown, rupture disks H. Fire/gas detection and fire-fighting systems I. Mechanical lifting equipment/personnel transport systems J. Station keeping systems K. Bilge/ballast systems L. Life boat, life rafts, rescue boats, launch and recovery systems M. Other	Number of SPI 1 and 2 incidents involving failure of equipment / total number of SPI 1 and 2 incidents * 100	COS Operator for all incidents within the 500-meter zone and for incidents to direct employees while offshore
SPI 4	Crane or personnel/material handling operations defined as a failure of the crane itself (e.g., the boom, cables, winches, ball ring), other lifting apparatus (e.g., air tuggers, chain pulls), the rigging hardware (e.g., slings, shackles, turnbuckles), or the load (e.g., striking personnel, dropping the load, damaging the load, damaging the facility). Reference MMS NTL 2019-N05.		

SPI 5	Number of planned critical maintenance, inspections and tests completed on time.
	
	▪ A planned task can be deferred if a proper risk assessment was completed and approved, and a new due date set.
	▪ COS Equipment
	  ▪ 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 No.	SPI Definition	SPI Metric	Reporting Entity
SPI 6	Number of work-related fatalities	Number of work-related fatalities	COS Operator when within the 500-meter zone and for direct employees while offshore COS Contractor when outside the 500-meter zone while offshore
SPI 7	Number of DART injuries and illnesses. BSEE defines DART injuries or illnesses as those that resulted in "Days Away from work, Restricted duty, and Job Transfer" outcomes.	# DART / total work hours * 200,000	COS Operator when within the 500-meter zone and for direct employees while offshore (same as reported on BSEE-0131 Form)
SPI 8	Number of recordable injuries and illnesses	Number of recordable injuries and illnesses/ total work hours * 200,000	COS Operator when within the 500-meter zone and for direct employees while offshore (same as reported on BSEE-0131 Form)
SPI 9	Number of spills greater or equal to 1 barrel that enter the water	Number of spills > or equal to 1 barrel / total work hours * 200,000	COS Operator for all spills within the 500-meter zone COS Contractor for spills outside the 500-meter zone while offshore

SPI No.	SPI Definition	SPI Metric	Reporting Entity
SPI 10	Number of dropped objects and their severity per the DROPSONLINE Calculator (https://www.dropsonline.org/resources-and-guidance/drops-calculator/) ▪ Potential Fatality ▪ Potential Major ▪ Potential Minor ▪ Potential Slight ▪ Number of dropped objects resulting in zero harm	Number of dropped objects per severity/ total number of dropped objects reported	COS Operator for all dropped objects within the 500-meter zone COS Contractor for dropped objects outside the 500-meter zone while offshore
Work Hours	For offshore workers, the hours worked are calculated on a 12-hour work day. Work hours are collected in the following categories: ▪ Total U.S. OCS construction workforce hours inside 500-meters ▪ Total U.S. OCS well workforce hours inside 500-meters ▪ Total U.S. OCS production workforce hours inside 500-meters ▪ Total U.S. OCS workforce hours inside 500-meters		COS Operator when within the 500-meter zone (same as reported on BSEE-0131 Form)

APPENDIX 2 SPI 3 EQUIPMENT DEFINITIONS

Equipment	Equipment Definition	Source of 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.	COS Definition
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.	API RP 96 and API Specification 6A
Downhole Safety Valves	Downhole safety valve: A device installed in a well below the wellhead with the design function to prevent uncontrolled well flow when actuated, e.g. SSCSV or SCSSV. Subsurface controlled subsurface safety valve (SSCSV): An SSSV actuated by the pressure characteristics of the well. Surface controlled subsurface safety valve (SCSSV): An SSSV controlled from the surface by hydraulic, electric, mechanical, or other means.	API 14C (Appendix G - Definitions)
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	API 53 with COS Addition
Process Equipment, Pressure Vessels and Piping	Process Equipment/Pressure vessel: A container associated with drilling, production, gathering, transportation, and treatment of liquid petroleum, natural gas, natural gas liquids, associated salt water (brine) designed to withstand internal or external pressure above ambient conditions. This definition includes containers used for pressurized storage of toxic and hazardous chemicals. Piping system: An assembly of interconnected pipes that are used to convey, distribute, mix, separate, discharge, meter, control, or snub flows of hydrocarbons or toxic and hazardous chemicals.	API 510 API 570

Automated Safety Instrumented Systems / Shutdown Systems	Automated Safety Instrumented System - a system implementing one or more safety functions, with specified safety integrity level(s), that detect abnormal process conditions and take automatic, necessary actions to achieve or maintain a safe state for the process with respect to a hazardous event. Shutdown Systems - a system of manual stations that, when activated, will initiate the shutting in (isolation and cessation) of all process stations of a platform production process and all support equipment for the process. May also be integrated with Fire and Gas Detection systems for automatic initiation.	IEC 61511 API 14C
Pressure Relief Devices, Flare Systems, Blowdown Systems, Rupture Disks	Pressure Relief Device – A device actuated by inlet static pressure and designed to open during emergency or abnormal conditions to prevent a rise of internal fluid pressure in excess of a specified design value. The device also may be designed to prevent excessive internal vacuum. The device may be a pressure relief valve, a non-reclosing pressure relief device, or a vacuum relief valve. Flare System – used to safely dispose of relief gases in an environmentally compliant manner through the use of combustion. Blowdown System - a collection of controls, valves and pipes that allow controlled depressurization of liquid or gas pressure contained within a process, piping, or pressure vessel to reduce or eliminate pressure induced stresses during a time of potential heat weakening of vessels and piping, as well as a reduction of the inventory of fuel present on the facility. Rupture Disk – A pressure containing, pressure and temperature sensitive element of a rupture disk device. A rupture disk device is a non-reclosing pressure relief device actuated by static differential pressure between the inlet and outlet of the device and designed to function by the bursting of a rupture disk. A rupture disk device includes a rupture disk and a rupture disk holder.	API RP 520-521 API 14G
Fire and Gas Detection and Fire Fighting Systems	Manual fire alarms (pull stations), call stations, and audible alarms / beacons Automatic Fire Detection Systems - The primary function of an automatic fire detection system is to alert personnel of the existence of a fire condition and to allow rapid identification of the location of the fire. The detection system(s) may be used to automatically activate emergency alarms, initiate Emergency Shutdown (ESD), isolate fuel sources, start fire water pumps, shut-in ventilation systems, and activate fire extinguishing systems such as gaseous agents, dry chemical, foam or water. The types of fire detectors commonly used on offshore platforms are as follows: Flame Detectors - e.g., Infrared (IR) Detectors, Ultraviolet (UV) Flame Detectors, Combination IR/UV) Heat Detectors – e.g., Fusible Plugs or links, Heat-pneumatic or Theronistor Sensors, Rate of Rise Detectors, Fixed Temperature Detectors Products of Combustion / Smoke Detectors – e.g., Ionization Detector, Photoelectric Detector	API 14G NFPA Fire Protection Handbook for Gas Detection

Fire and Gas Detection and Fire Fighting Systems	Gas Detection System – The primary function of a fixed gas detection system is to alert personnel to the presence of flammable gases, toxic gases, or a combination of both. Flammable Gas Detection – designed to respond to a broad range of hydrocarbon gases / vapors (e.g., methane, ethane, propane and vapors from the evaporation of hydrocarbon liquids). The predominant sensors for flammable gas detection in general, normally occupied spaces are the infrared (IR) sensor or the catalytic bead sensor. Toxic Gas Detection – many gas detection systems include both flammable gas and toxic gas detection for hydrogen sulfide, sulfur dioxide, and fluorine in the same system. The semiconductor and electrochemical sensors are most commonly used for the detection of the toxic gases. Excludes portable gas monitoring instruments. Fixed fire-fighting systems include the following: fire water pumps & drivers, distribution piping, fire hoses, stations, and nozzles, water spray systems / monitors, foam systems (fixed or portable), dry chemical systems, gaseous systems (e.g., CO2, Halon, FM-200 & FE-13, Inergen), and water mist / fine water spray systems. Fire water systems are installed on offshore platforms to provide exposure protection, control of burning, and/or extinguishment of fires. The basic components of a fire water system are the fire water pump, the distribution piping, the hose / nozzle, and deluge / sprinkler system. Additives such as foaming agents may be included to aid in extinguishing flammable liquid fires. Excludes portable fire extinguishers	
Mechanical Lifting Equipment / Personnel Transport Equipment	Crane (includes base mounted drum winches) - a type of machine, generally equipped with a hoist, wire ropes or chains, and sheaves, that can be used both to lift and lower materials and to move them horizontally. Includes: ▪ Boom chords, foot pins, hoist (hydraulics and brakes),lift cylinder, sheave assembly, stops, tip extension or jib, pendant lines ▪ Counterweights ▪ Gantry, mast or A-frame pins ▪ Hook block ▪ Overhaul ball ▪ Main hoist (hydraulics and brakes) ▪ Auxiliary hoist (hydraulics or brakes) ▪ Pedestal or crane base ▪ Load management system (MIPEG, CCM-7000 etc.) ▪ Crane safety system (anti two block, high & low angle kick outs) Top Drive - a device used on a drilling rig to actually rotate the drill pipe in order to drill the well. Includes main drill line hoist (hydraulics or brakes), crown-o-matic, top drive track, assembly rollers or wheels and bearings, hydramatics or hydromatics. Pipe racking system (PRS) including main hoist (hydraulics or brakes), track, hydraulic system, claws or fingers	API RP 2C & ASME B30 Series

Mechanical Lifting Equipment / Personnel Transport Equipment	Drawworks, Air Hoists, Tuggers Chain fall - a type of hoist with a chain attached to a fixed raised structure or beam and used to lift very heavy objects. Includes clutch, brake and sprocket. Rigging Accessories including hooks, chains, shackles, slings (below the hook), wire rope, D-ring, elevators, bails	
Station Keeping Systems	The station keeping systems for a floating structure are typically a single point mooring, a spread mooring, vertical tension legs, or a dynamic positioning (DP) system. Single point mooring components may include but not limited to: hoisting system, hawser, swivels, roller bearings, risers, u-joint connectors, counter weights, chain, chain table, wire rope, synthetic rope, connecting hardware, clump weight, buoy, and anchor. Spread mooring components: winch / windlass, chain jack, brakes, power, fairlead, wire rope, synthetic rope, connecting hardware, clump weight, buoy, and anchor. Vertical tension leg moorings are used by TLPs or tension leg platforms and are comprised of: mooring tendons, seafloor foundations Dynamic positioning system consists of components and systems acting together to achieve reliable position keeping capability. The Dynamic-positioning system includes the power system (power generation and power management), thruster system and Dynamic Positioning control system.	Used partial definitions from: API RP 2SK and Marine Technology Society (MTS)
Bilge/Ballast Systems	The vessel structure, machinery, piping, or controls related to ballast movement, watertight integrity and stability.	Det Norske Veritas (DNV)
Life Boat, Life Rafts, Rescue Boats and Launch and Recovery Systems	Lifeboat / Survival craft is a craft capable of sustaining the lives of person in distress from the time of abandoning the ship. Rescue boat is a boat designed to rescue persons in distress and to marshal survival craft. A life raft is an inflatable appliance which depends upon non-rigid, gas filled chambers for buoyancy and which is normally kept not inflated until ready for use. Launch and Recovery Systems - systems used to deploy or retrieve a lifeboat, life raft, or rescue boat. Components may include but not limited to: Winch, fall wire (lifting wire), sheaves (pulleys), davits, davit arms, connecting hardware, secondary securing method (gripes, safety pendants), cradle, lifting points, releasing hook(s), brake, brake release, power source to winch / davit / davit arm, free fall railing.	Used partial definitions from: International Maritime Organization – Safety of Life at Sea (IMO SOLAS) and USCG CFR 46.199 and 46.108