Investigation of December 2, 2017 Fatality
Petrobras 10000 Drillship
Lease OCS-16997, Walker Ridge Area Block 469

Gulf of Mexico Region, Houma District
Off Louisiana Coast

Feb. 13, 2019

U.S. Department of the Interior Bureau of Safety and Environmental Enforcement

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BSEE's National Investigations Program is administered by its Safety and Incident Investigations Division in Washington, D.C. Panel investigations, an integral tool for safety improvement, are chaired by division and regional staff, and conducted in coordination with region and district staff.

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List of Abbreviations and Acronyms

ACS - Anti-Collision System
AD - Assistant driller
BSEE - Bureau of Safety and Environmental Enforcement
CFR - Code of Federal Regulations
DP - Drill pipe
GOM - Gulf of Mexico
GOMR - Gulf of Mexico Region
HD - Houma District
IADC - International Association of Drilling Contractors
INC - Incident of Noncompliance
M/U - Made up
MOC - Management of change
MODU - Mobile Offshore Drilling Unit
MSU - Marine Safety Unit
OCS - Outer Continental Shelf
OCSLA - Outer Continental Shelf Lands Act
OEM - Original equipment manufacturer
OIM - Offshore installation manager
OJT - On the job training
P/U - Pick up
PAI - Petrobras America Inc.
PBS 10k - Petrobras 10000 Drillship
PHCM - Pipe handling catwalk machine
PIB-BV -Petrobras Internacional Braspetro B.V.
PJSM - Pre Job Safety Meeting
PLC - Programmable logic controller
POOH - Pull out of hole
PPE - Personal Protective Equipment
PTA - Pipe Tail-in Arm
R/B - Rack back
RAF - Risk Assessment Form
RCWM - Riser catwalk machine
SAR - Search and Rescue
SBOP - Subsea blowout preventer
SSE - short service employee
TDS - Top drive system
TIH - Tripping in the hole
TODDI - Transocean Offshore Deepwater Drilling, Inc.
TOFS - Time out for safety
USCG - United States Coast Guard
WR469 - Walker Ridge Block 469

Executive Summary

On December 2, 2017, an incident resulting in a single fatality occurred during pipe handling operations onboard the Petrobras 10000 Drillship (PBS 10k). Petrobras Internacional Braspetro B.V. (PIB-BV) was the majority owner of the PBS 10k. Petrobras Americas International (PAI), a subsidiary of PIB-BV, contracted Transocean Offshore Deepwater Drilling, Inc. (TODDI) to manage the PBS 10k during the time of the incident occurring on December 2, 2017.

The PBS 10k was located approximately 240 miles southwest of New Orleans, Louisiana, in the Walker Ridge Area (WR), Block 469 in the Gulf of Mexico (GOM). The drillship was positioned in a safe zone in WR Block 469 (WR 469) while repairs were being performed on the Subsea Blowout Preventer (SBOP) system. The drillship was not connected to the seafloor, as the subject repairs were being performed prior to initiating future wellbore operations. While the SBOP repair work was being performed, the drill crew proactively performed offline operations to prepare for future well work. This included picking up and racking back drill pipe (DP) on the auxiliary drill floor. At approximately 4:40 a.m., a floorhand sustained fatal injuries when he was pinned between the Pipe Handling Catwalk Machine's (PHCM) skate loading platform arm and a stanchion post on the auxiliary drill floor. The incident occurred near the end of a 12-hour shift on the first day back to the drillship after the crew had been off for 21 days.

The PHCM utilized a skate (which moved along on a track) to transfer DP from the catwalk to the auxiliary well center. The skate's design included loading platform arms that extruded from the body of the skate and were engineered to support tubulars, such as DP. The stanchion post was located on the port side of the skate from which there was approximately a three-inch clearance between the post and the skate's loading platform arms when aligned in the position it was in at the time of the incident.

At the time of the incident, the top drive and PHCM were simultaneously being used to pick up the DP. The victim and another floorhand were in a location away from the auxiliary well center, close to the stanchion post. The elevators were latched to the box end of the DP near the auxiliary well center and the driller had begun raising the DP with the top drive. At this point, the victim was facing away from the equipment being used and pulling on a cable anchored to the stanchion post in the yellow zone on the port side of the skate, seemingly stretching. While the driller lifted the DP, the skate operator used a remote control to retract the skate away from the auxiliary well center. When the loading platform arm passed by the post, it pinned the victim into the approximate three-inch clearance. The skate operator observed the victim pinned, and reversed the skate back toward the well center, releasing the victim from between the loading platform arm and the post. The victim fell to the floor.

Personnel quickly responded to the incident and contacted the onsite medic, who responded to the drill floor. The victim was transferred to the medic's office, where he received treatment while the emergency Search and Rescue (SAR) helicopter traveled toward the drillship. The victim was pronounced dead shortly after arrival of the SAR provider.

The Bureau of Safety and Environmental Enforcement (BSEE) conducted a Panel Investigation into the victim's death and the causal factors that led to the incident. The panel consisted of professionals from both BSEE and the U.S. Coast Guard (USCG).

The panel travelled to the PBS 10k drillship, conducted interviews and reviewed documents. Based on the investigation, the panel concluded that the fatal incident was the result of the victim being located in a pinch point area when the skate was moving away from well center and being pinned between the stanchion post and skate's loading platform arm.

The panel concludes this incident occurred due to the following causal factors:

- Victim was in a hazardous location and not facing the skate operations while the PHCM skate was being mobilized.
- Failure of crew to identify hazard and stop job when coworkers were not in safe location. Drill floor personnel failed to follow and enforce the Line of Fire and Unsafe Positioning safety rules of the rig.
- Failure to safely operate the PHCM skate.
- Lack of understanding and/or regard for the drill floor zone areas during operations.
- Failure to officially identify and mitigate the stanchion post Pinch Point hazard area.
- Failure to update and follow the Controlled Procedure.

In addition, the panel identified the following contributing factors:

- Complacency and fatigue resulting from a repetitious job while over ten hours into their first shift of the hitch.
- Lack of training, familiarity, and experience with the equipment on this drillship.
- Incomplete in training requirements to perform operations.

To strengthen implementations of existing safety and environmental management systems, the panel makes the following recommendations:

- Ensure management effectively verifies all personnel adhere to drill floor safety rules.
- Formalize equipment operations to reemphasize the awareness of personnel before equipment is put in motion.
- Ensure employees receive effective operational equipment training.
- Ensure all Control Procedures are operationally correct.
- Ensure all personnel adhere to the Controlled Procedures. The Controlled Procedures must account for all movement of the PHCM skate.
- Ensure personnel are trained on rig access zone diagrams.
- Investigate and implement proximity technology if suitable.

Introduction

Pursuant to 43 U.S.C. § 1348(d)(1), (d)(2) and (f) [Outer Continental Shelf Lands Act (OCSLA), as amended] and Department of the Interior regulations 30 CFR Part 250, the Bureau of Safety and Environmental Enforcement (BSEE) is required to investigate and prepare a public report for this incident. BSEE convened a panel Investigation that included:

Nicholas Fraiche (Chair), Petroleum Engineer, Office of Incident Investigations, GOMR
Cedric Bernard, Lead Inspector, Well Operations Inspection Unit, Houma District (HD), GOMR
Lt. Michael J. Groff, Marine Safety Unit (MSU), Morgan City, U.S. Coast Guard
Ross Laidig, Special Investigator, Safety and Incident Investigations Division
Robert Reeves, Inspector / Accident Investigator, Well Operations Inspection Unit, HD, GOMR
Simon Zippert, Petroleum Engineer, Office of Safety Management, GOMR

The purpose of this investigation was to identify the cause, or causes, of the fatality on the PBS 10k and issue recommendations to assist in preventing a similar incident from occurring. The BSEE report also includes recommendations on how to strengthen implementation of existing safety and environmental management systems and necessary reforms to existing regulations.

Lease Location and Information

Lease OCS-G 16997 (the lease) is approximately 240 miles southwest of New Orleans, LA and covers approximately 5,760 acres in Walker Ridge Area Block 469 (WR 469), in the Gulf of Mexico Central Planning Area (Figure 1). The water depth at this location was approximately 8,835 feet.

The lease was purchased by BHP Petroleum Inc., as the sole lease owner from GOM Central Lease Sale 157 in 1996. Effective on August 1, 2006, PAI became a two-thirds record title interest holder of the lease, with the remaining one-third held by TOTAL E&P USA, INC. PAI was designated as the operator effective March 13, 2007. TODDI was contracted to re-enter and complete well CH004 (Chinook #6) located in WR 469 using the PBS 10k, with work beginning in late-November 2017.

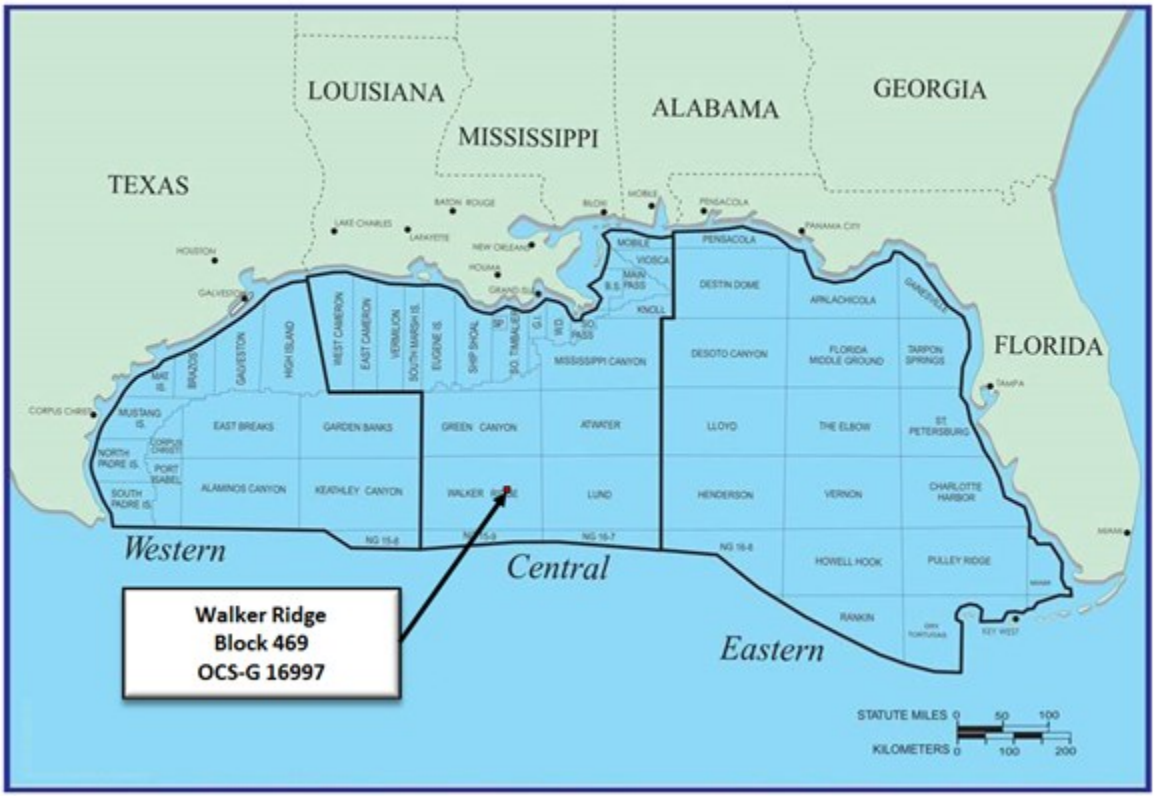

Figure 1: Lease location and position of PBS 10k on December 2, 2017

Petrobras 10000 Drillship

The Petrobras 10000 Drillship (PBS 10k) is a 748 foot (228 meter) long, 60,331 Gross Ton ship. Constructed by Samsung Heavy Industries of South Korea in 2009 (Figure 2), the PBS 10k is owned by P & M Drilling International B.V. headquartered in Amsterdam, Netherlands. The flag state for the PBS 10k is Marshall Islands.

The PBS 10k is a Mobile Offshore Drilling Unit, or MODU. MODUs, like the PBS 10k, move under their own power as a conventional ship between drilling locations. Once at a drilling site, the vessel uses dynamic positioning to remain on station throughout the course of drilling operations.

The PBS 10k has a dual derrick system consisting of main and auxiliary well centers, allowing for dual activity operations. Relevant to the incident on December 2, 2017 was the auxiliary well center, located toward the bow (or forward) of the drillship. With the drill pipe (DP) pipe rack also located toward the bow, the PBS 10k was designed to have drill pipe singles picked-up (P/U) from the pipe deck with a knuckle boom crane and racked back (R/B) on the auxiliary drill floor into the derrick using a Pipe Handling Catwalk Machine (PHCM), top drive system (TDS), iron roughneck and vertical pipe handling system.

Figure 2: Petrobras 10000 Drillship- image obtained from GCaptain.com

Companies Involved

P & M Drilling International B.V.

The PBS 10k was owned by P & M Drilling International B.V., a Special Purpose Company in the Netherlands, formed by Petrobras Internacional Braspetro B.V. (PIB-BV) and Mitsui & Co. Ltd (Mitsui). PIB-BV holds 50.55% interest and Mitsui 49.45%. PIB-BV was a subsidiary of Petroleo Brasileiro S.A., a oil and gas company partially owned by the Brazilian federal government.

Petrobras America Inc. (PAI)

Petrobras America Inc. (PAI) was a two-thirds owner of the lease (G16997) in WR 469, and was designated as the operator and local agent (designated operator) with full authority to act in the lessee's behalf in complying with the terms of the lease and applicable regulations. PAI, headquartered in Houston, Texas, was a wholly owned subsidiary of Petroleo Brasileiro S.A.

PAI contracted Transocean Offshore Deepwater Drilling, Inc. (TODDI) to operate the PBS 10k during the time of the incident occurring on December 2, 2017. As stated in the PAI-TODDI bridging document, PAI and TODDI agreed to 'bridge their respective safety and environmental policies and practices to be used at each facility and clearly define roles and responsibilities under such policies and practices prior to performance of oil, gas and sulphur activities in the Outer Continental Shelf,' which would include completion services with the PBS 10k.

Transocean Offshore Deepwater Drilling, Inc. (TODDI)

According to the Certificate of Compliance issued by the U.S. Coast Guard, TODDI was the Operator Manager of the PBS 10k. TODDI operates as a subsidiary of Transocean Ltd., an offshore drilling company that provides rig-based well construction services to customers around the world. TODDI directly employed three personnel on the drill crew involved in the incident: the driller, the assistant driller (AD) and one of the floorhands.

Spencer Ogden

Spencer Ogden is a global recruitment business that provides recruitment services to clients in the energy, engineering and infrastructure sectors, which included providing temporary workers to clients in the drilling sector. Spencer Ogden claimed they undertook appropriate checks to ensure that the workers supplied to their clients had the necessary skills and qualifications to work in the roles into which they are placed.

According to their representatives, Spencer Ogden's responsibility for operations on the PBS 10k was limited to the supply of skilled workers to TODDI. They indicated that once those workers were mobilized to the PBS 10k, the workers were under the direction, supervision and control of TODDI and / or PAI and subject to their rules, policies and procedures. Spencer Ogden employed three members of the drill crew involved in the incident: the banksman, the skate operator and a floorhand (victim).

Pipe Handling Catwalk Machine (PHCM)

According to the original equipment manufacturer (OEM) user manual, the PHCM on the PBS 10k is designed for the handling of tubulars and for ensuring maximum safety for operating personnel, giving an almost "hands-free" operation of the tubulars. Relevant components of the PHCM included: support structure, skate, shuttle, loading platform, tilt-ramp, Pipe Tail-in Arm (PTA) and Anti-Collision System (ACS), many of which can be seen in Figure 3 and Figure 4.

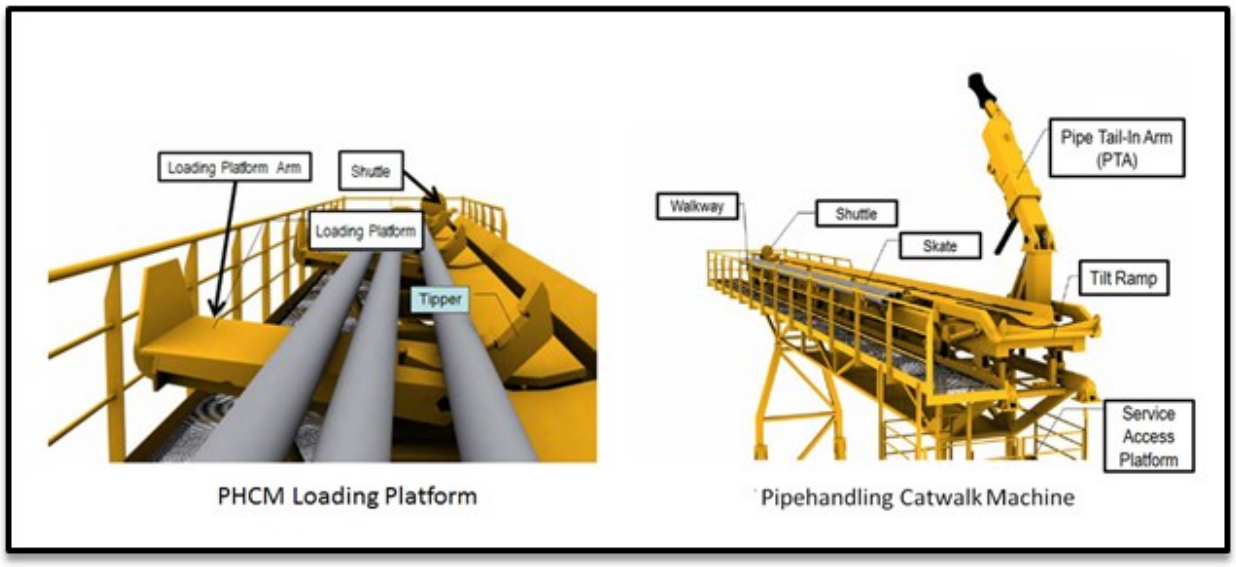

Figure 3: Pipe Handling Catwalk Machine schematic - created by BSEE using schematics from OEM manual

The skate is moved along a support structure, with a centerline pipe trough along which individual tubulars, such as DP, can be fed horizontally onto or off of the PHCM. The design allows the PHCM skate to run along rails on the structure and drill floor up toward the well center.

The shuttle is a small, wheeled trolley which is able to run the full length of the skate, within the pipe trough. When picking up pipe, the shuttle pushes drill pipe forward across the tilt ramp for connection to the top drive system. The tilt-ramp, positioned at the front of the skate, is used for lifting single tubulars up for easy latching on or off the top drive system. The tilt-ramp has a lifting height of approximately six feet.

The loading platform, which extends from the skate core and consists of numerous loading platform arms, is used as a storage area for tubulars. It is equipped with a hydraulic system for feeding, or tipping, individual DP into the pipe trough. Once inside the trough, the tubulars are then shuttled toward the drill floor.

The PTA is a short and robust arm designed to guide the drill pipe. The easily adjustable end stop system allows for the handling of pipe without any replacement of tools. The PTA consists of: the Single Arm (which is on a pedestal that is tilted by a cylinder); the Monkey Roller (which guides and centers the pipe); the Monkey Trap (which prevents "pipe fall out" from the roller); and the Telescopic Arm (which is used to center pipes directly above well center).

The PHCM is also incorporated into the drill floor anti-collision system (ACS), a safety system that prevents the collision of equipment on the drill floor, described later in this report.

The PHCM is normally operated by a floorhand using a remote control with joysticks and control switches, including an emergency stop button. It could also be operated from local hydraulic controls on the support frame. Personnel generally described the person performing these tasks as the skate operator.

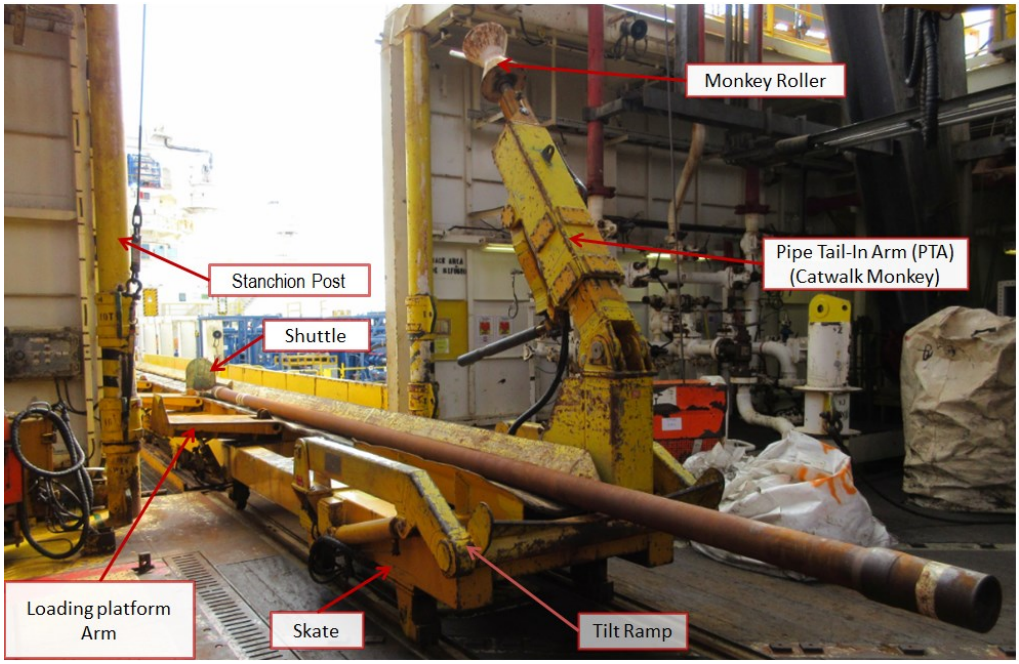

Figure 4: PBS 10K PHCM - post incident (BSEE photo)

Stanchion Post

The stanchion post located on the port side of the skate was relevant to the incident investigation. In its capacity on the drill floor, the stanchion post functioned, in part, to protect the wind wall when guiding tools or equipment on the drill floor and to support an above walkway. It also had an eyelet on a piece that swiveled and served as an anchoring point for a cable from a drill floor-mounted hoist at the time of the incident. The stanchion post was located in the yellow access zone and outside of the green lines of a box painted on the surface of the drill floor, described later in this report. When aligned at the position the PHCM skate was in at the time of the incident, there was approximately a three-inch clearance between the stanchion post and the skate's loading platform arm (see Figure 4).

Anti-Collision System (ACS)

The ACS is a safety system incorporated into the equipment systems on the drill floor that promotes safe operations by preventing the collision of machines. According to the manufacture's website, the ACS has position measurement capabilities to dynamically monitor the coordinates and calculate a machine's exclusion zone. The safety system is designed to stop the machines automatically before a potential collision occurs if the ACS senses a zone clash. The system is described as one that will prevent downtime and safety hazards by deflecting possible near accidents that could occur on the drill floor.

Drill Floor Access Zones

TODDI's policy for Restricted Access Zones states that the hazards associated with unrestricted access to potentially hazardous zones must be identified and the risks managed. Restricted Access Zones were classified as:

- red zone: Only authorized personnel actively involved in the immediate task may be present.
- yellow zone: Only personnel who have direct responsibilities or duties may be authorized to enter.
- green zone: Anyone may enter

The policy states that when not required for the immediate task, crew members must leave the red zone to go to the "Step Back" area. In addition, "Step Back" areas must: 1) be located within either a yellow or green zone; 2) not be used for any other purpose; 3) provide over-head cover in the event of dropped objects; 4) be kept clear for access and egress; 5) be clearly identified; and 6) protect personnel from the line of fire. Further, the policy indicated that the driller must ensure the crew "Step Back" when they are not required in the red zone.

According to the policy, personnel were not to enter a yellow zone unless they had direct responsibilities or duties within that area and had been given verbal approval by the area authority. Verbal approval to access red and yellow zones within the drill floor could be given by the driller. All access points needed to be clearly identified, (i.e. colored decks and walkways or a physical barrier marking the point at which personnel cannot proceed without authorization). This differed from the Drill Floor Access Zone diagram (zone diagram), which stated, "Drill Crew personnel with specific tasks may enter. All other personnel must obtain authorization from driller to enter or work in this area."

TODDI's policy describes the green zone as a designated unrestricted area or route which anyone could enter without approval. Green zones needed to be identified using signs, colored handrails or walkways. This differed from the zone diagram, which stated, "unrestricted access to drill crew personnel unless barriers are in place. All other personnel must notify driller upon entry."

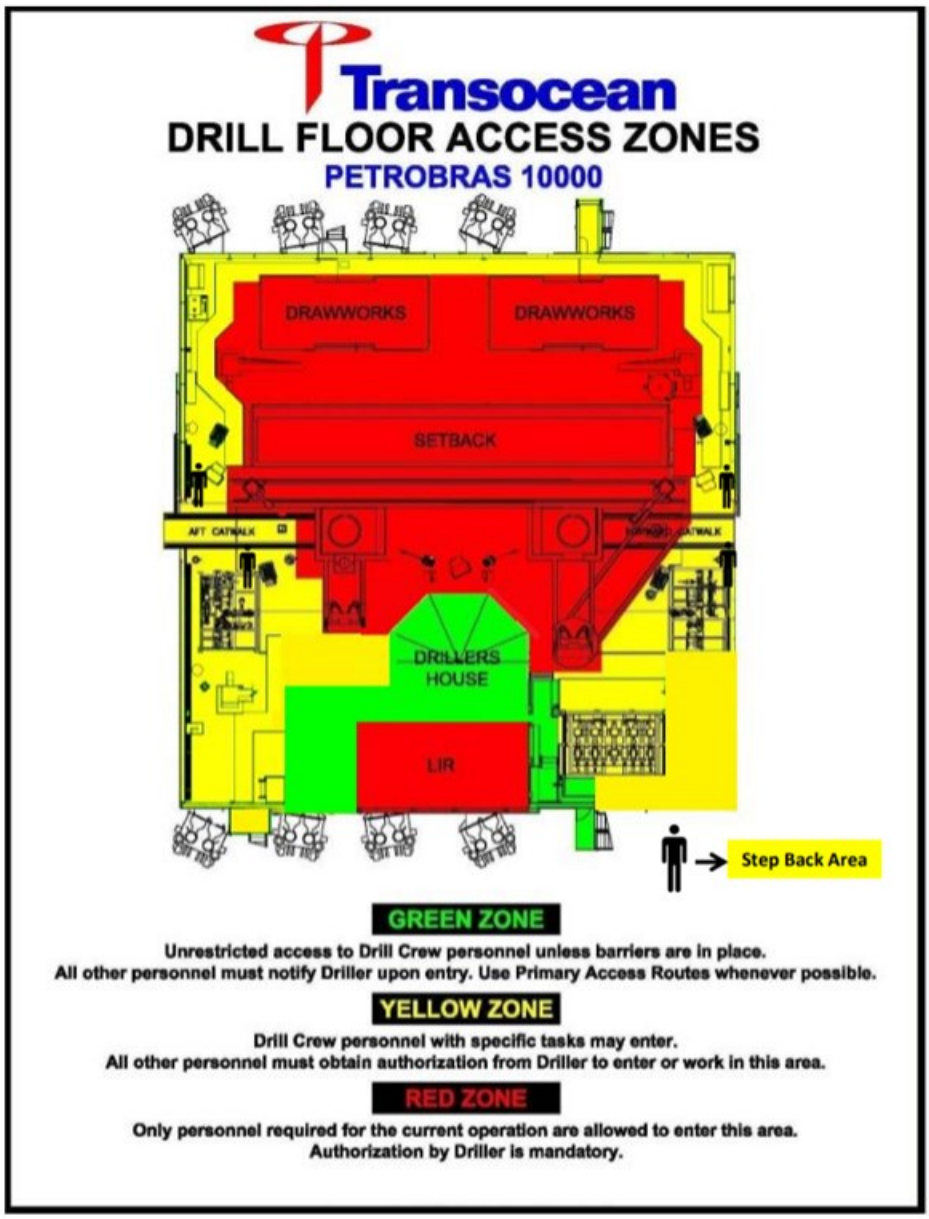

Figure 5: Drill Floor Access Zones diagram (posted on drill floor wind wall at time of incident)

According to the policy, the driller has responsibility to approve access to red and yellow zones on the drill floor and derrick. According to the TODDI Controlled Procedure used for the operations at the time of the incident, the drilling superintendent/ sr. toolpusher / toolpusher had the responsibility to ensure that a safe area for personnel was identified.

The Drill Floor Access Zones diagram shown in Figure 5 was posted on the auxiliary drill floor wind wall at the time of the incident. The diagram differentiates zone areas to ensure controls are implemented to prevent incidents by restricting access to potentially hazardous zones. Personnel indicated this diagram was primarily utilized for protection from dropped objects. Figure 5 included a legend for the Step Back area, as discussed later in this report. At the time of the incident, the victim was in the yellow zone area based on this diagram.

A small area within the yellow zone and located on the port side of the stanchion post was a rectangular box delineated by the wind wall and three faded green lines (see Figure 6). On the surface of the floor, inside these lines, were faded stenciled letters which read, “Step Back Area.” These words were also stenciled on the wind wall adjacent to the green box. Similar green lines and stencils were located on either side of the PHCM on both the auxiliary and main drill floors.

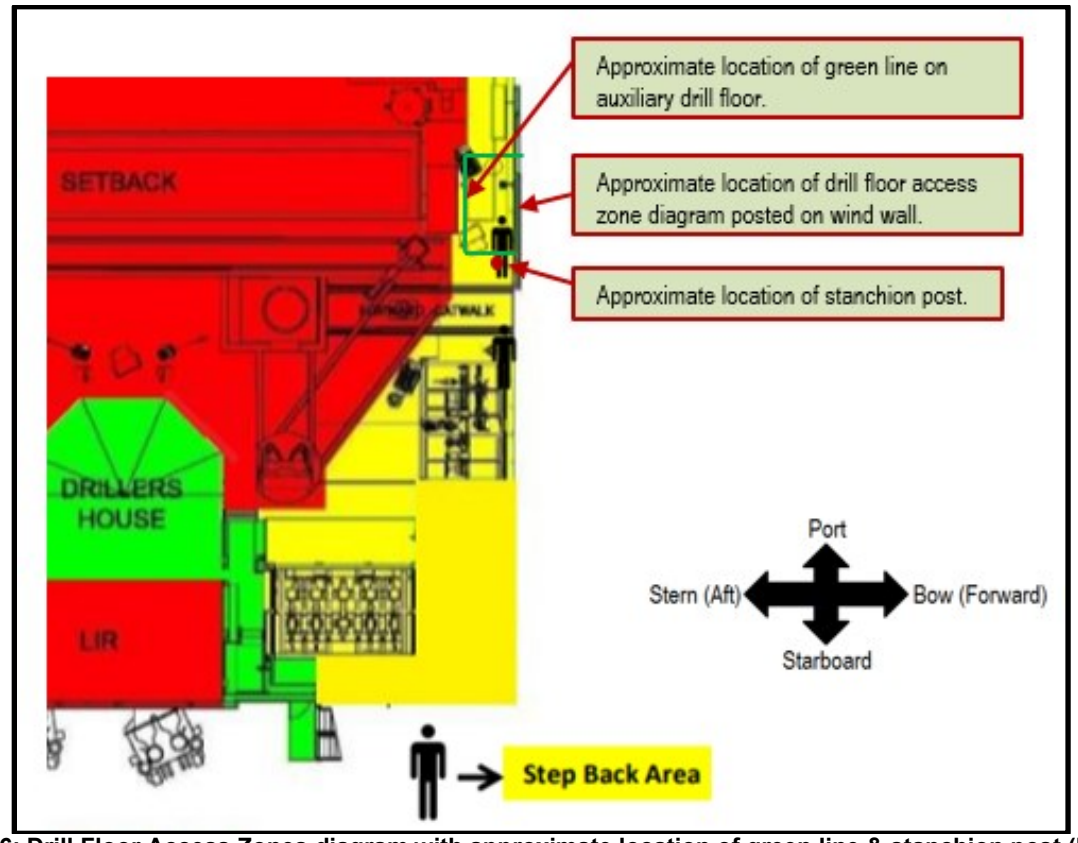

Figure 6: Drill Floor Access Zones diagram with approximate location of green line & stanchion post (BSEE illustration based on witness accounts and lines on actual drill floor)

As seen in figures 5 and 6, the location of the stanchion post, as well as a partial path of the skate, were both in a yellow zone and were not restricted to the requirements of the red zone. Also, the location of the character in the diagram legend is partially outside of the green line.

BSEE Investigation

BSEE's Panel was convened to conduct the full investigation into the facts and circumstances that resulted in the fatality. Panel members traveled to the PBS 10k to complete documentation of the incident location and speak to onboard crew members. The BSEE Panel reviewed electronic and written material, conducted interviews of personnel and observed the operation of involved equipment.

Pre-Incident History

While the PBS 10k was built in 2009, it began operating in the GOM a few months prior to the incident. The PBS 10k began traveling to the GOM from Colombia in September 2017. BSEE inspectors performed a pre-drill inspection on October 3, 2017. The majority of the drillship's well operations crew was assembled at that time or shortly thereafter.

Personnel and documentation described a series of 13 incidents occurring on the PBS 10k between September 19 and October 27, 2017, ranging from alarm and equipment issues to injuries. In response to those incidents, PAI tasked TODDI to develop an action plan. In late October 2017, a 36-hour safety stand down was initiated on the PBS 10k, and TODDI developed and implemented a 17-point safety action plan. During the safety stand down, TODDI highlighted, among other things, supervisor expectations, completing Risk Assessment Forms for all jobs, Time Outs For Safety (TOFS), START conversations, a Task Planning and Risk Assessment Prompt Card, PAI's Golden Rules and TODDI's Lifesaving Rules. Employees and supervisors also signed safety commitment letters stating that they were personally committed to achieve the Petrobras 10000 Safety Vision of "Operations conducted in an Incident-free workplace - all the time, everywhere."

In addition to TODDI's actions, PAI visited and evaluated the PBS 10k due to the recent significant increase in the number of HSE [health, safety and environment] anomalies. Records from this evaluation indicated that PAI concluded or observed that the HSE events were associated with change of rig crew. PAI noted the following associations: learning curve (only nine employees had prior experience on the PBS 10k); lack of experience with task planning and execution tools; excess of "will;" some employees not going through Change Management; or some employees not doing most of the designated training (completion forecast until December). In addition, they noted the lack of resources (network and PAI computer) and different regulatory requirements. According to PAI and TODDI, there had not been any incidents recorded after this action plan until December 2, 2017.

The PBS 10k's first well operation in the GOM began on November 1, 2017 at WR Block 249. While on this location, the drillship was inspected by BSEE on November 13, 2017. As a result of this inspection, BSEE issued three incidents of noncompliance for issues unrelated to the PHCM.

The PBS 10k arrived at the WR 469 location on November 24, 2017 for a completion operation with an expected duration of 150 days. At the time of the incident, the PBS 10k was positioned in a safe zone in WR 469 while repairs were being performed on the Subsea BOP. The PBS 10k was not connected to the seafloor, as the repairs were being performed prior to initiating future wellbore operations.

Incident History

TODDI used a 24-hour schedule operating in two 12-hour shifts (tours). The shifts for personnel on the PBS 10k drill floor were 6:00 a.m. to 6:00 p.m. (day shift), and 6:00 p.m. to 6:00 a.m. (night shift). They had shift change and safety meetings during the transitions from one crew to another.

According to their Daily Drilling Report, during the day shift on December 1, 2017, Drill Crew B spent much of their shift picking up DP from the deck and racking it into the derrick. The subsea personnel worked to repair the Subsea BOP.

December 1, 2017 was also a crew change day for members of the drill crew. On this day, the drill crew working the night shift (Drill Crew C) reported to pre-flight check-in at the heliport before 6:00 a.m. Drill Crew C arrived to PBS 10k by helicopter in two transports: the first at 7:20 a.m. and the second at 10:34 a.m. Once they arrived, the crew checked-in and was briefed on the status of operations. The crew did not have to report for duty until 5:30 p.m. that evening.

At approximately 5:30 p.m. on December 1, 2017, the PBS 10k had a changeover meeting to discuss operational activities and safety for the upcoming night shift. The meeting was led by, among others, the offshore installation manager (OIM), drilling superintendent and rig HSE advisor. It included members of all the different crews that would be working the next 12 hours on the drillship, including members of Drill Crew C. According to personnel and the shift hand-over report, this general safety meeting reviewed present and upcoming operations, and reemphasized the 17 point safety plan and lifesaving rules / tools.

Date	Time (Approximate)	Occurrence
Sunday, September 17, 2017		PBS 10k begins operations in GOM
October 23-24, 2017		Drill Crew C received on-the-job training on how to P/U and R/B DP utilizing aux. drill floor skate.
Friday, October 27, 2017		Safety Stand-down. 17 Point Safety Plan put into effect
Saturday, October 28, 2017		17 Point Safety Plan put into effect
Saturday, December 01, 2017		Drill Crew C arrives on PBS 10k
	5:30 p.m.	Drill crew C attends PBS 10k general safety meeting.
	6:00 p.m.	Drill crew C starts 12 hour night shift with the pre-job safety meeting then proceeds with night shift operations of picking up and racking back DP.
Saturday, December 02, 2017	4:40 a.m.	Victim caught between the stanchion post and skate. Medic responds to drill floor and the victim is transported to the rig hospital.
	5:00 a.m.	PAI requests Medevac (SAR), requesting for patient with crush injury to hip. Medic and PBS 10k personnel continuously treat victim's injuries, in consultation with an onshore doctor.
	5:30 a.m.	Onshore doctor advised SAR that patient was in grave / critical condition.
	6:06 a.m.	Search & Rescue (SAR) Helicopter Launched (estimated ETA 7:35a.m.)
	7:34 a.m.	SAR crew landed on the PBS 10k at WR 469
	7:58 a.m.	Medevac medic's pronounce IP expired at 7:58 a.m.

Figure 7: Brief timeline

Pre-Job Safety Meeting, Checklists and Risk Assessment

On December 1, 2017 at approximately 6:00 p.m., Drill Crew C held a Pre-Job Safety Meeting (PJSM) on the auxiliary drill floor (aux. floor) to discuss the future operation of picking-up (P/U) and racking-back (R/B) drill pipe (DP) on the aux floor. The following documentation was reviewed and signed off in the PJSM: (1) TODDI Controlled Procedure checklists (pre-picking up DP and pre-racking back DP); (2) Risk assessment forms (RAFs) for both of those procedures; (3) the Task Planning and Risk Assessment Prompt Card; (4) the Supervisor 5 Key Expectation Verification Form and (5) the job signature sheet. Some personnel indicated that P/U and R/B DP typically did not require the RAFs that were completed, but due to the safety incidents on the PBS10k in the previous months, TODDI required risk assessments for all jobs.

The safety meeting included only personnel involved in the P/U and R/B of DP on the aux floor. Names and signatures were included on the job signature sheet, which included the driller, assistant driller and four floorhands (including the victim) outside on the drill floor at the time of the incident; as well as four other personnel not directly involved in the operations when the incident occurred. The job signature sheet indicated that the toolbox talk must cover, at minimum: the task steps (include review of procedures if applicable), hazards and controls associated with each task step, on-site / on-day conditions and hazards, worksite layout, status of and entry to restricted access zones, management of repetitive tasks and re-enforcement of lifesaving rules and tools. Boxes for all of these, and others, were checked.

Completed by the AD, the Supervisor 5 Key Expectations Verification Form also emphasized task planning and risk assessments; as well as that every task/job must be monitored throughout its full duration by use of chronic unease, TOFS, situational awareness and supported by START conversations. Time outs for safety (TOFS) were planned at first racking in the derrick. Specifically checked on this document were boxes for Line of Fire, Situational Awareness and Challenge the Norm (chronic unease mindset); as discussed later in this report.

According to the Controlled Procedures, a toolbox talk should include, among others items: the task steps (include review of procedure if applicable); on-site / on-day risk assessment; each person(s) assigned responsibilities; status of and entry to restricted access zones; hazards and controls associated with each task step; safe area for personnel while equipment is moving; management or repetitive tasks; planned TOFS (if applicable); and reviewing stop the job situations such as violations of the restricted access policy and travel path not clear. Based on all information received, the required toolbox talk was performed.

A risk assessment was performed by the crew for the future operation utilizing the Task Planning and Risk Assessment Prompt Card, which provided resources for task planning, risk assessment, hazard identification, lifesaving rules (including line of fire and lifting incidents) and lifesaving tools (including barrier management and restricted access).

The Risk Assessment Form (RAF), which acted as their job safety analysis, was filled out with task steps, associated hazards, and respective controls. The crew discussed the future operation hazards and the AD physically wrote down task steps with the hazards and control items identified (see Figure 8). Included in the task steps for bringing the skate to the floor and allowing the block to come on and

latch onto pipe, one of the hazards was "[Personnel] being struck by skate," for which the control was for "[Personnel] to stand clear of skate." Another hazard was "Objects falling off block while moving," for which the control was "use Step Back area." The AD indicated in his interview with BSEE that he had not specifically considered the location of the loading platform arm of the skate and the stanchion post when evaluating the hazards, and instead was thinking of someone being in front of the skate. Using the Step Back area was identified multiple times in the risk assessment.

Transocean

RISK ASSESSMENT FORM

The Task Planning and Risk Assessment Prompt Card must be referenced when using this form.

Rig: PBIOK	Task: pk DP + Rack in Drk.
Senior Person Assigned to Task:	Department: Drlg
Supervisor:	Date: 12-1-17

Task Step	Identify Hazards	Risk Rating	Controls	Risk Rating
Roustabout to load skate Full of pipe Bring skate in into floor. Allow Block to come On + Latch onto pipe.	Personal Being Struck By Skate. Objects Falling off Block while moving Pinch points when latching elevators.	4	Personal to stand clear of skate Use Step Back area Keep Hands clear of elevators.	2
P/U pipe + tail in w/ lwFting armon Skate. Remove protector + use push pole to Stab into Stump.	Pipe Striking personal when Hoisting. Dropped object when lifting & pinched Hands when Stabbing.	4	Personal clear while Blocks moving Personal in Step Back area. Use 6" push poles.	2
P/U w/ IRS. Pull Slips + Lower into Rotary	Improper lifting. Back Strain when pulling slips.	4	Check for ID on pipe Proper lifting tech.	2

Figure 8: Risk Assessment Form filled out during PJSM

Personnel indicated during BSEE Panel interviews that it was the first day on their hitch, and the PJSM took longer than usual – upwards of an hour and a half to review the pre-job information that usually took 30 minutes. The PJSM also took longer because of the increased safety assessments required for 'routine' tasks which were mandated due to the 17 point safety plan. The BSEE panel interviews and the review of the Task Steps written on the RAF during the PJSM, it was shown that the crew reviewed and discussed the TODDI Controlled Procedure. However, the task steps in the Controlled Procedure and those handwritten on the RAF did not reflect all aspects of the actual Operational Procedure, as discussed later in this report.

Step Back Area

On December 1, 2017 according to the RAF and interviews, during the PJSM, the drill floor hands tasked with setting slips were instructed to be in the Step Back area during the TDS and skate movements.

The AD, who led the risk assessment and PJSM on December 1, 2017, indicated during a post incident interview that the area located behind the hoist was identified as the Step Back area (for the subject operation) during their pre-job safety meeting and also during previous training exercises. At least one other member from Drill Crew C confirmed this during BSEE Panel interviews.

In addition, a small area (behind the aux drill floor port side hoist) was outlined by faded green lines. The rectangular boxed area was delineated by the wind wall and three faded green lines (see figure 6 and 9). On the surface of the floor inside of these lines were faded stenciled letters which read: “Step Back Area” (see Figure 12). This was also stenciled on the wind wall adjacent to the green box.

However, the extent of the Step Back area on the zone diagram posted on the drill floor wind wall (shown in Figure 5) could have been interpreted in multiple ways. For instance, the character in the diagram legend could be interpreted as the location of the Step Back area; as three out of four of these characters were located near the green boxes painted on the surface of the drill floor. However, this interpretation could be misleading because only half of the character is inside of the aux port side green box. While the feet of the character are located on the starboard side of the stanchion post (see Figure 6). Alternatively, the same legend could be interpreted to mean that the entire yellow zone was the Step Back area.

In general, interviews conducted by BSEE panel indicated that personnel on Drill Crew C had similar but not exact interpretations of where the Step Back area was located. Some said the Step Back area, or safe zone, was the area designated as yellow on the zone diagram (see Figure 5) or with yellow paint on the surface of the drill floor; including the skate operator. Others described it as the area behind the hoist and/or within the green lines on the surface of the drill floor (see Figure 6).

The video provided to BSEE of drill crew operations within approximately 1.5 hours prior to the incident shows that the crew did not consistently position themselves in the green box while the skate or TDS was moved.

Figure 9: Green lines and Step Back area on drill floor (12/3/17 and 12/19/17)

Figure 10: Partial aerial view of surface of auxiliary drill floor (12/3/17)

After the PJSM, Drill Crew C started to perform the planned operation. Based on the International Association of Drilling Contractors (IADC) drilling report, the crew picked up 22 single joints of drill pipe and suspended the pipe from the aux. floor in preparation to be racked back. The IADC drilling reports indicates the crew performed this operation until approximately 9:30 p.m. on December 1, 2017.

During panel interviews, members of "C" crew indicated that the victim was the most experienced at operating the skate. The victim initially began the night shift operating the skate, but relinquished the remote control to a less experienced floorhand (hereafter referred to as the skate operator) in order to provide on the job training.

Operational Procedure

According to the PHCM user manual, the equipment must only be used for the prescribed purpose, and in accordance with the operating instructions. Instructions for handling pipes from the pipe deck to the drill floor were provided within the OEM user manual. In addition, TODDI had Controlled Procedures for "Make Up of Drill Pipe," which included a procedure for picking up drill pipe. The following is a description of how those instructions and procedures related to the operations for picking up drill pipe that took place on December 1 and 2, 2017 (based on interviews and video observations).

The typed Controlled Procedures document contained multiple warnings and caution statements that addressed moving equipment. A warning must be observed to prevent serious injury; and a caution must be observed to prevent damage to equipment and/or loss of operating effectiveness. Some relevant warnings and cautions included: *"Warning: Confirm deck crew loading ramp arms are clear before operating pipe catwalk. Personnel must be away from operating machinery"* for the floorhand's (skate operator) job step of running the pipe catwalk machine until the next tubular is past the lift arm. In addition, there was "*Warning: Do not allow personnel to be around moving equipment. Serious injuries have occurred to personnel during the operations of pipe catwalk machine,*" for floorhand's (skate operator) job step of visually clearing personnel from lift arm [tilt arm] and raising the tubular to elevator height prior to the driller lowering the TDS and latching elevators.

While personnel indicated they did not view the typed Controlled Procedures for M/U of DP, they explained that the AD reviewed and verbally discussed them with the crew while performing a hazard evaluation along with control mitigations for each hazard.

The operation of P/U DP on the night of the incident called for 6 drill crew members (driller, assistant driller, skate operator, banksman, and two floorhands) to be working on the rig floor. The driller and AD positions were generally required to operate equipment while supervising drill crew members. The driller generally sat in the Drill Control Center, Auxiliary Driller Chair and operated the TDS (Figure 13). The AD generally stayed in the Drill Control Center Auxiliary AD chair and operated the Iron rough neck. The skate operator generally walked with the PHCM skate during the operation and controlled the PHCM with a remote control. The banksman was generally charged with signaling to the driller for TDS movement. The two floorhands performed various other functions on the drill floor including: removing & installing DP slips, removing thread protectors, installing drifts, doping the DP, etc.

During the shift of the incident, the drill crew performed the operation of picking up DP by horizontally loading singles onto the PHCM loading platform arms in bundles of five. The skate operator used a portable remote with joysticks and control switches to activate a mechanism, called a tipper, which tipped a single joint of DP into the PHCM's shuttle cradle (see Figure 3).

The skate operator then remote functioned to push the DP via the PHCM shuttle in the cradle towards the well center, until it stuck out approximately 2.5 feet beyond the tilt ramp. Next, the skate operator would use the remote to raise the PHCM's tilt ramp until the box end of the DP closest to the aux-well center reaches a designated height. The skate and DP would then be advanced to the designated pick up location near well center (See Step #1 in procedure A & B in Figure 11). The driller then lowered the Top Drive System (TDS) that was hydraulically functioned to allow for the TDS elevators to tilt and latch onto the DP. Once the latch was verified by the banksman, the driller lifted the DP with the TDS elevators.

Until this point, the drill crew appeared to follow the Controlled Procedure.

However, the AD indicated that with the skate advanced toward the well center in the location where the TDS latched to the drill pipe, application of the Pipe Tail Arm (PTA) (needed to guide the drill pipe to well center, per the procedures) would cause the Anti-Collision System (ACS) to shut down the TDS controls and therefore prevent them from performing the operations. According to the AD and another employee that worked on the PBS 10k drill floor, the ACS allowed for the simultaneous manipulation of the PTA and the raising of the TDS only when the skate was reversed a certain distance away from the well center. Thus, the ACS prevented the Controlled Procedure from being followed.

According to the ACS user manual, a machine collision alarm would occur and the colliding machine would be stopped immediately when the auxiliary top drive was towards the auxiliary catwalk machine (PHCM); and when the auxiliary catwalk machine was toward the auxiliary top drive.

The ACS on the PBS 10k was equipped with override functions to release (disregard all stop signals from all other machines in the ACS) or ignore (the position coordinates received from the machine and thereby not send stop signals to the other machines when a collision to this machine is possible). The user manual described that these were the modes to use, respectively, in case of communication breakdown between machine PLC (programmable logic controller) and ACS PLC, or in case of Measurement Not Healthy signal from machine PLC. Both functions noted that COLLISION IS POSSIBLE.

There was no indication that an override function was used for the ACS. According to one individual who worked on the PBS 10k, using bypass or override on the ACS was a "no-no." He said that if they had to bypass or override an ACS function and something went wrong, they could lose their job.

Therefore, when the crew performed these activities on the morning of the incident, the driller lifted the DP with the TDS and the skate operator simultaneously reversed the PHCM skate backwards (away from well center) to a designated position (See Figure 11 Procedure A step#2). This action of reversing the skate away from well center was not described in the TODDI Controlled Procedure or the Risk Assessment Form; nor was it in the OEM PHCM user manual (See Figure 11 Procedure B). These additional skate movement steps increased the number of times the PHCM skate would transverse backward and forward; which increased the number of times the skate's loading platform arms passed the stanchion post. These additional steps subsequently created additional opportunities to encounter hazards due to added movement of equipment.

TODDI's Management of Change (MOC) policy indicated that an approved MOC process must be applied to manage temporary or permanent changes for, as a minimum, changes that may impact critical barrier requirements; changes to the management system, including temporary changes and improvements resulting from corrective and preventive actions; and changes to OEM's specifications, applications, and/or software for the critical systems and equipment. There was no indication that a formal MOC process occurred for the additional steps for this activity.

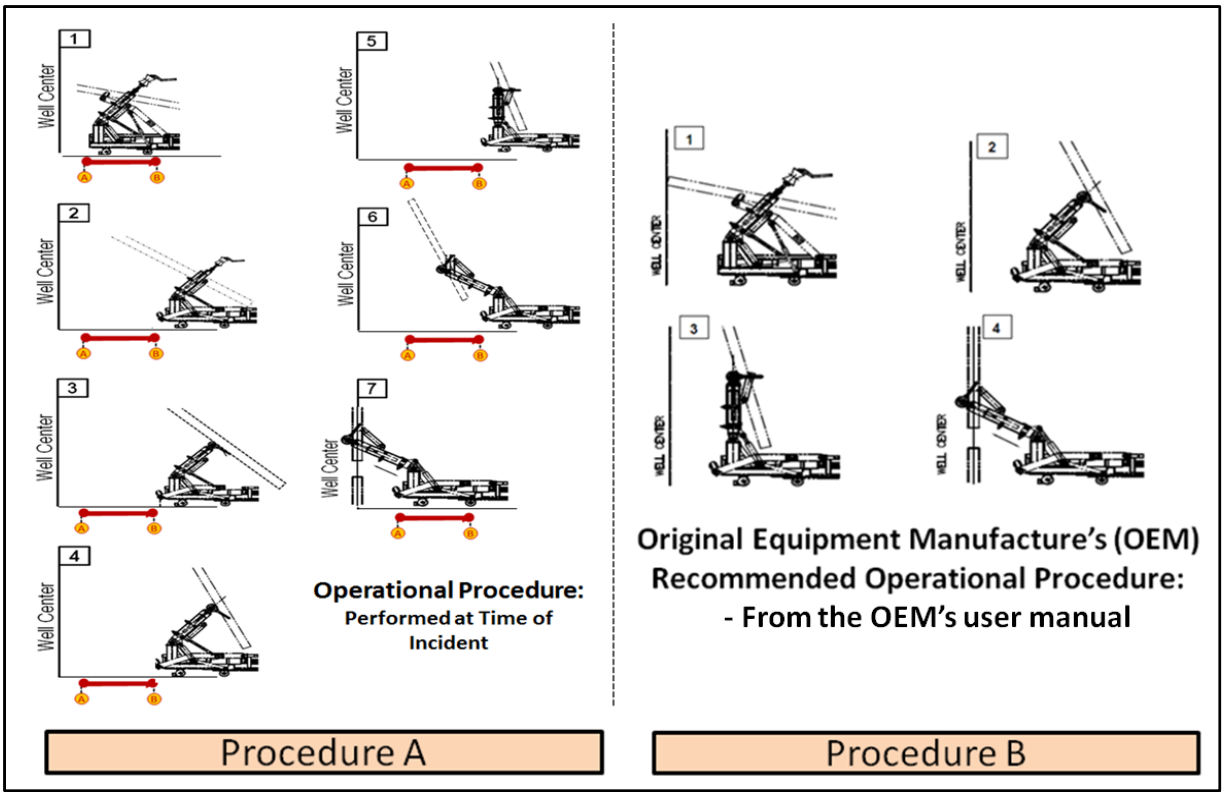

Figure 11: PHCM Operational Procedures (BSEE illustration using OEM user manual schematic)

The skate was reversed away from well center to the designated position and the TDS raised the DP vertically (See Figure 11 Procedure A step#2). The skate operator manipulated the PTA until the PTA roller was under the DP (See Figure 11 Procedure A step#3). The skate operator and driller worked together in manipulating the PTA arm and lifting the DP in order to: (1) lift up the DP pin end off the skate's shuttle and (2) guide the DP pin end in front of the skate (See Figure 11 Procedure A step#4, 5 & 6). With the DP pin end in the front of shuttle, the floorhands were then be able to remove the thread protector and dope the DP.

Next, the skate operator advanced the skate toward well center while using the PTA to guide the pin end of the DP; while the driller slightly raised the DP so that the pin end was above the box end of the suspended DP already inside the auxiliary rotary table (See Figure 11 Procedure A step#6 &7). The driller then lowered the DP until it connected with (stabbed) the DP already in the hole. The skate operator then retracted the PTA from the DP and reversed the skate away from well center.

The skate operator then reversed the skate enough that it was clear of the path of the iron roughneck. With assistance from the banksman, the AD advanced the iron roughneck toward the well center, gripped the two DPs and torqued until the DPs were connected.

Once successfully made up, the driller lifted the DP slightly in order for the floorhands to pull the slips. The driller then lowered the suspended DP through the rotary table until the box end of the DP was just above the drill floor. The floorhands installed the DP slips. The rest of the DP singles were picked up (P/U), made up (M/U), and tripped through the Auxiliary rotary table hole until the designated amount of drill pipe was suspended from the rotary.

On December 1, 2017 from 9:30 p.m. to 11:00 p.m., the IADC drilling report indicated the drilling crew pulled out of the hole (POOH) and racked back (R/B) approximately 2,260 ft. of 5-7/8" DP. The crew R/B the DP in stands (consisting of 3 single joints per stand) in to the designated setback area. The PHCM was not used when racking back the DP.

From 11:00 p.m. on December 1, 2017 until about 4:30 a.m. on December 2, 2017, the IADC drilling report indicated the drilling crew picked up 49 singles of 5 7/8" drill pipe. Up until that point, a total of 90 stands had been racked in the derrick; with 14 stands left suspended in the rotary table. The PHCM was used while picking up these singles.

As the crew continued to P/U and R/B drill pipe throughout the night, they had breaks for Time Out For Safety (TOFS). TOFS occurred when a bundle of DP was loaded from the pipe rack to the PHCM loading platform arms; which some personnel estimated as about a five (or more) minute break every 30 minutes or so. The crew members also rotated lunch schedules between 11:00 p.m. and 1:00 a.m. Personnel indicated that the victim operated the skate while the skate operator took his lunch break.

All personnel indicated that throughout the shift, the drill crew was not rushed and took their time picking up and racking back drill pipe, while taking TOFS when DP was loaded from the pipe rack to the PHCM loading platform arms. The skate operator indicated that they were supposed to take a break around 3:00 a.m., but instead worked through it.

Multiple personnel on the drill crew indicated that toward the end of their shift they were getting tired, and they talked and joked about being tired. They described making comments such as, “ready to hit that bed” and going to get coffee.

During this time, the skate operator and banksman generally stayed near the well center in the red zone to operate the skate and serve as a spotter for the TDS, moving out of the way of equipment and dropped objects periodically when they were not needed close to well center. The skate operator typically walked around the auxiliary drill floor with the skate as he advanced and retracted it. Personnel generally described that the skate operator would look at the TDS and skate when the drill pipe was lifted, to ensure he retracted the skate in coordination with the TDS being raised by the driller.

During panel interviews the skate operator indicated that the two other floorhands (victim included) should have been in the safe zone or Step Back Area when the TDS and/ or skate was moving, and they should walk toward the well center and into the red zone for tasks such as removing the protector, installing/retrieving the drift and doping the drill pipe threads when those tasks were needed. When not performing those tasks, video provided to the panel showed the victim was consistently seen outside the green rectangle on the surface of the drill floor; and the other floorhand was usually seen away from the well center but still in a red zone near that area. The skate operator indicated that the victim was reminded to get into the Step Back Area. Video footage of approximately 1.5 hours prior to the incident clearly showed that floorhands were often in the red zone when equipment (PHCM, TDS and Iron Roughneck) was moving, but no one stopped the job.

One crew member recalled to the BSEE Panel that the victim was not in the Step Back area several times throughout the night and the other floor hands would signal to the victim to move out of the danger zone. The video archive showed the victim entering the restricted area near the stanchion post multiple times during the operation. There are several instances on the video where the victim narrowly avoids being contacted by the skate loading platform arm at the pinch point between the stanchion post and the loading platform arm as the skate is moving.

On December 2, 2017 around 4:40 a.m., the drill crew was picking up DP, as they had been doing on and off all night. The skate had just been advanced toward the auxiliary well center for the elevators to latch onto the box end of the DP. The victim was standing on the aft side of the hoist, appearing to be in the yellow zone outside of the green box (see Figure13). As the driller lowered the TDS to latch the elevators to the DP, the victim moved toward the port side stanchion post and seemed to stretch on the hoist cable anchored to the post. His position appeared to still be in a yellow zone, but also still outside of the green box (see figures 12, 13, 16, & 17). He faced away from the ongoing operation on the aux floor.

The elevators had just been latched to the box end of the DP and the TDS and PHCM were simultaneously being utilized to pick up the DP. The skate operator and banksman stood in the red zone in front of the skate as the elevators latched to the DP. The banksman used a hand signal to confirm the latch to the driller, and then began walking away from the auxiliary well center. The driller then began to raise the TDS elevators. While the elevators raised the DP vertically, the skate operator reversed the skate away from the auxiliary well center. He said he was looking up to ensure a proper elevator latch on the DP. The AD was standing behind his chair in the driller's shack.

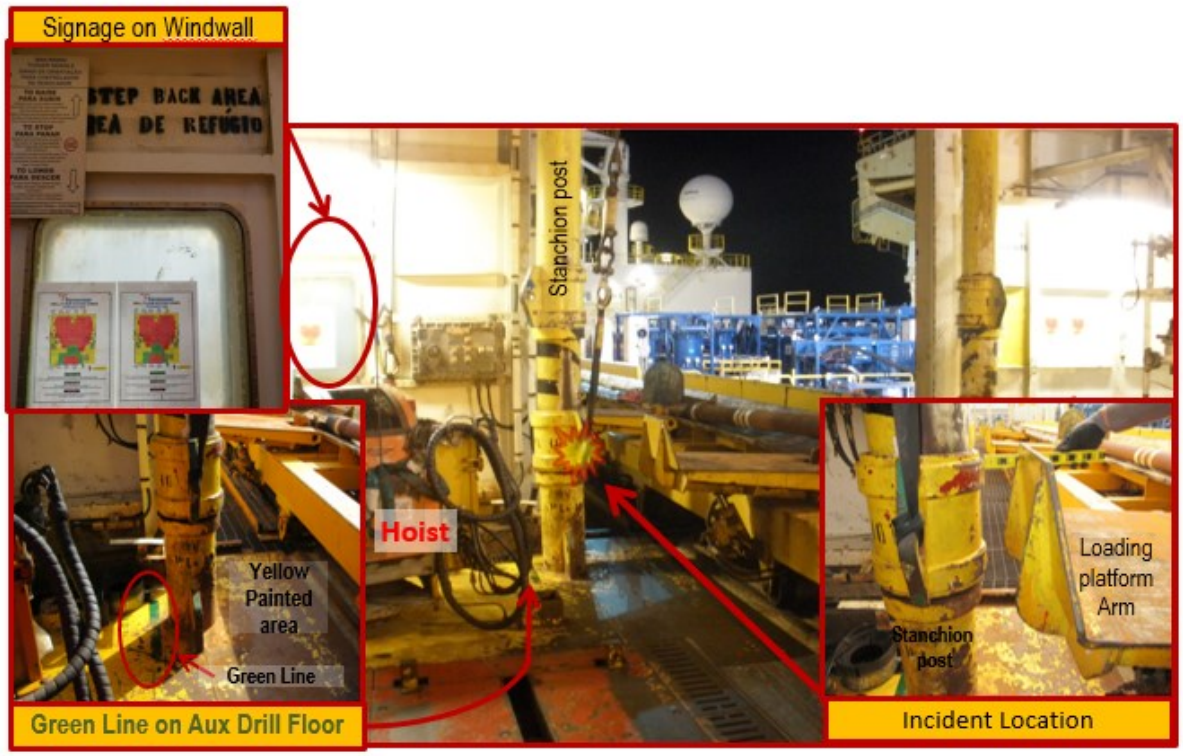

Figure 12: Auxiliary drill floor loading platform arm/ stanchion post proximity (floor hand view)

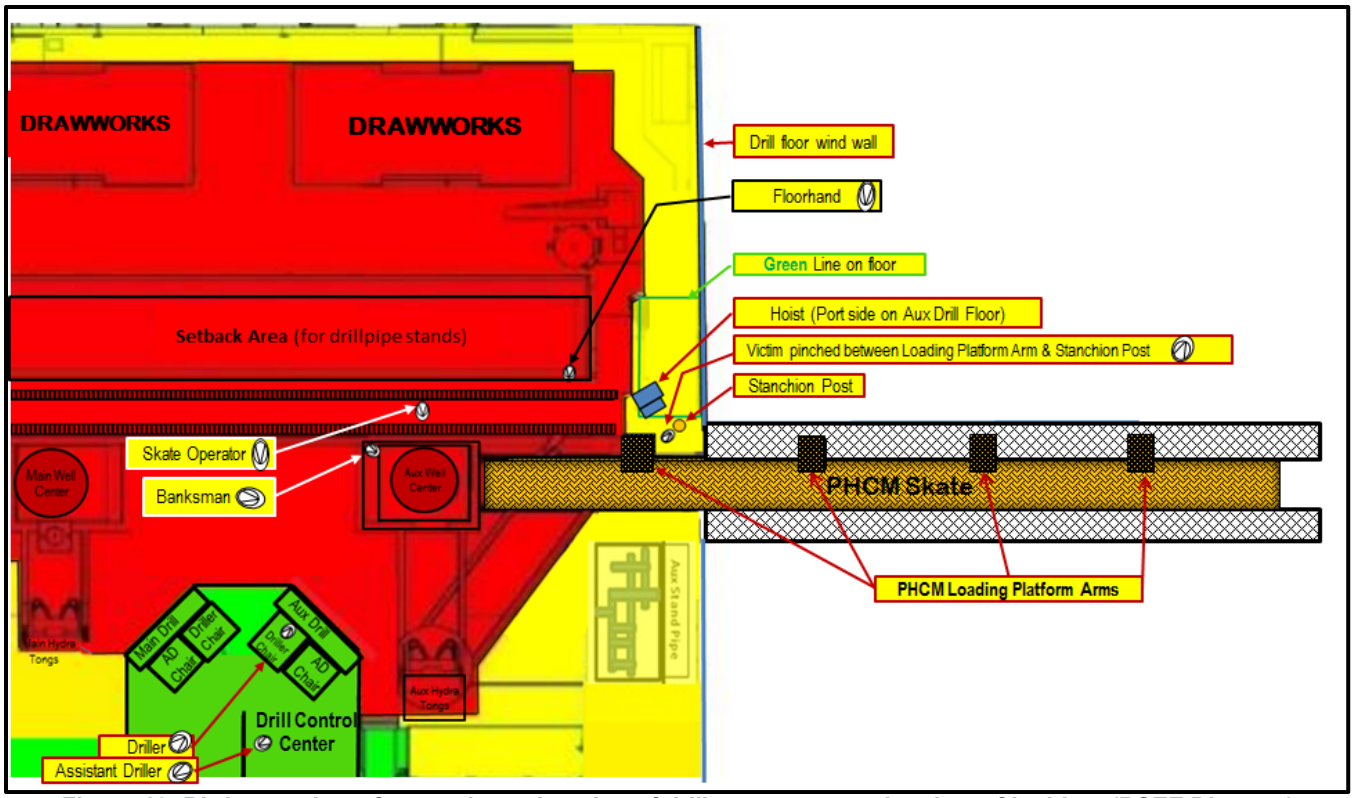

Figure 13: Birds-eye view of approximate location of drill crew personnel at time of incident (BSEE Diagram)

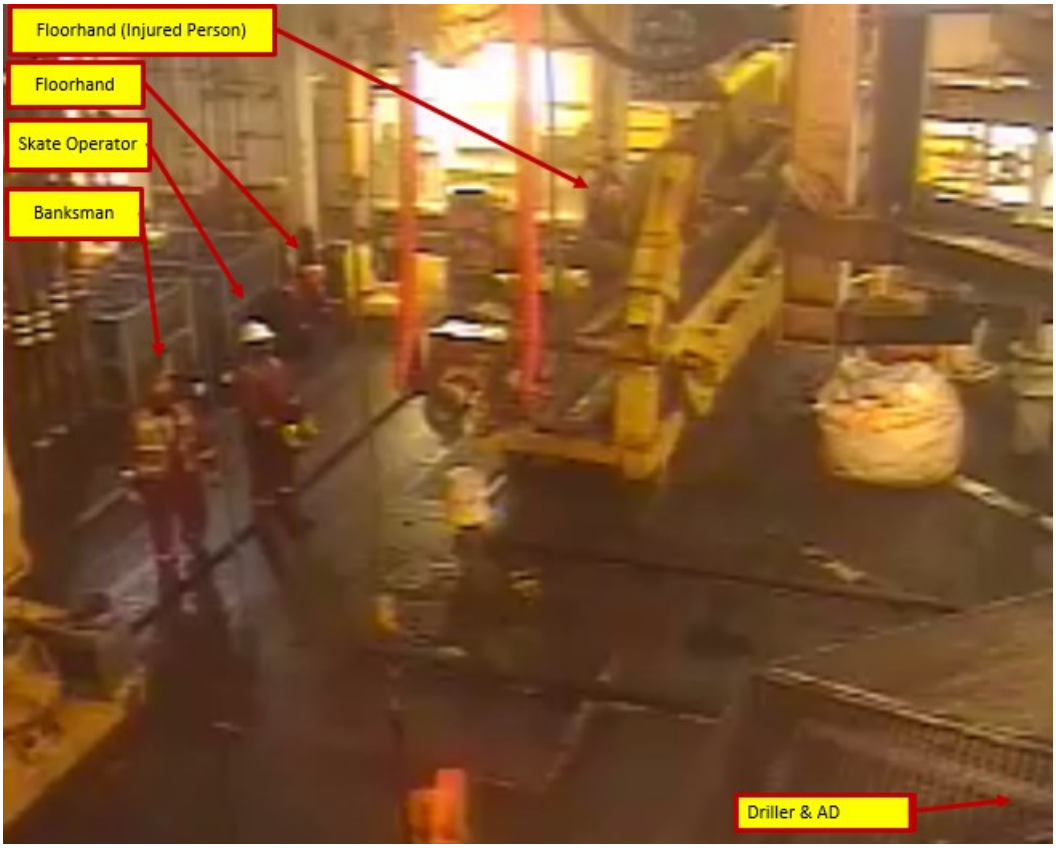

Figure 14: Image of auxiliary drill floor near the time of the incident.

When the skate was moving, the skate's loading platform arm passed the stanchion post where the victim was located, creating a dangerous pinch point that had not been specifically identified by the drill crew. At the convergence of the loading platform arm and the stanchion post, there was approximately a three-inch clearance between the port side aux stanchion post and the skate's loading platform arm at the closest point. The skate was moved in reverse while the victim was in the strike zone of the previously unidentified pinch point (see figures 12, 13, 14, 16 & 17). No one on the drill crew proactively stopped the job. The victim, who was still facing away from the operation, was pinned between the stanchion post and the skate loading platform arm.

A floorhand described that he heard someone say, "Tell him to stop." Then he saw the victim stuck between the skate and the stanchion post. The floorhand told the skate operator to stop, which the skate operator heard. The skate operator indicated that he used the joystick on the remote to move the skate in the opposite direction (toward well center), and then hit the emergency stop button. When the skate moved toward well center, it released the victim and he fell to the surface of the drill floor.

Incident Response

The banksman went into the drill shack and informed the driller and AD that the victim was injured. Drill crew personnel called the onsite medic and stayed with the victim, talking to him as he went in and out of consciousness. Some personnel got a stretcher, and others went to personally inform and assist the medic to respond. The medic came to the drill floor and evaluated the victim. The victim was then transported to the medic's office on a stretcher, where the medic treated him for his injuries while communicating with an onshore doctor. At the decision of TODDI in consultation with the medic, PAI contacted their designated Search and Rescue (SAR) provider for an emergency medical evacuation at 5:00 a.m.; who notified the SAR team at 5:08 a.m.

The SAR team helicopter was initially delayed due to fog, during which time PAI made preliminary attempts to secure other means of evacuation, including the USCG and another SAR provider. Before they secured another means of evacuation, the initial SAR provider was cleared to fly (approximately 66 minutes after the initial request for evacuation) and began its route to the PBS 10k arriving at 7:34 a.m. While waiting on the SAR, personnel on the PBS 10k continued to provide treatment to the victim with assistance from the onshore doctor, but the victim's vital signs deteriorated. He was pronounced dead shortly after arrival of the SAR provider.

A representative from PAI notified the BSEE, Houma District at approximately 8:20 a.m. on December 2, 2017 that a fatality occurred during operations onboard the PBS10k.

BSEE and USCG personnel attempted to travel to the PBS10k later that same day to begin the investigation into the incident, but were delayed until the following day (December 3, 2017) due to weather. The BSEE/USCG team collected pertinent records, conducted preliminary interviews of personnel, and documented the incident area with photographs.

Worker Training, Experience and Familiarity with the PBS 10K

All personnel working on the drill floor at the time of the incident had training and experience working offshore, some having served in their positions for multiple years and others having even served in more advanced positions throughout their careers before taking less senior positions on the PBS 10k based on job availability. None of the six crewmembers on the drill floor had worked together on the PBS 10k for more than three or four hitches.

The panel reviewed training records for the victim, a Spencer Ogden employee. The records showed that the victim had completed a number of the training modules required by TODDI, including Rig Orientation, Team Safety, HSE on-the-job training (OJT), banksman Slinger OJT, LCE Offshore 2017, and floorhand OJT. He had not completed the Line of Fire 2.1 – Proximity training that some others on his crew had. According to his resume, the victim had been working as a floorhand in the offshore drilling industry since August 2011.

According to training history provided to the panel, the skate operator, also employed by Spencer Ogden, had completed such courses as Team Safety, Rig Orientation, HSE Orientation (Rig Specific), Lifesaving Rules and Tools, Line of Fire 2.1 – Proximity and Task Planning and Risk Assessment, among others. He had not completed the floorhand OJT. According to his resume, the skate operator had worked offshore as a roustabout from November 2015 until April 2017.

The Floorhand OJT module included competencies and tasks of, among others, identifying where it was safe and unsafe to stand during various operations on the drill floor (and why), describing pinch points on the floor and avoiding accidents associated with them, and demonstrating floorhand job positions when picking up pipe. The documentation provided did not include the training on or responses to those topics. The victim's floorhand OJT was certified by the OIM and a driller on the PBS 10k September 22, 2017.

Most personnel described that the training they received to operate the skate was OJT. A meeting sign-in sheet indicated that the skate operator and victim, among others, attended an awareness session for "RAF's acknowledgement (Continue to operate Anti Collision System," on October 20, 2017. This document was provided by the PBS 10k drilling superintendent, who indicated that they did not have a formal training for personnel to operate the skate, but this sign-in sheet was the best documentation he had, as of the day after the incident, for showing they received training on the skate.

The drilling superintendent said this training also involved acting out doping pipe and all activities that they would be doing, including emergency shutdowns, operating valves and operating equipment. He said they did this for hours, and allowed many different operators to operate the equipment. He said the ACS included all the equipment on the drill floor, including the skate and the racker. He said he did not know how involved in the training each person was; but that the victim was familiar with working the skate from training. He also explained that at the time of the incident, sign-offs or approvals were not needed to operate the equipment; but they became needed after the incident.

Additional documentation showed a training exercise on October 23 -24, 2017. Drill Crew C was involved in training new crew members on the riser catwalk machine (RCWM) and pipe catwalk machine operation. Additionally, the reports indicated that Drill Crew C performed a training exercise on

P/U and R/B drill pipe. These activities included the same assistant driller and three of the four floorhands (banksman, skate operator and victim) that were on the drill floor at the time of the incident on December 2, 2017. The fourth floorhand had not yet arrived to work on the PBS 10k at the time of this training.

During panel interviews, the driller indicated that the person who was most familiar with the type of equipment would help to train the others on their crew. The driller said the victim was considered the person most familiar with the skate, and so he helped the skate operator to learn how to operate it on the shift of the incident. The victim was listed on the RAF as the person who inspected the skate. The skate operator said he felt confident operating the skate, and the driller and assistant driller expressed that he had been doing a good job throughout the shift. The December 1-2, 2017 night shift was the skate operator's first time operating the skate on the PBS 10k during real operations.

Other than during training exercises over five weeks prior to the incident, the shift of the incident was the first time they had picked up and racked back pipe together. The skate operator said he was not provided with the user manual or written instructions for how to operate the skate, but that he just received OJT about how to operate it. He described his training on the skate as learning the controls, such as what each button did; and just pretty much getting familiar with the skate. He said they used one pipe at a time, maybe three pipes in one span, and did it, took it back out, and then switched remotes and the next guy did it. He said they were also taught that when the skate was moving everybody was supposed to get back to their safe zone. Regarding what to look for before energizing the skate, the skate operator said he was taught to look "at the position of the pipe and everybody else pretty much, make sure everybody's in their safe zone." He described the safe zone as the yellow areas.

When asked if the training included anything like pre-energizing steps (such as taking a pause before operating to make sure everybody was in their area before energizing the skate), the skate operator said he did not recall. He also indicated that on his first hitch every time something moved, they would yell out, "Safe zone, safe zone," real loud and everybody just went to their safe zone. However, he said they did not do this on the shift of the incident. The panel did not receive a reason why drill Crew C did not yell out load prior to moving equipment on the night of the incident. The assistant driller indicated that they had multiple timeouts if personnel left the Step Back area

Onboard the PBS 10K, a short service employee (SSE) would typically be newly hired personnel with less than six months experience with the company or transferred personnel with less than three months on the facility; both including contract workers such as those on Drill Crew C. The length of the SSE program could be shorter if the SSE employee's named supervisor felt they met the requirements of the program and the OIM gave final approval. Due to the PBS 10K recently coming to the GOM and utilizing a new crew, all of the crewmembers on the drill floor and in the drill shack at the time of the incident were SSEs. Even the Master / OIM had been a SSE until only three days before the incident - based on a three-month requirement.

According to TODDI's policy for their SSE program, the SSE must be assigned a named supervisor for the length of the SSE program, to provide knowledge, advice and support to help the SSE become competent in their position. The supervisor could also assign an experienced crew member to assist with the training and development of the SSE. Before an SSE was permitted to perform tasks or duties unsupervised, the SSE supervisor must have signed-off the relevant task in the OJT task list.

Training history reports indicated that the victim and banksman had completed floorhand OJT. The skate operator had not completed the floorhand OJT.

According to personnel, TODDI had OJT in which a person in training would "shadow" a more experienced worker on a particular crew. If a person in training performed satisfactorily, they would be evaluated by the supervisor prior to any advancement. Some personnel also described an official or unofficial mentor program to help personnel with less experience. While records indicated that the victim had completed floorhand OJT, no documentation was provided to the panel to indicate either the skate operator or victim was in a mentor program.

The panel requested records for any SSE or mentor employees that were on the PBS 10K drill floor at the time of the incident, but did not receive any documentation that those employees were assigned a supervisor for the SSE program. When the skate operator was asked if he had a mentor, he said not exactly, but that the victim, who had the most experience, pretty much mentored everybody that was on the drill floor.

So other crew members would be aware of a person's experience level, SSE's on the PBS 10K would wear an hard hat which was a color other than white until they completed the SSE program.

As mentioned, the panel was provided a list of training history and certificates and the floorhand OJT training module which the victim successfully passed, and received personnel descriptions of the training exercises previously described. However, the panel did not receive clear documentation of formalized training provided to either the skate operator or victim for all aspects associated with picking up pipe and operating the skate.

Line of Fire

TODDI posted signage throughout the drillship that detailed the Lifesaving Rules for operations. The understanding for Lifesaving Rules is that if these rules are followed completely then they are proven to save lives from commonly occurring dangers. One prominent Lifesaving Rule as per the signage throughout the PBS 10k was the Line of Fire Rule.

Line of Fire means to be in the path of moving objects or in the path of released energy. To avoid the line of fire is to remove oneself from the contact zone of moving equipment or to remove oneself from any area where uncontrolled energy could be released. The line of fire can also be avoided by mitigating the potential hazards, especially the uncontrolled release of energy.
The TODDI Line of Fire Rule states that one must do the following to be compliant:

- Identify and control all Line of Fire hazards
- Keep myself and others out of the Line of Fire
- Be aware of all caught between hazards
- Be aware of all moving machinery
- Be aware that Line of Fire hazards can change during the task

PAI also had a series of "Golden Rules." Among those, was one for unsafe positioning. This rule stated that "Do not enter barrier areas. Never put yourself under [loads] or between vehicles, parked or moving. Always keep yourself in a safe and protected place."

Documents provided to the panel indicated the crew had attended multiple meetings that discussed the Lifesaving Rules and Golden Rules. Some meetings specifically described a discussion of Line of Fire, a rule that included the mantra that "I must...keep myself and others out of the Line of Fire."

At least one interview indicated that throughout the night, personnel saw the victim move into the red zone, and the guys would bring him back in to the safe zone area. He described that the victim would wander off again, and the guys brought him back in.

Video footage provided to the panel showed multiple personnel in the red and yellow zones while the TDS and skate were in motion, including instances of the victim nearly getting struck by the skate as he stood near the stanchion post prior to the incident. However, none of the personnel on the drill floor or supervisors in the drill shack appeared to stop the job during those instances.

Fatigue / Complacency

The incident occurred approximately 10.5 hours into a 12-hour shift. This was also the first shift by the personnel working on the drill floor since returning to the PBS 10k after 21 days off work. In addition, some personnel were authorized to stay at a hotel in New Orleans or Galliano, LA, and then drive or take a van to the heliport; while others drove from home. PAI indicated that the relevant members of Drill Crew C had checked in at the heliport by 5:42 a.m. on December 1, 2017.

In general, personal recollections of their arrival times differed from flight records obtained from PAI. According to flight records, the driller, assistant driller and one of the floorhands arrived on the PBS 10k at approximately 7:20 a.m. on December 1, 2017. After arriving, they received a briefing about the status of operations and could go to their rooms. The driller estimated sleeping from around 12:30 or 1:00 p.m. to around 4:00 p.m.; the assistant driller estimated sleeping from around 9:00 a.m. to 4:30 p.m.; and the floorhand estimated sleeping for two or three hours.

The other three floorhands, including the victim and the skate operator, then arrived on another flight around 10:34 a.m. on December 1, 2017. One of the floorhands described driving 13 hours on November 30 to December 1, 2017 from South Texas to Port Fourchon, LA to get to the heliport, then reported to work and flew to the rig. He estimated he got about three hours of sleep in the 30 hours leading up to the time of the incident. The skate operator indicated that the only sleep he got after arriving at the heliport was on the helicopter on the way to the drillship; which he indicated was the same for the victim.

Personnel then had to report for a safety meeting at 5:30 p.m., after which they began their shift. Personnel described that they were not rushed, and they took lunch and regular breaks (TOFS) every time the crane crew loaded more pipe to the skate. The skate operator indicated that they worked through a 3:00 a.m. break because no one said anything about stopping.

TODDI had a policy for managing when physical, mental or emotional impairment was suspected or identified. This policy required efforts be made to ensure that personnel are not allowed to work while impaired physically, emotionally or mentally (including fatigue) and bringing suspected impairment to the attention of the supervisor in charge. In addition, any requirement for personnel to work more than

12 continuous hours must receive approval, specific factors must be considered for any person to work in excess of a 16 hour continuous period, and personnel must have a minimum of a six hour rest period after any extended work period. The policy did not address considerations for travel time to work locations.

In addition, TODDI attempted to address monitoring tasks through a concept called, "Chronic Unease." This was one of the topics addressed in the Supervisor's Five Key Expectations form and was described in their policy for Task Planning and Risk Assessment. In such, they described Chronic Unease as the opposite of complacency; and that it was a persistent concern about how risks are managed and controlled by calling effective TOFS before an incident occurs. "You must call TOFS at any time you identify any deviation from the plan, additional risks, or concerns due to your Chronic Unease mind-set," the form said.

No personnel specifically stated that they were or believed others were impaired, nor did any records indicate they worked in excess of 12 continuous hours. However, all of the personnel on the drill floor at the time of the incident indicated they felt tired or fatigued, and many of them said they or others mentioned being tired during the shift of the incident, including the victim.

Some personnel indicated they got coffee and said they were ready to hit the bed. The AD said he and the victim also joked about being tired, but that they did that a lot and were not serious. Personnel also described that they were stretching and trying to loosen up, which the panel witnessed on the video, viewing three of the four crew members on the drill floor bending over, kneeling or stretching throughout the two hours leading up to the incident and also within about three minutes of the incident. Some personnel stated the first day out was always the hardest due to lack of sleep. There was no indication that anyone called a TOFS due to fatigue or personnel being in a hazardous location in the moments leading up to the incident.

Alarms

Personnel described a blinking light at the end of the PHCM towards the bow of the drillship, which could be turned on when operating the PHCM. The video provided to the panel showed this blinking light was on at the time of the incident. While personnel may have been able to see the light from the drill floor and the light was operating at per OEM specifications, the light was not physically located on the drill floor and did not appear to change when the PHCM skate was or was not in motion.

At the time of the incident there were no audible alarms on the PHCM. The PHCM was not equipped to have audible alarms during operation. The PHCM skate was energized and moved forward and reversed on a predefined rail system. There was no typical beeping alarm that sounded when this equipment was moving in either direction. Given the general noise level on an offshore facility where hearing protection is always required as part of the normal personal protective equipment (PPE), the normal motor and movement noise of the skate could easily be concealed to a floorhand.

After the incident, the OEM issued a notification to customers of the availability of a catwalk movement alarm kit. This kit provided an alarm sounder and beacon mounted on the front of the skate located closest to well center. The OEM indicated that it provided an increased level of safety by use of sound and flashing light when operating the skate drive to and from the drill floor.

An audible alarm system that would have activated on movement of the skate could have served to notify personnel that movement was in progress and possibly alerted the injured party that he was in the Line of Fire.

Design of Drill Floor

The PBS 10k is equipped with a dual activity drill floor which accommodates both the main and auxiliary well centers on the same floor. The PBS 10K has two derricks to allow for simultaneous rig operations. The drill control center, which accommodates both the auxiliary and main drill controls, is in the center of the drill floor (see Figure 13). The drill control center uses a partial hexagonal window arrangement as well as several video cameras to see all the rig activities. The aux drill floor was designed for pick up and racking back drill pipe. The PHCM skate is on a rail system and enters the aux drill floor side (bow side of the ship) and proceeds toward the auxiliary well center. On the port side of the skate is the hydra-rack pipe racking system. On the starboard side of the skate is the iron-roughneck. Other equipment, including the hoist, is also located on the port side of the skate in the vicinity of the green lines and stencils for the Step Back area (see Figure 15).

The skate enters the auxiliary drill floor along the catwalk between the wind walls. On both the port and starboard side of the skate is a stanchion post. The clearance between the skate loading platform arm and the stanchion post is about three inches when the loading platform arms are extended, as is the case when pipe is loaded onto the skate (see Figure 16). This minimal clearance acts as a pinch point hazard when the skate is in use and the loading platform arms were extended. The pinch point hazard could be mitigated by lifting the platform arms when not being used to hold tubulars. The arms are not required to be extended when the cart is retracting empty. However, the arms are required to be extended when loading tubulars.

Figure 15: Depiction of access to the green box / Step Back area (provided by PAI)

In addition to job specific risk analyses, such as the RAF, documentation and interviews described that personnel on the drillship performed hazard hunts and risk perception exercises to identify potential hazards. If a hazard hunt or risk assessment were performed when the skate was not in use, was positioned adjacent to the pipe rack or with the loading platforms raised, all of the hazards associated with the task of picking up drill pipe may not have been readily apparent; including that of the stanchion post and loading platform arms.

Personnel described having to turn sideways when walking along the catwalk or the skate and the video archive shows the injured person several times narrowly avoiding the skate pinching him in that area prior to the fatal incident. However, according to personnel the specific hazard of a pinch point between the loading platform arms and the stanchion post was never identified and thus never mitigated prior to the incident.

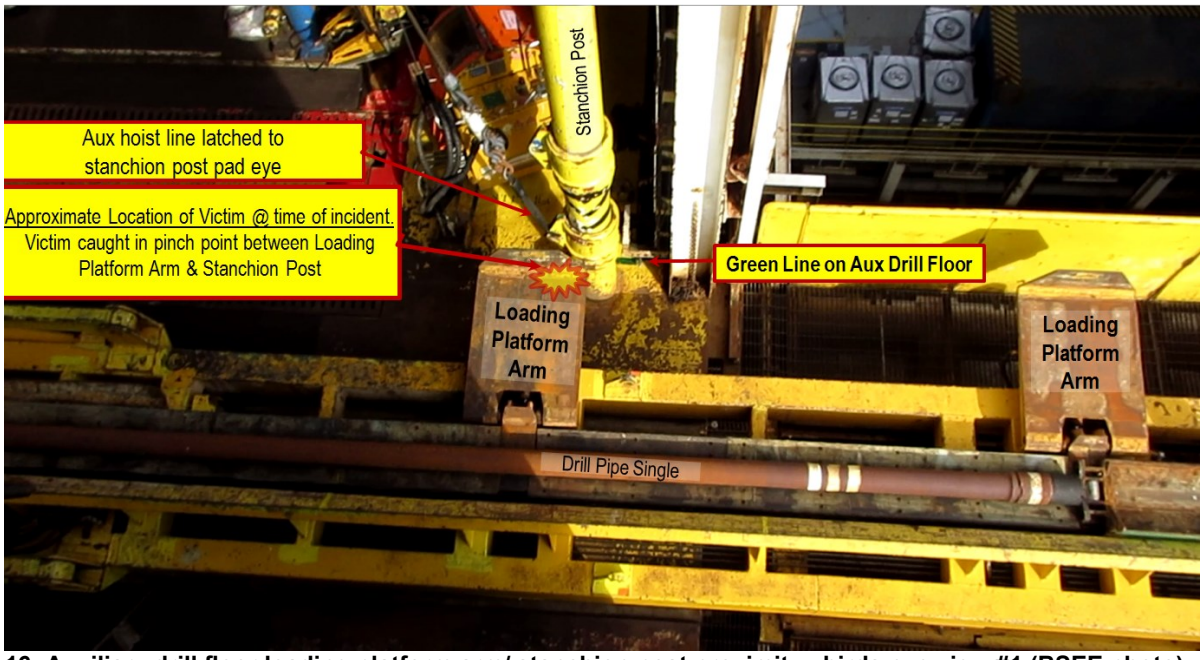

Figure 16: Auxiliary drill floor loading platform arm/ stanchion post proximity - birds-eye view #1 (BSEE photo)

When multiple singles were placed on the loading platform arms, there was little to no space available for someone to walk between the skate and the stanchion post. However, space became available as each pipe was offloaded from the loading platform and into the PHCM's shuttles cradle. Once the last drill pipe single was tipped into the skate's shuttle cradle, personnel had space to walk between the skate, the loading platform arms and the stanchion post (see Figure 17). In fact, in the hours preceding the incident the victim was observed stretching and also moving between the skate, the loading platform arm and the stanchion post after the last drill pipe was tipped.

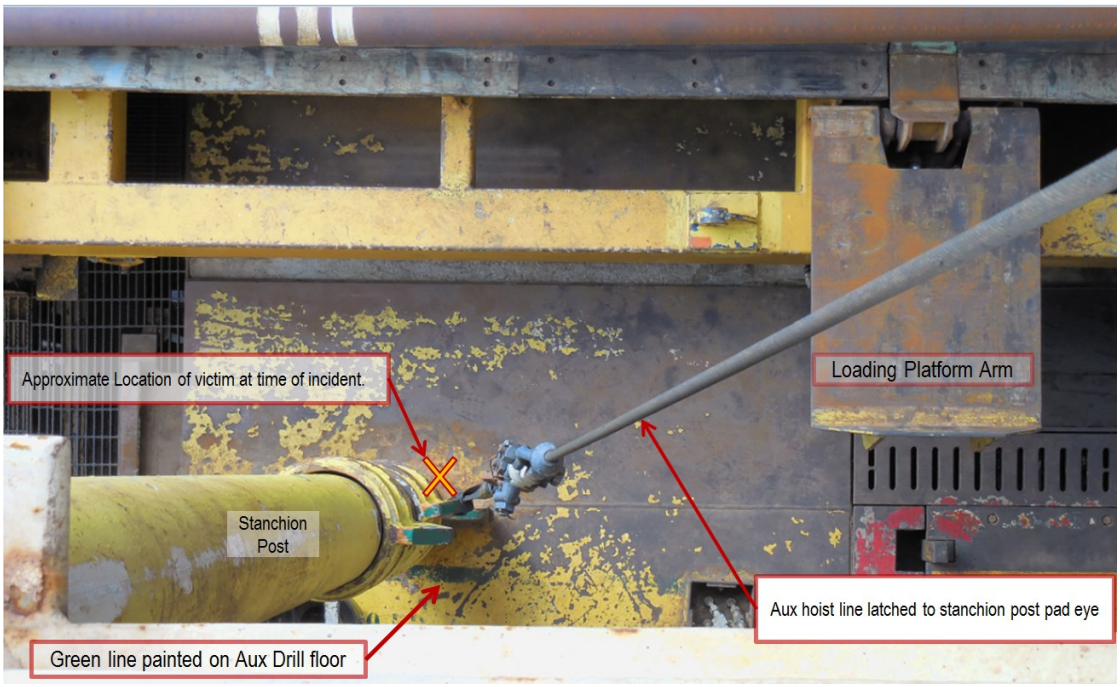

Figure 17: Auxiliary drill floor loading platform arm/ stanchion post proximity - birds-eye view #2 (BSEE photo)

Conclusions

The conclusions of direct and contributing factors reached by the BSEE Panel are based on the observations made during the investigation, interviews that were conducted and a review of documentation collected from TODDI, PAI, Spencer Ogden and other relevant companies.

The panel identified the following factors as primary causes of the incident:

The panel concluded that the death of the victim was the direct result of being in a hazardous location while facing away from the pipe handling operations at a critical time while equipment was being mobilized. The victim was positioned in a pinch point area, seemingly stretching, when the skate was mobilized. The victim was pinned between the stanchion post and skate's loading platform arm.

One cause of the incident was the victim moving into the hazardous pinch point area without anyone stopping work. Although it was in a yellow zone, the pinch point area was outside of the (green line sectioned) Step Back area designated in the PJSM. While in this area, the victim appeared to be stretching on the hoist line anchored to the stanchion post, with his back to the moving equipment. Despite that the victim and other drill crew members, located outside on the drill floor, were not in the (green-line delineated) Step Back area; none of the drill crew members or supervisors stopped the job before moving the skate. This not only occurred during the time of the incident, but earlier in the shift as well. By not stopping work, the victim, supervisors and other crew members failed to use the principles of TODDI's Life Saving Rule for Line of Fire; as well as PAI's Golden Rule for Unsafe Positioning. If a Time Out For Safety or stop work authority was called and the skate had not moved, then the skate's loading platform would not have created the pinch point hazard at that time.

Another cause of the incident was the failure to safely operate the PHCM skate. The skate was mobilized while the victim was stationed in an unsafe area inside the path of the skate. The victim did not all of a sudden move inside the restricted area at a key moment. The victim was stationary in clear sight of all the floorhands in the unsafe area at the time of the incident.

The third cause of the incident was the lack of understanding, enforcement and/or regard for using the drill floor zone areas and where to safely stand during operations. While the AD stated the step-back area (located behind the hoist) was reviewed during the pre-job safety meeting, the video archive showed the floor hands did not use the zones correctly during the operation and supervisors did not adequately enforce zone violations. Post-incident interviews with Drill Crew C floorhands indicated conflicting accounts as to the extent of the "Step Back area." Additionally, the Drill Floor Access Zones Diagram posted on the wind wall was inadequate and misleading for routine drill floor operations such as picking up drill pipe[1].

[1] BSEE concluded the Drill Floor Access Zones diagram posted on the wind wall within 10 feet of the incident location was inadequate and misleading for routine drill floor operations such as picking up drill pipe. The subject diagram did not identify the area of convergence of the loading platform arms and the stanchion post or the entire path of the skate as a red zone. The diagram incorrectly indicated the victim was in the safe Step Back area at the time of the incident. Based on post incident interview accounts, the diagram was made primarily to protect personnel from dropped objects; yet nothing on the diagram indicated strictly dropped objects.

The panel identified a pinch point with only a three-inch clearance between the stanchion post and skate's loading platform arm, when the loading platform arm was extended and aligned with the stanchion post, also caused the incident. This pinch point hazard was unidentified by the drill crew and was without sufficient barriers to prevent entry to the pinch point. This was a hazardous location that was not adequately identified, mitigated or clearly marked as a hazardous zone. The pinch point hazard was not identified on any known official risk assessment.

The panel further found the failure to follow the TODDI and OEM recommended procedures for picking up pipe caused the incident. The actual operation performed by the drill crew added an additional step to those procedures, which involved retracting the skate from the well center. Personnel described that the anti-collision system, which offered operational safety benefits, would shut-in the top drive system if the skate was not retracted from well center when attempting to control the drill pipe with the Pipe Tail-in Arm, so the step was necessary to perform the intended task. This additional movement was not included or addressed in the risk assessment form, Controlled Procedures or OEM procedures and increased the number of repetitions the skate's loading platform arm passed the stanchion post. There was no Management of Change for the procedure modification. The procedure performed by the crew led to more opportunities for a pinch-point risk that had not been sufficiently mitigated. The incident occurred during the additional step of retracting the skate from well center.

The panel identified two factors that may have contributed to the incident:

The incident occurred approximately 10.5 hours into the drill crew's first 12-hour shift on the drillship after 21 days off. Some members of the drill crew reported getting minimal sleep in the 24 hours or more prior to the incident. In addition, the crew had been performing the repetitive tasks of picking up and racking back the drill pipe. Therefore, complacency and fatigue could have contributed to the incident.

While the work crew had received training for picking up pipe, the shift of the incident was the first time they performed this task on the PBS 10k in a non-training environment. They were all considered short service employees, and none had been on the drillship for more than three months. There was no formal training to operate the skate, and personnel generally described that the victim was the most experienced operating skates, and was helping the skate operator learn how to operate it during the shift of the incident. Therefore, a lack of training, familiarity and experience with the drill floor equipment and layout on this drillship could have contributed to the incident.

Recommendations

Based on the findings from this investigation, the BSEE Panel recommends companies operating on the U.S. Outer Continental Shelf consider the following to further protect health, safety, property and the environment:

Zone identification:

- Clarify the meaning and location of access zones with employees, in procedures and on diagrams.
- Ensure all personnel are trained on restricted access zones, including periodic refresher training, and know where they are supposed to be at all times during an activity.
- Incorporate a system to ensure the access zones are clearly marked on the surface of the drill floor, such as a schedule to evaluate paint wear or utilization of colored mats.

Safe zone areas:

- Incorporate a shelter area where drill floor personnel can go when equipment is in motion.
- Ensure the designated safe areas are clear of equipment or other impediments to access.

Remove identified pinch point hazards and equipment modifications:

- Alter the design of a skate to add more clearance to eliminate the hazard.
- Remove the pinch point (hazardous) area by relocating the stanchion posts.
- Add physical barriers (i.e. caution tape) around pinch point (hazardous) area.
- Add an audible alarm to moving equipment, especially the skate.
- Add an additional visual alarm (i.e. light) which would alert floorhands during skate movements.

Pre-Job Safety Analysis:

- Evaluate risks for all tasks included in an operation. Evaluations should include how planned tasks relate to each other and clearly state where personnel must be located during high-risk operations.

Safety Programs:

- Refresh the safety culture improvement initiatives (i.e. Life Savings Rules, Line of Fire, and Prompt card).

Job Procedures:

- Update procedures to include all steps necessary to complete the job. All steps should then be analyzed for hazards and the hazards subsequently mitigated. Deviations from procedures should be evaluated and considered for change management.
- Include safe locations to stand during the job steps in the procedures.

Training:

- Review OJT programs. Consider formalizing OJT programs to provide continuity of methodology, materials and documentation.

- Ensure employees receive effective operational equipment training. Equipment training should include not only the operation of the equipment, but also its relationship to personnel and other equipment prior to putting it in motion. Consider incorporating a mandatory PHCM equipment operation certification in accordance with OEM guidance.

Short Service Employees (SSE):

- Evaluate management controls of SSE programs to ensure personnel new to a position or facility are addressed in these programs, including proper familiarization with specific equipment and work areas.

Fatigue

- Review employees' fitness for service on the first day of work on each hitch (including requirements to travel) and consider opportunities to maximize rest and limit fatigue. Further consideration should be made to ensure employees avoid complacency and remain fit for service throughout shifts involving repetitive tasks.