

Investigation report

Report	
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Involved	
Team T-1	Approved by/date Kjell M Aulfem/18 June 2021
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Contents

1	Summary.....	2
2	Background information.....	3
	2.1 Description of the facility and the organisation.....	3
	2.2 Position before the incident.....	4
	2.3 Abbreviations.....	5
3	The PSA’s investigation	5
4	Course of events	6
	4.1 Before the incident	6
	4.2 The incident.....	7
	4.3 After the incident.....	9
	4.4 Timeline.....	9
5	Potential of the incident.....	10
	5.1 Actual consequence	10
	5.2 Potential consequences	10
6	Direct and underlying causes.....	11
	6.1 Direct causes	11
	6.2 Underlying causes.....	11
7	Emergency response	12
8	Regulations.....	12
9	Observations	12
	9.1 Improvement point.....	12
	9.1.1 Compliance with governing documentation for crane operations.....	12
10	Barriers which have functioned.....	13
11	Discussion of uncertainties.....	13
12	Assessment of the player’s investigation report.....	14
13	Appendices.....	14

1 Summary

A lifting incident with personal injury occurred at 10.10 on Sunday 17 January 2021 on the pipe deck on Equinor’s Heidrun facility. This happened during the completion of a crane operation following the lifting and positioning of a 12-foot control cabin on the pipe deck. A roustabout on top of a catwalk who was serving as slinger had freed the crane’s chain pennant/hook from the control cabin’s lifting sling and signalled the crane operator to lift. When the operator started lifting, the pennant or possibly the hook had at some point become snagged in the catwalk. The pennant came free once the luffing rope was sufficiently taut, and the roustabout standing close by was hit on the head by the pennant/hook. They fell about 80-100 centimetres to land on an underlying gangway which extends along the whole length

of the catwalk. It is uncertain which part of the pennant/hook hit the injured person, and exactly where on the catwalk the snagging occurred. Nor is it known how much force was needed to free the pennant/hook from the snagging.

The direct causes of the incident were that the pennant/hook became snagged, and that the slinger was standing very close when the pennant/hook came free again.

The injured person suffered injuries to their face area when the pennant/hook struck, and additional head injuries when they fell to the gangway. Under slightly different circumstances, the incident had the potential to cause further serious personal injury to the roustabout, or their death.

Both the police and the Petroleum Safety Authority Norway (PSA) were notified of and briefed on the incident immediately after it occurred. The police quickly decided to investigate it and requested assistance from the PSA, which has also conducted its own investigation. The PSA and the police flew out to Heidrun on Monday 18 January 2021.

The following improvement point has been identified by the investigation:

- compliance with governing documentation for crane operations.

2 Background information

A lifting incident with personal injury happened at 10.10 on Sunday 17 January 2021 on the pipe deck on Equinor's Heidrun facility. This happened during the completion of a crane operation, when an incident with personal injury occurred.

2.1 Description of the facility and the organisation

Heidrun lies on the Halten Bank in the Norwegian Sea, about 175 kilometres north of Kristiansund. On stream since 1995, the field has been developed with a floating concrete tension-leg platform (TLP) and associated seabed templates. The water depth is 350 metres.



Figure 1 – Heidrun TLP.

Equinor is operator for the field, and the operations organisation for Heidrun is located in Stjørdal.

2.2 Position before the incident

The incident occurred during completion of a lifting operation using an offshore crane. This job formed part of the preparations for a forthcoming logging operation to be conducted with equipment installed on the pipe deck. The relevant lift was a control cabin raised from the storage deck to a suitable position on the pipe deck.

Fine weather and daylight prevailed on Heidrun at the time of the incident. Light conditions were good on the pipe deck. With a significant wave height of about 3.5 metres, the wind strength was about 6.5 metres per second from the south-east. Even with the fine weather, personnel involved in the incident explained that the facility was experiencing a good deal of motion – particularly on the pipe deck, which is high up on the topside. During an inspection on the day after the incident, weather conditions were about the same and the motion really noticeable. When suspending a chain pennant freely over the deck, it was easy to see how the facility moved in relation to it. The PSA team was informed that this is normal on Heidrun and reflected the TLP's design.

Equipment involved in the incident were the west offshore crane, a six-metre chain pennant with a WLL of eight tonnes, and a control cabin. The latter was configured as a 12-foot container weighing about six tonnes.

2.3 Abbreviations

PSA	Petroleum Safety Authority Norway
SAR	Search and rescue
TLP	Tension-leg platform
WLL	Working load limit

3 The PSA's investigation

Composition of the investigation team, with disciplines.

Reidar Sune - logistics and emergency preparedness (leader)
 Bjarte Rødne - logistics and emergency preparedness
 Anita Oplenskedal - logistics and emergency preparedness

Taking place at 10.10 on 17 January 2021, the incident was notified to the PSA's emergency phone line at 10.30. A Teams meeting was held between the PSA and Equinor at 14.00 on the same day, where Equinor provided brief information about the incident.

Both the police and the PSA were notified of and briefed on the incident immediately after it occurred. The police quickly decided to investigate and requested assistance from the PSA, which has also conducted its own investigation.

The PSA team travelled to Kristiansund on 17 January 2021 and flew to Heidrun together with the police on the first helicopter of 18 January 2021. After arrival and a safety briefing, a kick-off meeting was chaired by the police. The latter gave a short briefing on their inquiry, and the PSA team provided a briefing on its role as support for the police and the mandate for its own investigation. Equinor also supplied brief information on the incident and what had been done in its wake.

Activities covered by the investigation included:

- verification of the area and equipment involved in the incident
- reconstruction of the incident with the police's technicians, the PSA's representative and Equinor personnel present
- documentation review
- interrogations of/interviews with personnel involved in the incident and relevant supervisory personnel.

The police conducted nine interrogations of personnel involved in the incident, with the PSA presents at all of them with the exception of one where the PSA carried out a subsequent interview offshore. After returning to land, the PSA team also used Teams

to interview the person with operational responsibility for lifting operations on Heidrun and the roustabout involved in the incident. The interview with the latter was conducted some time after the incident to take account of their condition. The police had earlier been in touch with and interrogated the injured person without the PSA being present.

4 Course of events

4.1 Before the incident

The well-logging consignment – totalling four load carriers comprising the control cabin, the winch and two sets of equipment – arrived on Heidrun in late December 2020. Because of a Covid-19 outbreak between Christmas and the New Year, the logging operation was delayed and the load carriers were temporarily placed at the aft of a lower deck. When it was decided that the job could start, these units had to be moved further forward on the lower deck by the south crane in order to bring them within reach of the west crane. The latter would then lift them on to the pipe deck, where the operation was to be carried out.

Preparations for the lifting operation were made with Schlumberger personnel who were responsible for the forthcoming job and owned the equipment. These arrangements consisted largely of planning to get the equipment placed in a suitable spot and in the right position. The lifting operation was regarded as a normal job, described by personnel involved as routine, and partly planned by radio because of Covid-19. This was not unusual, but has been used to a greater extent since the outbreak of infection on Heidrun between Christmas and the New Year. The lifting operation was well manned, with four roustabouts from Odfjell on the deck.

When the incident occurred, the first of the four loads – the control cabin – had been lifted onto the pipe deck and positioned correctly in the pre-planned area. The cabin was installed with the personnel door facing the west offshore crane, and with its wire rope lifting sling laid on the opposite side to the door opening, looking east towards the catwalk and away from the crane operator. This was intended to avoid the sling coming into conflict with the entrance door on the west side. See figure 2 below.

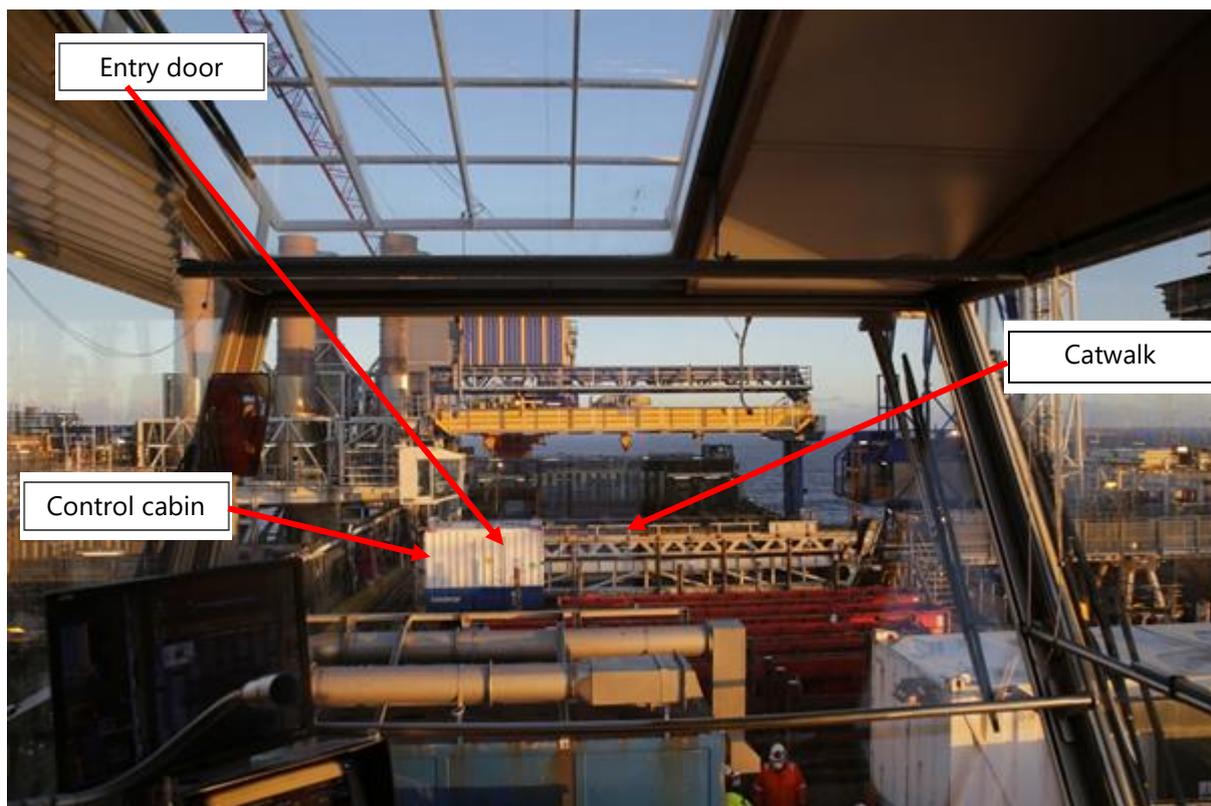


Figure 2: Photographed from the west crane in the position it occupied during the incident. The control cabin is the white and blue structure to the left, with the catwalk behind it. Source: police.

4.2 The incident

The actual operation to lift the control cabin into place had been completed and the cabin was installed in the correct position as shown in figure 2. What remained was to release the crane hook from the lifting sling. For ease of access, the slinger mounted the catwalk located behind the cabin in order to unhook the load. See figures 3, 4 and 5. The crane operator could easily see the slinger but the end of the pennant, including the hook, on the rear side of the cabin was not visible.

According to descriptions in interviews, the slinger released the hook from the load, placed the end of the pennant with hook on the catwalk, and gave the command "free hook". The crane operator carefully began to lift, but the slinger almost immediately shouted "stop" over the radio. Before the operator managed to react, they saw the slinger struck by the pennant, lose their hard hat and disappear from view.

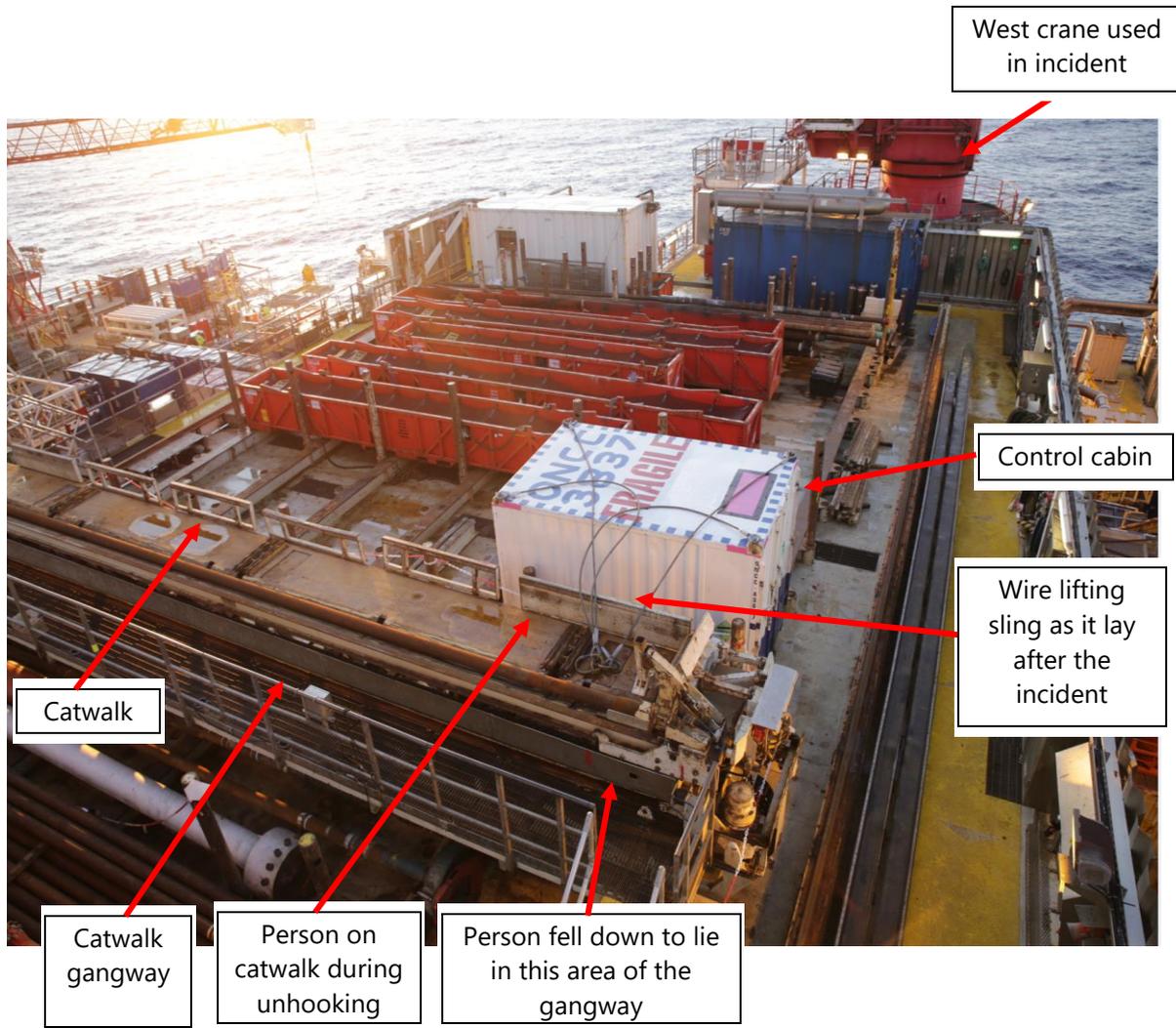


Figure 3 - Overview of pipe deck with catwalk and cabin, with west crane in the background. Source: police.

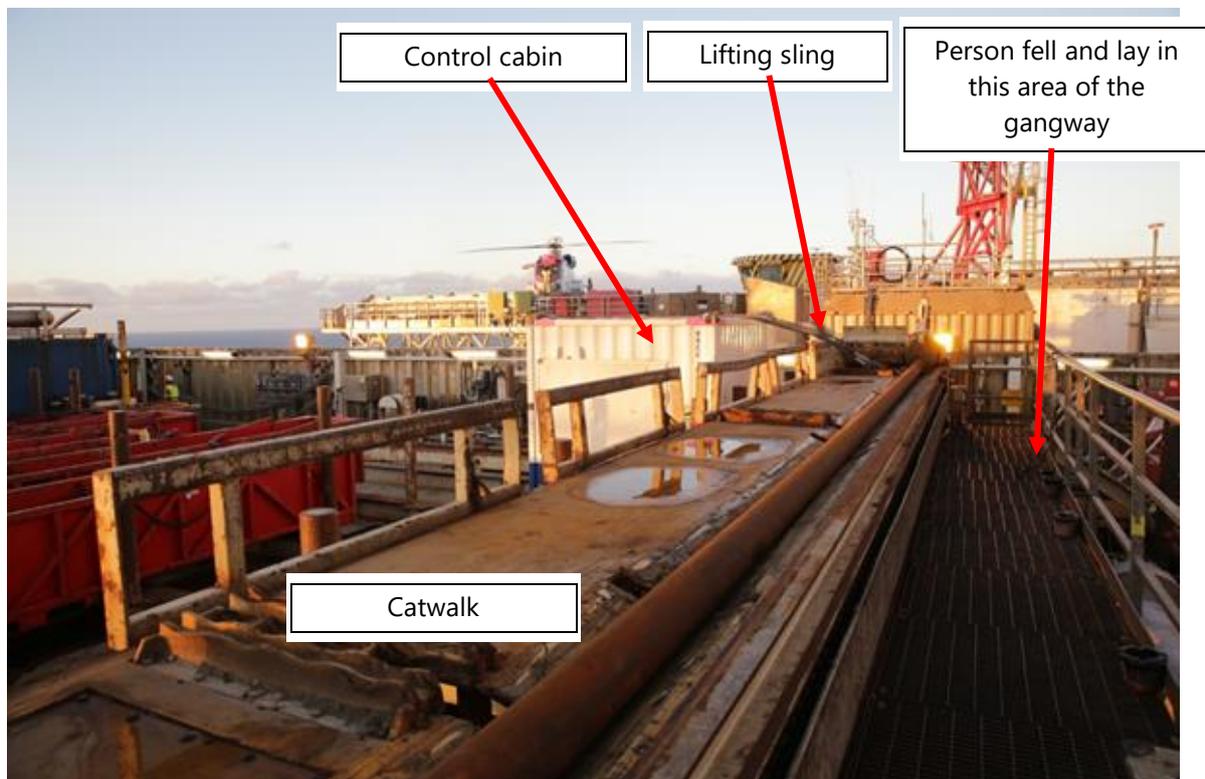


Figure 4: Where the slinger was located. Cabin visible to the left of the catwalk. Source: police.

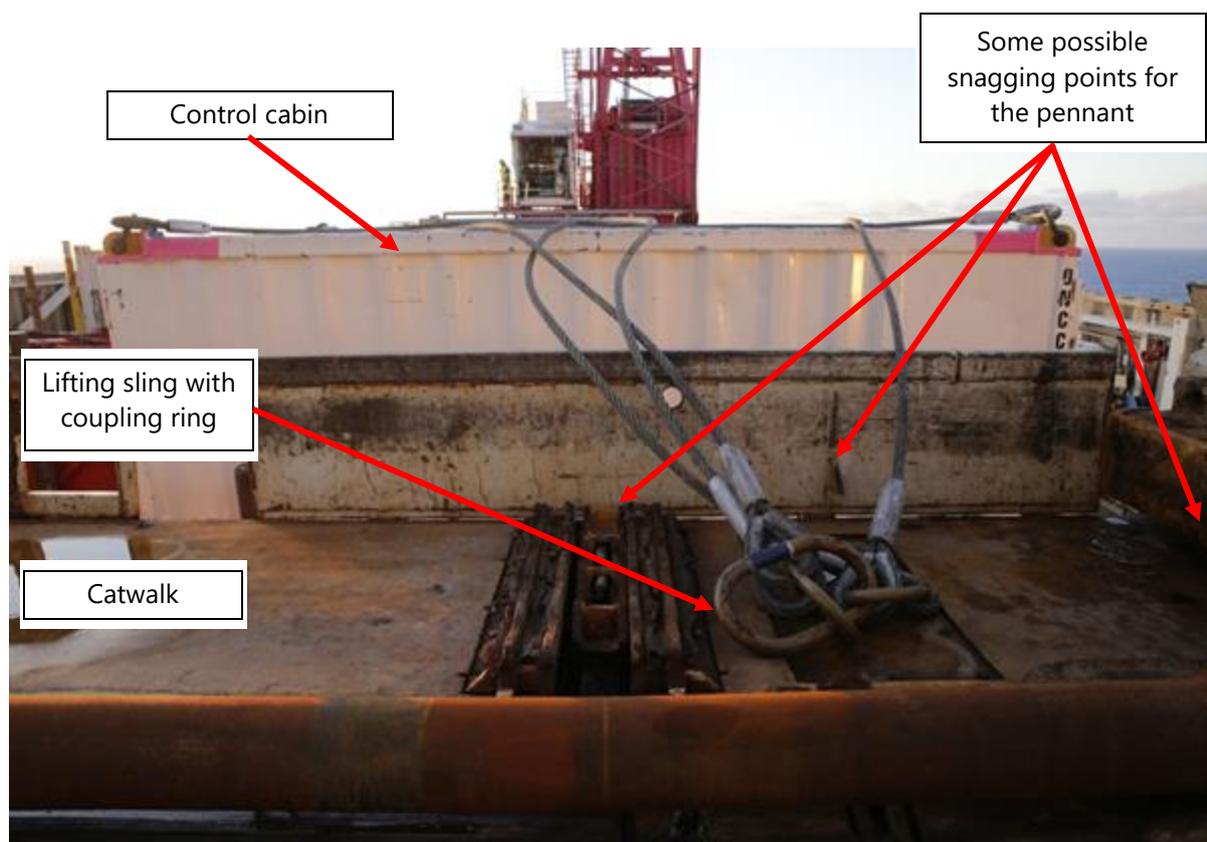


Figure 5: Location of wire rope sling during the PSA team's inspection of the incident site. The west offshore crane is visible in the background. Source: police.

4.3 After the incident

The banksman and other personnel in the area responded immediately and took care of the injured person. According to the first to arrive, the latter had injuries to their face and head, and slipped in and out of consciousness. The responders gave first aid and notified the incident. When the medic arrived, treatment was initiated at once and preparations made for transfer to the hospital.

A search and rescue (SAR) helicopter transported the injured person ashore for further treatment. Heidrun has a SAR helicopter stationed on the facility. See chapter 7.

4.4 Timeline

From the arrival of well-logging equipment on Heidrun until just after the incident.

Date	Time	Activity
18 Dec 20		Four load carriers with well-logging equipment arrived on Heidrun. The operation was postponed because of Covid-19, and the carriers were temporarily stored on the aft skid deck.
17 Jan 21	Before 09.00 (coffee break)	The four equipment carriers were moved further forward on the aft skid deck by the south crane to bring them within reach of the west crane.

17 Jan 21	About 09.45 (after break)	Control cabin lift started. Motion in Heidrun meant the crane operator had to put the load down on the deck several times to "quieten down/gain control of" its movement before the cabin was finally in the correct position as planned on the pipe deck.
17 Jan 21	About 10.10	The slinger notified the crane operator of "free hook" and lift. When the operator began to lift, they quickly received a "stop" command over the radio. At the same time, the slinger moved towards the snagged pennant which tightened and then suddenly came loose. The operator saw the slinger get struck by the pennant and disappear from view.
17 Jan 21		The injured slinger was immediately taken care of by the personnel present and subsequently by the medic on board.
17 Jan 21	About 11.10	The injured slinger was flown ashore by the SAR helicopter.

5 Potential of the incident

5.1 Actual consequence

The person injured was hit by the west crane's chain pennant/hook while a lifting operation was being completed. This occurred while this person was on the pipe-deck catwalk freeing the chain pennant from the load. They were hit in the head area by the pennant/hook and consequently thrown off the catwalk to the adjacent gangway, a height of about 80-100 centimetres. First aid was initiated immediately after the incident, and the injured person fluctuated between unconsciousness and a conscious condition. They were soon afterwards flown to St Olav's Hospital in Trondheim by the SAR helicopter stationed on Heidrun when the incident occurred, and were discharged from the hospital a few days later.

No visible damage was caused to the equipment concerned or to the surrounding area. The police released the area after they and the PSA were finished with their investigations, and had documented the equipment and the area involved.

5.2 Potential consequences

The PSA team takes the view that the potential of the incident, under minimally different circumstances, could have been fatal. This relates both to the way the injured person was struck by the pennant/hook and the fact that they fell and landed on a gangway where a number of structures and railings were present. These could have caused further injuries than the ones the person concerned actually suffered.

6 Direct and underlying causes

6.1 Direct causes

The direct causes of the incident were that:

- the offshore crane's chain pennant became snagged in a protruding structure or component on the catwalk when the crane operator lifted, causing the pennant to tighten
- the pennant/hook came free of the snag with great force
- the slinger had positioned themselves very closely and in the line of movement for the pennant/hook when this came free of the snag.

Established practice on Heidrun was to hold up the hook until the crane operator could see the pennant was free in order to ensure that there was no danger of it snagging. That was not done on this occasion. Interviews with personnel involved established that the lifting operation was completed as follows:

- the pennant was freed from the load and its end with hook placed on the catwalk
- the slinger moved away after giving the commands "free hook" and lift
- the slinger saw that the pennant/hook had become snagged when the crane operator began to lift
- the "stop" command was given
- at the same time, the slinger moved towards the pennant/hook before seeing that the operator had stopped the movement and slackened off
- the roustabout was very close and in the line of movement for the pennant/hook when the pennant came free from the snag
- the result was that the injured person was struck in the head region by parts of the pennant/hook and thrown down to the catwalk gangway.

It is uncertain whether the injured person was struck by the pennant chain or the hook. Nor is it known how much force was required to free the pennant from the snag. No information has been available which provides a basis for calculating the forces in the pennant, since the crane's data logger was not functioning to record and store the "historical weight" on the hook.

6.2 Underlying causes

The investigation has not identified clear underlying causes which the PSA team can see could have contributed to the incident. However, conditions were uncovered which might have made a contribution, related primarily to:

- inadequate understanding of the risk of approaching a hazardous situation such as snagging
- incorrect use of the command "stop" over the radio
 - "halt" (in Norwegian) is preferable to "stop", because the latter can be confused with the Norwegian word for "up" – which was not the case here, however, since the command was correctly understood as "stop".

7 Emergency response

The Heidrun medic was notified immediately after the incident and went to the injury scene after asking the central control room (SCR) to mobilise the first-aid team. The latter and the on-scene commander mustered at the scene. The SAR medic also attended.

The emergency response and action leaders decided to go to the emergency response centre after hearing the call over the PA system for the medic to go to the pipe deck. They called into the SCR to learn the status of the incident before going to the room. The incident was identified fairly quickly as a personal injury.

Heidrun has a SAR helicopter stationed on board, which was prepared while the platform and SAR medics prepared the injured person for transport.

Personnel were not told to muster, since an overview of the incident was quickly established. Notification was implemented in accordance with the applicable emergency response plan.

The PSA team takes the view that the emergency response on board functioned well.

8 Regulations

Section 92 of the activities regulations on lifting operations. See Norsok R-003N on safe use of lifting equipment

9 Observations

The PSA's observations fall generally into two categories.

- Nonconformities: this category embraces observations where the PSA has identified breaches of the regulations.
- Improvement points: these relate to observations where deficiencies are seen, but insufficient information is available to establish a breach of the regulations.

9.1 Improvement point

9.1.1 Compliance with governing documentation for crane operations

Improvement point

Inadequate compliance with governing documentation

Grounds

Underlying causes exist which may have contributed to the incident. Examples included:

- inadequate understanding of the risk of approaching a hazardous situation, such as possible snagging, before it has been clarified
- incorrect use of verbal communication (in Norwegian) over the radio
 - "stop" instead of "halt". The former could be interpreted as "up"
- knowledge of who had operational responsibility in the area where the incident occurred (Odfjell/Equinor)
- familiarity with Norsok R-003
- the established practice on Heidrun of keeping hold of the hook until the threat of snagging had passed was not followed.

Requirement

Section 92 of the activities regulations on lifting operations, see Norsok R-003N with appendices, see section 20 of the activities regulations on start-up and operation of facilities

10 Barriers which have functioned

The PSA team takes the view that emergency response functioned as planned.

11 Discussion of uncertainties

None of the interviewees who were in the immediate vicinity of the incident had seen which part of the pennant – hook or chain – struck the injured person. Nor did anyone observe which part of the pennant snagged or where on the catwalk this happened.

Inspections of the chain pennant and on the catwalk showed no damage or clear marks which stood out. The chain pennant had a number of scratches, but that is quite normal for this equipment in everyday use. The same applied to the snagging point on the catwalk, which has much damage/markings but from normal usage. It has therefore been impossible to determine whether the hook or other parts of the chain pennant snagged or where on the catwalk the snagging occurred. Several locations are possible.

Nor is this likely to be of much significance, since a number of places exist with protruding structures and components where snagging could occur on and in the areas around this type of equipment.

It has also proved impossible to determine the size of the forces required to clear the snagging. This is because crane's data logger was not functioning with regard to recording and storing "weight" on the hook. With reference to Equinor's investigation report, forces on the hook have been calculated, but the PSA team has not found a basis for doing such a calculation.

Planning was done over the radio because of the Covid-19 position, but the PSA team has found no indications that this contributed to the incident.

12 Assessment of the player's investigation report

Equinor investigated the incident, and its report was received on 8 April 2021. The description of the course of events and causes of the incident largely coincide with the PSA team's observations and assessments. Equinor is more convinced that it was the crane hook which snagged in the guide on the catwalk, and about how much energy had accumulated in the crane's luffing rope and pennant and which struck the slinger. The PSA team's investigation found no basis for concluding with certainty that it actually was the hook which snagged or where on the catwalk this occurred, and how much energy struck the injured person. That has its background in the technical investigations conducted together with the police, which showed damage at several points on the chain pennant including hook and on the structure, and in the fact that the crane's data logger was not functioning.

The PSA team is also uncertain about the significance of the report's focus on a retrofitted guide, which it concludes was the snagging point, and that this was installed in a way which failed to conform to the applicable work process, which lacked adequate risk assessments, and which lacked documentation. The PSA team's assessment is that snagging could have occurred at numerous points which are present in this type of equipment and areas, but it agrees that modifications should be assessed and documented.

Equinor's report specifies five learning points and improvement requirements, with a number of recommended measures, and specifies a number of measures which could help to avoid similar incidents. The PSA team takes the view that all the measures described are relevant, regardless of the direct cause.

13 Appendices

Appendix A

The following documents have been drawn on in the investigation

- Notification of incident on Heidrun
- Organisation chart Heidrun
- WR1156 - supplement to emergency preparedness on the Norwegian continental shelf – Heidrun, latest revision 2 December 2020
- SO05660-Opr - safe use of lifting equipment (Norsok R-003) - Heidrun, latest revision 23 November 2020
- Maintenance history west crane 1170-73M0001A
- Annual check deck cranes, 2020, Axess
- Information on wind direction, relevant period
- Information on significant wave height, relevant period

- Personnel on board (POB) overview
- Information on personnel qualifications
- Action list in an emergency
- Certificate crane boom rope
- Certificate crane luffing rope
- Certificate crane pennant
- Certificate crane ball
- CIM log Heidrun 17 January 2021 CMT
- CIM log Heidrun 17 January 2021 IMT

Appendix B

Overview of personnel interviewed.