

Investigation report

Report			
Report title		Activity number	
Investigation of lifting incident	Investigation of lifting incident with dropped object on Jotun B 044027505		
Security grading			
☑ Public	Restricted	Strictly confidential	
Not publicly available	Confidential		
Involved			
Team		Approved by/date	
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1 Summary

In connection with a plugging campaign on the Jotun B production facility, an incident occurred on 19 May 2018 when a high-pressure riser fell about eight metres onto the wellhead. Given the riser's length of 15 metres and weight of 15.7 tonnes, this corresponded to about 1.23 megajoules in kinetic energy just before impact.

Jotun B is operated by Point Resources. The Petroleum Safety Authority Norway (PSA) decided to investigate the incident on 22 May 2018, and its investigation team travelled out to the facility on 24 May 2018. Key information is listed below.

- All 22 wells on Jotun B were in the process of being permanently plugged.
- Plans called for this work to be completed during the autumn of 2018.
- Plans call for Jotun B to be removed in the course of 2020.
- At the time of the incident, the plugging campaign was in the final phase with only a few wells (three of 22) remaining to be permanently plugged.
- The plugging operation had reached well B-18.

19 May 2018

- While the drilling rig was still positioned over well B-7, the high-pressure riser comprising three components two tubular sections linked by a valve was made up with a lifting accessory for installation on the B-18 wellhead at 05.30.
- Owing to an ongoing acid wash job in well B-12, the assembly of tubulars and valve remained suspended over well B-7, with slips and elevator (type BX 4-50), until about 23.00.
- The work permit for planned operations during the evening and night was reviewed and signed by the drilling crew at about 19.00.
- About 22.30, rough positioning of the drilling rig had been completed and a toolbox talk was conducted with the personnel involved before starting to lower the riser.
- Lowering the riser for installation on the B-18 wellhead began at about 23.15.
- About 23.23, the riser came loose and dropped about eight metres onto the wellhead. Given the riser's length of about 15 metres and weight of roughly 15.7 tonnes, this corresponded to some 1 232 136 joules in kinetic energy just before impact.
- After dropping, the riser was left standing in an apparently correct position on the wellhead.
- The drill string with lifting accessory was hoisted up, the accessory was removed and was placed to one side.
- No personal injuries were suffered, but the incident had the potential under slightly different circumstances to cause a fatal accident.

20 May 2018

- About 00.15, the offshore installation manager (OIM) was notified of the incident.
- About 03.00, the OIM notified the second-line emergency response duty officer.
- About 03.30, the OIM went off duty for the night.
- About 10.22, Point Resources notified the PSA of the incident.

22 May 2018 The PSA decided to investigate the incident.

2 May 2018 The PSA investigation team flew out to the Jotun B facility.

24-27 May 2018 The PSA investigation team conducted a number of interviews, checked documentation and made several site inspections in collaboration with those involved.27 May 2018 The PSA left the Jotun B facility.

A number of meetings were subsequently held on land between the companies involved and the PSA investigation team.

The report lists twelve (12) nonconformities in the following areas:

- o the "see to it" duty
- risk analyses
- o training
- user manuals for lifting equipment
- \circ use of uncertified lifting equipment
- \circ dealing with nonconformities
- o barriers
- o classification of equipment in the drilling module
- \circ the maintenance programme
- $\circ \quad \text{planning and prioritisation}$
- o follow-up
- o division of responsibility for lifting accessories and drilling equipment.

In addition, the report identifies one (1) improvement point in the following area:

• temporary equipment.

2 Background information

In connection with a plugging campaign on the Jotun B production facility, an incident occurred on 19 May 2018 when a high-pressure riser fell about eight metres onto the wellhead. This riser was 15 metres long and weighed 15.7 tonnes. That corresponded to 1.23 MJ.

This is classified as a defined situation of hazard and accident, "DSHA20B Crane and lifting operations – lifting equipment in the drilling module", with the consequence "DSHA21B Dropped objects – drilling areas" on Point Resources' Jotun B facility.

2.1 Description of facility and organisation



Optimus modular drilling rig.



Jotun B.



Jotun B is a four-leg production facility centrally placed in the Norwegian North Sea and belongs to the PL 027B and PL 103 licences in blocks 25/8 and 25/7 Jotun.

This facility was originally owned and operated by ExxonMobil. The field was discovered in 1994 and a plan for development and operation (PDO) was approved in 1997. Jotun B came on stream in 1999, and has been unstaffed for several periods with remote operation from Jotun A (floating production facility). The decision was taken in 2006 to shut down the drilling rig on Jotun B. Production ceased in 2016.

Because the derrick had been removed in 2015, a new drilling rig was required to conduct the plugging operation. A PTD-500-AC (Optimus) modular facility, delivered by M H Wirth, was chosen. This is owned and operated by Petro Well Services (PWS).

Jotun B was part of the portfolio of ExxonMobil facilities acquired by Point Resources in November 2017. The organisation which initiated the plugging project also transferred to Point Resources, as did personnel responsible for lifting operations on these facilities.

Since ExxonMobil had already started the plugging campaign on the facility's 22 wells, Point Resources took over all the contracts with subcontractors for this activity. In connection with the takeover of Jotun B, Point Resources chose to use the same guidelines and standards as ExxonMobil for all lifting operations.

The Optimus modular drilling rig was installed on Jotun B in the spring of 2017. Pursuant to the disposal decision, Jotun B is to be removed by 2020.

2.2 Position before the incident

According to the control room on Jotun A, the weather on the evening of 19 May 2018 was:

- cloud cover: variable
- wind: 21 knots
- direction: southerly, 170 degrees
- temperature: 9°C.

Since it was late in the evening, the only activity underway on board was connecting the highpressure riser to well B-18. The drawworks on the drilling rig was used to lower the riser during the incident. Five people took part on various deck levels in the work of lowering the riser into position, as well as a winch operator during the actual incident.

The various deck levels were illuminated, but the strength of this lighting varied between them. Illumination was minimal on the level between the old and new drill floors, while light conditions were good on the BOP and hatch decks.

2.3 Abbreviations

- BOP Blowout preventer
- KPI Key performance indicator
- IFS Petro Well Services maintenance management system
- OIM Offshore installation manager
- PWS Petro Well Services
- SAP Point Resources maintenance management system
- SJA Safe job analysis
- SWL Safe working load
- TDM Temporary drilling machine
- WP Work permit

3 PSA investigation

Composition of the investigation team:

Sigmund Andreassen – logistics and emergency preparedness discipline Lars Melkild – logistics and emergency preparedness (participated only on land) Kenneth Skogen – HSE management

Ola Heia - drilling and well technology (investigation leader).

3.1 Conduct of the investigation

The PSA's investigation team travelled to Jotun B on the morning of Thursday 24 May 2018. After arrival and a safety briefing, a kick-off meeting was held where the OIM briefly presented the incident and subsequent action. The reason for and the mandate of the PSA's investigation were outlined by the team. Furthermore, agreement was reached on how the investigation would be conducted on board, including who would be called for interview as well as how and when an inspection tour of the relevant areas would be carried out. The conversation was held with the safety delegate service and representatives of the facility's management as well as with personnel involved in the incident.

A total of seven interviews were conducted from Thursday 24 to Saturday 26 May. Documents received and requested were reviewed. Verifications of the maintenance management systems for Point Resources and PWS were carried out throughout the period in collaboration with qualified people who were relevant and selected. A summing-up meeting was held before the departure date originally planned for the afternoon of Saturday 26 May. Departure had to be postponed because of fog until the morning of Sunday 27 May. The team decided to continue its investigation until the new departure time.

A human-technology-organisation (HTO) diagram has been prepared as a tool for charting direct and underlying causes. See appendix A.

After its stay on Jotun B, the team held several meetings with Point Resources – which were also attended by Halliburton's project manager for the plugging campaign – and reviewed maintenance systems at both PWS and Halliburton for follow-up of the modular Optimus rig.

4 Course of events

Work was under way on Jotun B to plug all 22 wells permanently, and had reached well B-18. While the drilling rig was still positioned over well B-7, the high-pressure riser comprising three components – two tubular sections linked by a valve – was made up with a lifting accessory for installation on the B-18 wellhead at 05.30 on the day of the incident (19 May 2018).

Skidding of the rig from one well to the next was done by Aker Solutions with the assistance of necessary personnel from PWS, Halliburton and Cameron. Because an acid wash job was taking place in well B-12, the load was hung off over well B-7 with slips and elevator (type BX 4-50) right until lowering began about 23.00 on the same day.

Work permits (WPs) were prepared on Jotun B to cover operations for a week at a time (Ref AT 00105223). Plans for activities over the next 48 hours were reviewed at the morning meetings. A toolbox talk was also conducted. The "energy wheel – hazard potential/what can go wrong?" document was reviewed in connection with the talk. Where the point on dropped objects was concerned, attention concentrated only on the use of personal anti-fall equipment.

An operational instruction intended to cover skidding and lifting of high-pressure risers has been prepared as document no 11126-OFF-017. This specifies that lifting will be conducted in accordance with the ExxonMobil procedure XOM Operations Crane and Lifting Gear Manual. It is clearly stated here that only certified lifting equipment must be used. See section 5.0 in the instruction. Personnel involved in the incident were familiar with the procedure, and had participated in the meetings and interviews before the job started. The person with operational responsibility for lifting was not informed about the forthcoming operations before the incident because these were regarded as routine lifts.

About 19.00, the WP for planned operations during the evening and night was reviewed and signed by the drilling crew.

About 22.30, rough positioning of the drilling rig had been completed and a toolbox talk was conducted with the personnel involved before starting to lower the riser. On this facility, the practice was to lower the string (in this case the high-pressure riser) in order to make fine adjustments to its position over the wellhead.

About 23.15, lowering of the high-pressure riser for installation on the B-18 wellhead began. Personnel were positioned on the various deck levels down to the wellhead area in order to monitor and, where necessary, lead and guide the riser past and through the narrow openings between deck levels.

When lowering started, one person was posted on the facility's original rotary table, one on the BOP deck, one on the hatch deck and two in the wellhead area.



In order to help lead the string past the opening in the BOP deck, the person stationed on the facility's original rotary table descended to help lead/guide the string.



At the time the incident occurred, two people were posted down in the wellhead area, one was on the hatch deck, two were on the deck by the BOP room and one was in the driller's cabin on the drill floor. At about 23.23, the riser came loose and dropped about eight metres onto the wellhead. Given the riser's length of about 15 metres and weight of roughly 15.7 tonnes, this corresponded to some 1 232 136 joules in kinetic energy just before impact. The riser was left standing in an apparently correct position on the wellhead, at a slight angle from the vertical. No personal injuries were suffered, but the incident had the potential under slightly different circumstances to cause a fatal accident.





Before the OIM was contacted, the lifting accessory was retrieved and detached from the drill string. It was then placed to one side on the pipe deck.

It was not until about 00.15 on 20 May 2018 that the OIM was contacted by Halliburton's project manager.

About 00.45, the area was secured .

About 00.45, the OIM notified the second-line emergency response on land.

About 00.50, the operations manager was notified.

It took about 50 minutes from the incident had occurred until the OIM was woken up and informed of the incident. The OIM is the person with operational responsibility for lifting on Jotun B.

The OIM is the person who deals directly with lifting safety when such operations are being conducted on the facility.

Halliburton's project manager was asked to take photographs to document the incident.

The lifting accessory was hoisted out of its position and transferred to the pipe deck.

About 03.00, the OIM reported to the second-line emergency response.

About 03.30, the OIM went off duty.

5 Potential of the incident

5.1 Actual consequence

The consequence of the incident was a delay to the plugging programme for several days because of equipment damage. That also created a need to bring experts and additional personnel out to check the equipment involved for damage.

Material damage appeared to be confined to the lower part of the high-pressure riser which landed on the wellhead, and to the top of the latter. Visually, the wellhead suffered the greatest damage. It was unclear how quickly plugging work on B-18 could resume, given the damage caused to the wellhead and riser.

The view was that the wellhead could be repaired and readied relatively rapidly to resume plugging on B-18. However, the lifting accessory used in the incident when the high-pressure riser dropped was taken out of service immediately. It was decided to use alternative lifting devices and methods to complete the plugging programme.



Top of wellhead with damage.	Top of wellhead with damage.
Top of wellhead with damage.	Top of wellhead with the area around it.
Close-up of the top of the wellhead flange showing dented metal.	Close-up of wellhead top.
Photo showing that the lifting accessory is not centred in the drill floor on the Optimus rig.	Lifting accessory passing through the old drill floor on Jotun B. It is visibly displaced towards the liner wall.



5.2 Potential consequences

Personnel were posted on three deck levels down to the wellhead and in the actual wellhead area to guide the high-pressure riser down through the narrow spaces for installation on the B-18 wellhead. Under slightly different circumstances, the incident had the potential for fatal or serious injuries to two or more people, since they were standing relatively close to the dropping riser.

It emerges from position drawings and interviews that five people were within cordoned-off areas on three deck levels down to the wellhead and standing by the actual wellhead. They were intended to support and guide the risers through the openings in the various deck levels.

Lack of opportunity to fine-tune the position over the wellhead and the fact that the upper part of the lift (the drill string section) was bent meant the riser might have landed at an angle from the vertical and caused substantial harm to both personnel and equipment. A number of objects sticking out from the riser, including pad eyes, could have hit equipment and people. A lot of loose equipment was lying on the decks down towards the wellhead area. Under slightly different circumstances, these items could have been thrown about and harmed people and materials in the area within the cordons.

The gap between the Optimus drill floor and the old drill floor on Jotun B was very narrow. This meant the person responsible for guiding the high-pressure riser through the deck opening there had to kneel to keep an eye on the load's movement through and past obstacles during the lowering sequence. From there, the riser had to be guided into the opening from the BOP deck to the hatch deck. The person on the BOP deck was guiding the riser through this opening when the load loosened and fell. He leapt clear immediately to a safe position. The person on hatch deck was some distance from the area which the riser was lowered through and was therefore not in the immediate drop zone. The two people positioned by the wellhead to guide the riser into place had been standing moments before right next to the opening where the load was to be guided through. When the riser fell, they were roughly a metre from the area where the riser landed.

6 Direct and underlying causes

6.1 Direct cause

The locking mechanism in the lifting accessory failed. This accessory lacked a secondary locking mechanism for suspended loads in case the primary device failed. The load would accordingly come loose if the only barrier is a non-functioning locking mechanism.

The most likely reasons why the locking mechanism failed are:

- the skirt of the lifting accessory was pressed against the side wall in a narrow area, so that the mechanism ceased to function
 dropped high-pressure riser
- the skirt or part of it caught on an edge in a narrow area, pushing up the skirt and putting the mechanism out of action → dropped high-pressure riser.



	Locking mechanism for accessory to lift the riser viewed from below in the locked position.		The accessory for lifting/ lowering the riser on its way down through the hatch and next to the diverter.
	The accessory for lifting/ lowering the riser parked on a beam in the locked position.		The accessory for lifting/ lowering the riser parked on a beam in the open position. The beam has caught the skirt and deactivated its locking mechanism.
Position of the locking		Position of the locking mechanism.	
mechanism. Right up		Right down means no locking/	
means maximum		attachment function.	
locking/attachment			
function.			

6.2 Underlying causes

ExxonMobil commissioned Oceaneering to verify specially designed lifting accessories (SDLAs) in the drilling area before the plugging operation. See Oceaneering report 839631 dated 12 December 2017. This report identified a number of deficiencies in relation to regulatory requirements for equipment to be used during the plugging operation. Lack of knowledge about these requirements among SDLA users was also identified. Neither ExxonMobil nor Point Resources followed up the report's recommendations before the equipment was taken into use. Nor can the investigation team see that Point Resources informed users at PWS about the SDLA deficiencies. The accessory involved in the incident was clearly marked with a safe working load (SWL) of 20 tonnes, which indicated that this device was intended for lifting. The accessory did not carry colour code for the year, which is an important aid in confirming that the annual competent control has been carried out.

Point Resources also told the PSA team that it had chosen not to classify the lifting accessory for the health, safety and environmental consequences of potential functional failures. This is in spite of the fact that the company's governing documents identify and emphasise the various hazards of lifting and hoisting, with injunctions on the use of approved lifting equipment and to refrain from walking under suspended loads.

The user manual for the lifting accessory was deficient. This had also been identified by the Oceaneering verification. In its report, Oceaneering recommended ensuring that equipment on board had the necessary user manuals and certifications pursuant to the requirements of the Norwegian machinery regulations (Regulation 2009-05-20 no 544).

PWS had sent the lifting accessory to Cameron, the original manufacturer, for checking. However, the checks carried out were confined to those recommended in the API 16A appendix B and API 6A appendix J standards. See the certificate labelled order no 4370340. No competent control was carried out pursuant to the recommendations in Norsok R-003N. ExxonMobil, and now Point Resources, nevertheless specify in their governing documents that they comply with Norsok R-003N as the recommended norm through their procedures for conducting lifts.

The lifting accessory was connected to two short drill string sections and a valve as a simple way of using the drilling machine and elevator for the lifting operation. When checking the assembled drill string and when connecting the lifting accessory during its site investigation, the PSA team established that the string was bent. This is also likely to have been the case during the incident.

It emerged from interviews with people involved in the incident, and was also revealed in the Oceaneering report, that PWS personnel had inadequate training in Norsok R-003N on use of lifting equipment. Specific training with the accessories used during the incident was also deficient. A representative from the lifting accessory supplier took part in the presentation of this equipment and explained how it should be connected to the high-pressure riser. This person came from a different discipline team at the supplier than the one which had delivered the lifting accessory and thereby lacked detailed knowledge. The presentation involved studying the drawing shown below. Aspects related to competent control or possible hazards associated with the use of the accessory were neither identified nor discussed. The presentation was confined to the way the accessory should be connected to the riser.

Interviews with people involved in the incident also revealed that product-specific training with other lifting equipment used on board was deficient as well. It was not possible to document that the lifting gear used had been checked or used in accordance with the user instructions from the manufacturer or supplier.

According to Norsok R-003N, the recommended standard in the regulations, the person with operational responsibility must be involved in planning and executing non-routine lifting operations. The job being done during the incident was considered to be routine, and the person with operational responsibility therefore did not become involved in its planning and execution. Personnel involved did not know who had operational responsibility for lifting on Jotun B. The main job of this person is to provide guidance and to ensure compliance with procedures and chosen standards.

The potential for the riser dropping was not identified when establishing the WP for the lifting operation.

In connection with the toolbox talk, those involved had not adequately identified hazards in the lifting operation which was to be carried out. They did not follow their own procedures for executing lifts. The lack of involvement by the person with operational responsibility for lifting was not treated as a nonconformity.

Halliburton was contracted by ExxonMobil, later Point Resources, for permanent plugging of wells on Jotun B. PWS, with its modular Optimus drilling rig, was then hired in by Halliburton to perform the operational part of the assignment.

During the investigation, it emerged that bridge documentation intended to describe systems and equipment to be used and maintained during the plugging job was missing.

No documentation identified who had maintenance responsibility for the equipment used. It emerged during interviews that views differed about who was responsible for maintaining a number of the equipment items, since a lot of leased gear was circulating.

PWS had its drilling rig with equipment to be operated and maintained, without the equipment items and functions being catalogued and classified in the maintenance management system. A maintenance programme with necessary routines was lacking. Verifications of performance and weaknesses or an overview of barriers in the drilling module could not be presented. The barrier philosophy in or barrier follow-up by the companies was unclear to the investigation team.

Furthermore, the IFS maintenance management system in PWS lacked an overview of corrective maintenance activities. A few corrective activities were admittedly found in other formats such as paper copies.

The investigation team was shown maintenance routines, in the form of paper checklists, performed by PWS. These turned out to be unknown to the land organisation, since they did not derive from the company's maintenance management system.

Follow-up of equipment leased from third parties was deficient, since it was confined to a message after 12 months to send the items concerned back to land.

Where leased equipment involved in the incident is concerned, mention can be made of drill pipe and the manual slips. This equipment lacked documentation of maintenance carried out during the time they had been on the facility

Point Resources has later explained that it believed third parties were responsible for maintaining equipment which belonged to the company in the drilling module. That includes such items used during the incident as the lifting accessory, the high-pressure riser and the high-pressure riser valve.

Part of the above-mentioned equipment was found in the Point Resources maintenance management system to have been sold in 2016-17, and lacked maintenance routines in the company's system.



A "bent" drill string which was used together with the lifting accessory to raise and lower the high-pressure riser (on top).
A "bent" drill string which was used together with the lifting accessory to raise and lower the high-pressure riser (on top).
The lifting accessory connected to the drill string. It can be seen that the tool is not suspended centrally over the rotary-table opening.
The lifting accessory connected to the drill string. It can be seen that the tool is not suspended centrally over the rotary-table opening.

7 Emergency response

Not applicable – no mustering or alarm, only notified to the PSA.

8 Regulations

Section 10.4 of the regulations on the performance of work concerning equipment-specific training

Section 9 of the machinery regulations on sales and delivery of partly completed machines Section 7 of the framework regulations on responsibilities pursuant to these regulations Section 5 of the management regulations on barriers

Section 6 of the management regulations on management of health, safety and the environment

Section 15 of the management regulations on information

Section 17 of the management regulations on risk analyses and emergency preparedness assessments

Section 21 of the management regulations on follow-up

Section 22 of the management regulations on handling of nonconformities

Section 21 of the activities regulations on competence

Section 25 of the activities regulations on use of facilities

Section 46 of the activities regulations on classification

Section 47 of the activities regulations on maintenance programme

Section 48 of the activities regulations on planning and prioritisation

Section 49 of the activities regulations on maintenance effectiveness

Section 92 of the activities regulations on lifting operations

9 Observations

The PSA's observations fall generally into two categories.

- Nonconformities: observations where a breach of the regulations has been identified.
- Improvement points: observations where deficiencies are seen, but insufficient information is available to establish a breach of the regulations.

9.1 Nonconformities

9.1.1 "See to it" duty

Failure to follow up see to it duty towards subcontractors.

Grounds

In connection with the risk assessment of lifting equipment in the drilling module, Point Resources had failed to follow up the subcontractor to assure itself that identified findings and deficiencies with the lifting equipment had been corrected before it was taken into use. This also applied to expertise and equipment-specific training of personnel.

The investigation team found no documentation showing that maintenance and identification of barriers in the drilling module were followed up by Point Resources with the third party.

Requirement

Section 7, paragraph 2 of the framework regulations on responsibilities pursuant to these regulations

9.1.2 Risk analyses

Failure to identify major accident potential.

Grounds

Failure to conduct risk analysis for identifying dropped objects. At the time of the incident, the risk of losing the 15.7-tonne high-pressure riser had not been identified. Both a safe job analysis (SJA) and a toolbox talk had been conducted without identifying this risk.

Requirements

Section 17, paragraph 3, litera a) and paragraph 4, litera a), d) and g) of the management regulations on risk analyses and emergency preparedness assessments

9.1.3 Training

Insufficient and lack of adequate training with equipment used for lifting operations in the drilling module.

Grounds

Adequate training with the equipment used during the incident could not be documented for the personnel involved.

No documented equipment-specific training for loose lifting equipment existed. Where the lifting equipment used during the incident was concerned, the only information available was a drawing which explained how the high-pressure riser should be connected.

Requirement

Section 21, paragraph 1 of the management regulations on follow-up, see section one of the guidelines, see section 10.4 of the regulations on the performance of work concerning equipment-specific training

9.1.4 User manuals for lifting equipment

Missing and inadequate documentation of the lifting accessory for the high-pressure riser.

Grounds

Following a documentation review and interviews with those involved, it emerged that the lifting equipment used during the incident lacked a user manual. Deficiencies in the lifting equipment on Jotun B were revealed in internal report no 839631 of 25 September 2017. This covered training, use, usage checks and maintenance.

No information was provided about risks associated with erroneous use, correct use and the consequences of erroneous use. All that existed was a drawing of an operational procedure (PWS doc no 1126-OFF-017, rev 2, dated 9 September 2017).

The specific lifting accessory which failed was manufactured in 1998 and is subject to the machinery regulations adopted by Norway in August 1994. The regulations require a user manual (appendix 1, chapter 1.7.4 of the machinery regulations).

Since the regulations were drawn up, it has emerged that lifting equipment used in the drilling area has been treated at times not as a lifting accessory but as a tool for drilling operations. The investigation could not establish whether an assessment had been made of the lifting accessory involved in relation to any form of technological development in the area. Nor could it be established whether knowledge gained from other investigations resulting in orders to the industry had been used to indicate that user instructions for the lifting accessories involved needed to be improved.

Requirements

Section 9 of the machinery regulations on the sale and delivery of partly completed machinery, see appendix 1, chapter 1.7.4 and chapter 4 with 4.1.2.6c) and e)

9.1.5 Uncertified lifting equipment

The high-pressure riser was lifted using uncertified lifting equipment.

Grounds

Uncertified lifting equipment was used.

Personnel executing lifting operations on the drill floor did not know who had operational responsibility for lifting on Jotun B.

The document 24 Policy for loose lifting equipment on drill floor 20.10 2010, file number 001-2010, issued by Esso Norge AS specifies a number of requirements directed at lifting equipment used in connection with a running tool. See the extract from this document below.

c) Op	erations/maintenance manuals, which shall include but not be limited to: assembly drawings, list of components, nominal capacities and ratings, operating procedures, wear limits,
ts and Setting	Esso Norge AS #hhange/Desktop/Lifting MEMO doc/h10/22/2010 An ExxonMobil Subsidiary
•	recommended frequency of field inspection and preventive maintenance, methods and acceptance criteria,
	Itemized spare parts (not applicable to single component equipment) and recommended stock levels.

These requirements do not appear to have been met. The lack of certification for lifting equipment was known to the responsible people in the company through internal report no 839631.

Requirement

Section 92 of the activities regulations on lifting operations, see the guidelines which refer to Norsok R003N

9.1.6 Dealing with nonconformities

Failure to follow up earlier improvement points.

Grounds

Improvement points specified in the PSA's 2017 report (PSA ref 2015/907) concerning the risk register (item 5.2.1), maintenance (item 5.2.2) and lifting equipment (item 5.2.7) were implemented only in part. This is despite the fact that the operator at the time (ExxonMobil) claimed in a letter of reply dated 26 October 2017, reference S-39771, that these improvement points had been accepted and would be implemented before February 2018. These conditions, identified in the above-mentioned 2017 report, were highly significant for the outcome of the incident.

Requirement

Section 22 of the management regulations on handling of nonconformities

9.1.7 Barriers

Failure to identify and follow up barriers in the drilling module.

Grounds

During the investigation on Jotun B, it emerged that no overview of barriers in the drilling module was available.

Identification and classification of barriers were lacking, as were performance requirements for them. No information existed on barrier weaknesses and functions for the Optimus drilling module, even though it was reported during the investigation and at a meeting with Point Resources on 1 June 2018 that the company's barrier philosophy had been applied to the drilling module.

A more detailed check of the PWS maintenance programme conducted on 19 June 2018 provided further support for the findings of the investigation team.

Requirement

Section 5 of the management regulations on barriers

9.1.8 Classification

Equipment in the drilling module was unclassified.

Grounds

Random checks of the maintenance management system at the third party (PWS) were unable to establish whether the equipment in the drilling module had been classified. PWS was unable to produce an overview of classified equipment at the time of the investigation. This meant that the equipment was not risk-assessed as lifting equipment. Nor was any user manual prepared or acquired to meet the requirements in the machinery regulations.

Meetings after the investigation on the facility found that the equipment had not been classified in line with the requirements in the activities regulations. PWS had only categorised equipment types using the model in the DNVGL-OS-E101 Drilling facilities standard.

Point Resources divides its equipment into types A, B, C and D for criticality, with A as the highest and D the lowest, and prioritises maintenance activities on that basis. Again, it could not be shown that this had been applied in the maintenance management system for the drilling module.

Requirement

Section 46 of the activities regulations on classification

9.1.9 Maintenance programme

The maintenance programme was inadequate or non-existent.

Grounds

Random checks of the maintenance management system at Point Resources failed to yield an overview of maintenance activities carried out with the lifting equipment used in the incident.

The lifting equipment had a maintenance programme until 2007, but this was halted and deactivated following the 2006 decision to shut down the Jotun B drilling facility. This programme was not reactivated in the Point Resources maintenance management system when the Jotun B plugging operation began in 2017.

No checks of the lifting accessory used for the high-pressure riser were conducted by the competent control before being taken into use. It was not labelled with the year's colour code, which is also a requirement in the Point Resources governing documents. The code is a verification to the user that the accessory has been subject to periodic competent control.

According to the maintenance programme history for the lifting accessory, competent control was carried out up to 2005. No such checks in any form can be documented since then.

The lifting accessory involved was reclassified by ExxonMobil/Point Resources to remove its definition as lifting equipment. That was done before starting the plugging campaign. This reclassification could not be documented or explained. The accessory was checked in 2017 by the equipment supplier, but competent control was not carried out. It was labelled with manufacturer and serial number and "SWL 20 t" was painted on, which indicates that this was a lifting accessory.

Several running tools (type BX elevator) were available on Jotun B, but there was only one account in the PWS maintenance programme. That made it impossible to see which equipment had been used and maintained during the various parts of the plugging operations. Because the running tools and lifting equipment had several different owners, securing the necessary overview of maintenance done on the various equipment items was challenging. Much of the leased equipment used in the plugging operations on Jotun B was not registered in the maintenance systems and therefore lacked a maintenance history.

A number of maintenance activities carried out were recorded as "OK", but had no description of what was to be or had been done. Furthermore, a number of discrepancies existed with equipment numbering on drawings and duplicated numbering of equipment in the PWS maintenance system.

Requirement

Section 47 of the activities regulations on maintenance programme, see the guidelines which refer to Norsok R003N

9.1.10 Planning and prioritisation

Lack of planning and prioritisation of maintenance for the drilling module.

Grounds

One investigation activity involved verifying parts of the maintenance management system for the modularised drilling rig. The operator of the system could not show whether work orders were planned or prioritised in line with the requirements for classification and criticality (see nonconformity 9.1.8). Compliance with the principles in the Point Resources barrier philosophy could not be established. This meant there was no opportunity to follow up requirements concerned with maintenance efficiency.

Requirements

Section 48 of the activities regulations on planning and prioritisation Section 49 of the activities regulations on maintenance effectiveness

9.1.11 Follow-up

Lack of follow-up from Point Resources concerning the lifting accessory and drilling module used in the incident.

Grounds

As noted in nonconformities 9.1.8 and 9.1.9, classification and management of maintenance activities were lacking for the Optimus drilling module.

Verification of the Point Resources maintenance management system failed to reveal any work order relating to the lifting accessory used. The latter had been at a third party for non-destructive testing (NDT) and checks (certificate dated and approved 24 March 2017), without a work order being generated in the maintenance management system. The report submitted on the work done by the third party showed that the accessory had not been handled or checked as lifting equipment. It lacked approval by a competent control.

Requirements

Section 6 of the management regulations on management of health, safety and the environment Section 21 of the management regulations on follow-up

9.1.12 Division of responsibility for lifting accessories and drilling equipment

No bridge document existed on the division of responsibility for the lifting accessory.

Grounds

Uncertainty was expressed during the interviews on Jotun B after the incident over who was to maintain the lifting accessory used in the incident. It was explained at a meeting with Point Resources on 8 June 2018 that no bridge document existed to show the division of responsibility and demarcations for loose lifting accessories and drilling equipment.

Requirements

Section 15 of the management regulations on information Section 48 of the activities regulations on planning and prioritisation

9.2 Improvement point

9.2.1 Use of standards

The drilling module was defined as temporary equipment.

Grounds

In the interviews on the facility and at meetings on land, the subcontractor for the drilling module maintained that the whole model with all loose equipment was to be regarded as temporary equipment (Norsok Z-015).

The original documentation for the drilling module referred to both Norsok D-001 Drilling facilities and DNVGL-OS-E101 Drilling facilities. This could create confusion, since the requirements in the activities regulations on use of facilities applies regardless of the choice of standards.

Requirement

Section 25 of the activities regulations on use of facilities

10 Barriers which have functioned

The results of the SJA and the toolbox talk limited the number of people who would be present inside the cordoned-off area at the time the incident occurred.

11 Discussion of uncertainties

The lifting accessory has earlier been defined as such, with regular competent control, without this being described or explained in the SAP maintenance system. It is uncertain whether there should not have been a reaction to the design, or to the absence of a secondary locking mechanism in the locked position as well.

Documentation related to the plugging operation on Jotun B was written in a mix of English and Norwegian. The high-pressure riser and its central valve were perceived as being owned by Point Resources, while SAP could give the impression that parts of the equipment involved had been sold to others. This also appeared to apply, for example, to the BOP and the central valve on the high-pressure riser. That complicated maintaining an overview and creating a sense of responsibility in the right personnel for following up documentation and maintenance of this equipment.

Extensive use was made of leased equipment. Uncertainties existed about the maintenance and history of the equipment as well as training in its use – particularly the safety-critical items.

The set-up of the lifting system, with elevator and string plus lifting accessory, was suboptimal. As a result, centring the string was so difficult that it proved impossible to avoid obstructions entirely. The locking mechanism on the accessory was thereby released, with the consequent dropped load.

It was claimed that KPIs were not used for the plugging campaign. A number of those involved therefore claimed that there were no challenges related to efficiency/level of activity at the time of the incident.

12 Assessment of the player's investigation report

Point Resources investigated the incident itself and completed its report on 15 June 2018. The description of the course of events and the probable direct causes related to technical conditions by and large concur with the PSA team's observations and assessments.

The report describes the regulations which apply to the lifting accessory and the deficiencies associated with it. This is also in line with the PSA assessment.

In the PSA's view, the investigation report from Point Resources puts too much emphasis on issues related to the definition of the lifting accessory, dropped objects in the risk register, the SJA and the toolbox talk. The report devotes less attention to underlying causes, such as the failure to follow up the internal report of September 2017. Deficiencies were found by the PSA in the maintenance systems at Point Resources and PWS. This is not described in the Point Resources report. Nor has any assessment been made of conditions related to ownership of and responsibility for maintenance of the various equipment items involved in the incident.

Point Resources mentions in its report that the company considers it likely that the incident could have resulted under slightly different circumstances in personal injuries or, in the worst case, deaths. This is in line with the PSA investigation team's assessment.

13 Appendices

A: Relevant diagrams, figures and so forth.

B: The following documents have been utilised in the investigation.

- Work permits of 19 May 2018
- Certificate for the lifting accessory (repair/remanufacture)
- Description of the incident
- Riser package operating and maintenance instructions
- Cameron riser document
- Policy for loose lifting equipment on drill floor, 20 October 2010
- Oceaneering audit report, dated September 2017
- RSC Inspection Report Ferro Mag report ref 669948 HW Pup Joint
- Certification of Compliance HWDP Pup Joint serial no OWS-PJ-982-NWG ref S1722001- 3
- RSC Inspection Report Ferro Mag report ref 673897- HW Pup Joint
- Casing slips inspection report report ref 166083, serial no OWS S 140
- Casing slips inspection report report ref 166145, serial no OWS S 291
- Technical report Cat 4 inspection of slips, cert no 3792-N2-V, report no VT-60034.1
- Work permit no 00105223 dated 18 June 2018
- Bridge document well control philosophy ExxonMobil/Petro Well Service dated 30 January 2017
- PWS well control manual OPS-401 rev 1, dated December 2016
- POB report dated 19 May 2018
- Point Resources organisation chart offshore
- Point Resources organisation chart onshore
- Petro Well Service organisation chart
- List of people involved in the incident
- Historical work permits
- PTD-500-AC product certificate, top drive drilling module
- Witness statements from personnel involved in the incident
- Toolbox talks last two before the incident
- Certificates for yoke and bail drilling module drawworks
- Sketch of dropped riser with the location of personnel involved in the incident
- Image of lift/drop of riser from driller's control panel
- BOP and riser handling during skidding doc no 11126-OFF-017

- Halliburton HSE activity plan Jotun B doc no PL-NO-HAL-PM-XOM-003, rev 1 13.5 2016
- Halliburton competence overview 11.10 2016
- PWS offshore site mandatory training matrix OAG-X200-570-MTX-001 rev A5
- Halliburton quality plan P/A campaign Jotun B ExxonMobil E&P Norway doc no QP-NO-HAL-PM-XOM-001
- Thread certificate for pup joints report no 003016
- PWS operational philosophy modular P&A unit, doc no OPS-208, Rev 01, dated January 2017
- Product certificate modular P&A unit, doc no 174187-R-BJ381-VB02-0100, March 2017
- Check card for BX-4 elevator, report no 9101, dated 5.7 2017
- Check card surface condition frame BX-4 elevator, report no 166104, dated 20.10 2017
- Data book for BX-4 elevator NL 332483, P/N: 10091627-001
- PWS maintenance manual, modular P&A unit, doc no OR-237, rev 01, dated January 2016
- PWS employee internal training doc no 08-002 competence, training and development
- PWS employee internal training doc no 05-001 well integrity and well control
- PWS employee internal training doc no 03-002 dropped objects
- PWS employee internal training doc no 05-008 cementing
- PWS weekly check list maintenance for modular P/A drilling package
- PSA Jotun B Audit, RFI response doc ref 1126-PM-008, rev 03, dated 13.6 2018
- PSA 36138 high pressure riser running tool design

C: Overview of personnel interviewed.

D: Schematic overview of the course of events.