

Investigation report

Report

Report title Report of the investigation into an incident with a dropped object on Gyda	Activity number 049019009
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Security grading

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Involved

Team T-3	Approved by/date Erik Hørnlund
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1 Summary

An incident occurred on 15 May 2019 on the Gyda facility operated by Repsol Norge AS in connection with skidding the derrick. The Petroleum Safety Authority Norway (PSA) decided on 16 May 2019 to conduct an investigation, and its team travelled out to the facility on 20 May 2019.

In the team's view, this incident could have resulted under slightly different circumstances in loss of life.

The direct cause of the incident was heavy wear on parts of the skidding system, which in turn overloaded the mounting bolts holding a 480-kilogram side plate in place. These bolts failed and the plate fell from a height of about three metres.

Two people were beneath the skidding system and the plate's starting point. Both managed to jump clear, but one fell to a lower deck and injured himself. He was sent ashore for follow-up by a doctor, but was back at work on his next regular offshore tour.

The main observations from the investigation relate to the following conditions:

- experience transfer
- maintenance.

In addition, the report present improvement points in the following areas:

- training
- operational conditions
- positioning of the control panel.

2 Background information

While skidding the derrick, an incident involving a dropped object occurred on 15 May 2019 on the Repsol-operated Gyda facility. A 480-kilogram side plate fell from the gripper system for the derrick skidding system. Two people were in the area close to the incident, and one of these fell 1.5 metres when he acted to avoid the dropping object. Repsol has classified the incident as a defined situation of hazard and accident (DSHA) G71: personal injury – work accident or acute illness with the need for external assistance.

2.1 Description of the facility and the organisation

Repsol is the operator for Gyda. The field produces through a facility comprising a six-leg jacket supporting drilling and process modules and living quarters. It came on stream in 1990. Archer AS has held the drilling contract since 2002, including operation and maintenance of the drilling module.

Gyda witnessed less drilling activity in 2010-18. Planning began in 2017 on restarting the drilling rig in connection with well plugging. The drilling equipment and skidding system was overhauled before the plugging campaign began in 2019. At 15 May 2019, three of 32 wells had been plugged and the programme is expected to be completed in the spring of 2021.

2.2 Description of the skidding system

The Gyda platform has 32 well slots and a drilling module which can be moved between these with the aid of a skidding system. This works by shifting the derrick from one well to another. The module can be skidded both north-south and east-west with the aid of two separate skidding systems. These comprise skidding cylinders, a gripper system and a hydraulic system with associated control panel. The gripper system consists of a top plate and two side plates with skids positioned on the skid beam. Each side plate weighs 480 kilograms and is attached with two mounting bolts.

During skidding, the gripper system grips the skid beams with the aid of hydraulic cylinders in the top plate. The skid cylinders are then activated, pulling/pushing the derrick into the desired position.

The hydraulic system has a working pressure of 210 bar on the skidding cylinders, while the working pressure for the gripper system is 350 bar. When the six hydraulic cylinders in the gripper system are activated, the side plates lift up to grip the underside of the skid beam's flange. The function of the bolts on the side plate is to hold the plate in position and guide the gripper system when the cylinders are extended/retracted with each grip. These bolts are not designed to withstand the forces if the jacking clamps push out horizontally.

The operator panel for the skidding system is placed on an elevated deck alongside one of the skid beams for east-west movement and, in certain well positions, the gripper system will be immediately above this panel. The elevated deck is about 1.5 metres above the main deck.

Drilling contractor Archer has drawn up a checklist (CP-03-04.02-GYDA.01) which describes measures and preparations for using the skidding system, and its operation.

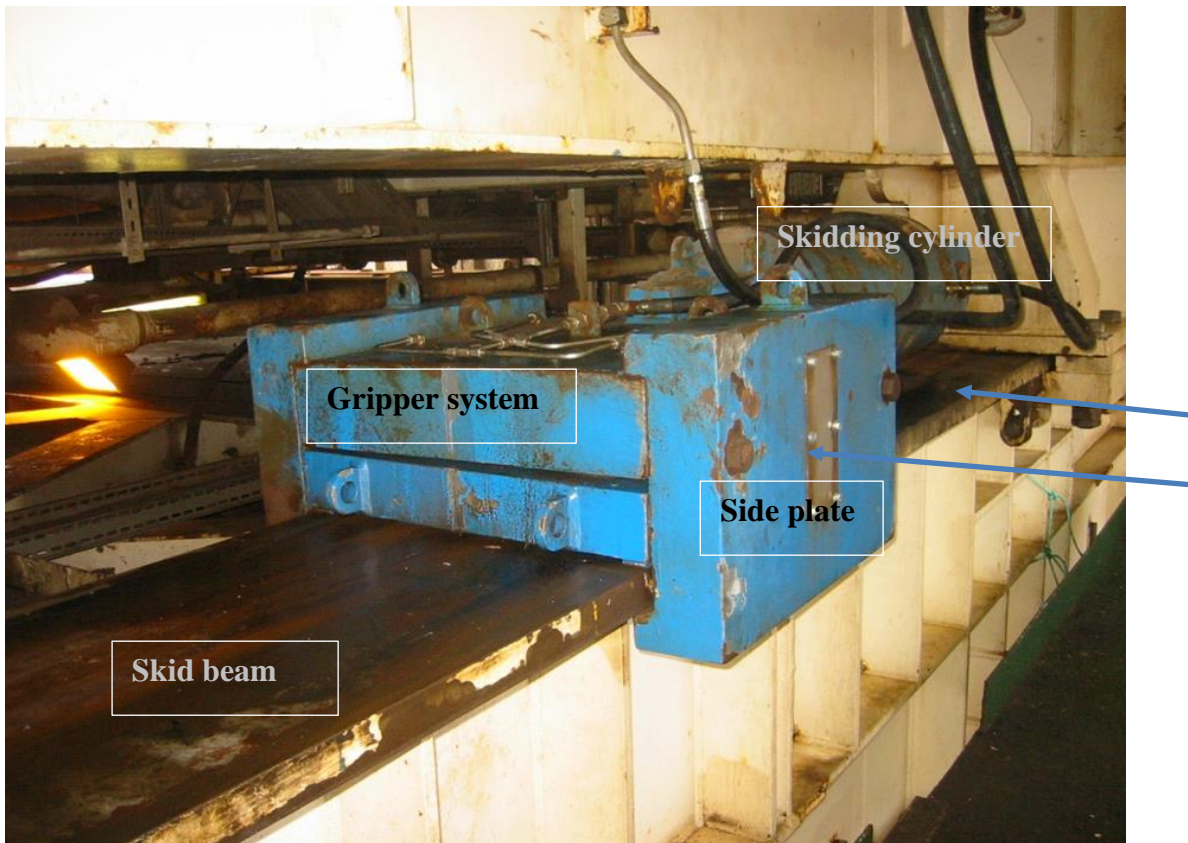


Figure 1: The north skidding cylinder with gripper system for east-west movement. The skidding cylinder can be seen behind the gripper system (on the right). Blue arrows indicate the bolts holding the side plate in place.

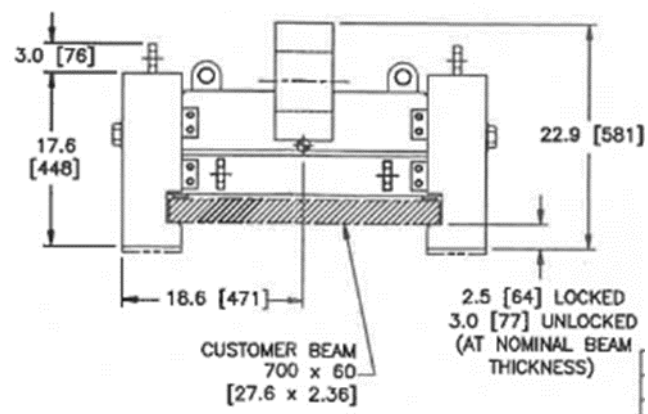


Figure 2: Diagram of gripper and top flange on the skid beam.

2.3 History of the skidding system

1990	Gyda comes on stream
1995	Operations begin with an increased number of drill pipes in the derrick. Wear on skid beams is reported as a result of them being cold-rolled by a gripper from the mid-1990s
2004	Wear on skid beams is reported after an inspection in January 2004
2005	On the basis of observations made in the 2004 inspection, the gripper system on the east-west system is modified with longer clamps, which provide a larger gripping surface, and two extra cylinders. Skid-beam wear is not repaired
2010-2018	Low activity in the drilling facility
2017	Planning begins on plugging and abandoning wells
2018	The gripper system with skidding cylinders is overhauled as part of preparations to restart the drilling package after a long inactive period
2019	Practice for skidding the derrick is changed, with the BOP hung off in the travelling block during moves between wells. It had previously been parked in the drilling module during skidding
2019	The side plate on the jacking clamp becomes detached during skidding on 15 May. Repsol starts investigating the incident on 16 May

3 PSA investigation

Composition of the investigation team:

Lars Melkild logistics and emergency preparedness (investigation leader)
 Semsudin Leto HSE management
 Eigil Sørensen drilling and well

3.1 Procedure

The PSA team flew out to the Gyda facility on the afternoon of 20 May 2019 and returned to land on 22 May 2019. After arrival and a safety briefing, a kick-off meeting was held where Repsol's investigation leader gave a short briefing on the incident and the status of the company's investigation work, which began on 16 May 2019. The mandate for the PSA's investigation was presented to Repsol. Agreement was reached on how to organise further investigatory work, interview personnel and carry out inspection in the field. Most of the personnel directly involved in the incident had gone ashore. Interviews were carried out with people who normally have roles in skidding operations and with selected Repsol and Archer managers. A phone conversation was also conducted with the injured person a few weeks after the stay on the facility.

Requested documents were reviewed. These included user manuals, operational procedures and information from the maintenance system and the HSE database (Synergi).

4 Course of events

In connection with the on-going plugging campaign, the drilling module was to be shifted from well A-04 to well A-07. A work permit dated 14 May 2019 was established for this operation. At the same time, personnel involved began preparations pursuant to Archer's checklist for skidding operations. The latter document was referenced in the work permit. A toolbox talk was conducted at 09.30 on 15 May. The work permit was activated at 10.18. Two people stood at the control panel and guards were posted around the module and the BOP, who kept an eye on the operation.

The east-west skidding operation commenced at 11.30. Three-four attempts were made to shift the rig from west to east without any movement in the module. All the attempts resulted in the gripper system slipping on the skid beam. At 11.35, one side plate became detached from the gripper system. A loud bang was heard when that happened and the person at the control panel quickly jumped back a few steps before falling to the deck below. During skidding, part of the railing on a level with the control panel is removed to provide room for parking the pipe chute, and this was where the operator fell. The side plate dropped close to the spot where the control panel operator and skidding leader had been standing. It weighs 480 kilograms, and fell about 3.5 metres. During its descent, the plate first hit a pipe support and then the skidding-system control panel before landing on the deck. The central control room was notified. The person who fell was immediately accompanied to the hospital for examination, but his injuries were not judged to be critical. After treatment by the nurse, he was sent ashore on the search and rescue (SAR) helicopter from Ekofisk.

Both bolts holding the side plate were ripped free, and were later found at distances of 14 and 18.5 metres from the gripper system.



Figure 3: Reconstruction of the position of personnel when the incident occurred. The gripper system above is without the side plate.



Figure 6



Figure 4



Figure 5

A series of photographs to show how the plate first hit a pipe support (figure 4) and then landed down on the operator panel (figures 5 and 6).



Figure 7: The 480-kilogram side plate in its final position on the deck next to the operator station.

5 Potential of the incident

5.1 Actual consequences

The bolts holding the side plate were ripped free and shot out, but no personnel were present where they landed.

After the bolts were ripped free, the side plate fell off the gripper system. When dropping, it first hit a pipe support and then the control panel before ending up on the elevated deck.

When the side plate on the jack became detached, the operator jumped back to avoid being hit and fell 1.5 metres to a lower deck. He was injured, but walked unaided to the hospital and was later transported to hospital by SAR helicopter. The injured person was discharged from hospital on the same day, and given a clean bill of health before his next offshore tour.

Drilling operations were delayed because of the damage to the skidding system.

5.2 Potential consequences

Under slightly different circumstances, the dropping side plate could have struck one of the two people standing at the operator panel, with fatal consequences.

The bolts, which each weigh about one kilogram, were thrown 14 and 18.5 metres from the jacking clamp and out over the deck. It must be assumed that they could have had sufficient energy to cause serious personal injury.

One person fell from a deck elevated 1.5 metres above the pipe deck. Under slightly different circumstances, that could have resulted in serious personal injury.

The side plate dropped close to hydraulic piping and valves. If it had hit these, a local leak of hydraulic fluid and chemical exposure could have affected personnel in the vicinity.

6 Direct and underlying causes

6.1 Direct causes

The east-west skid beams and side plates on the gripper system are worn and their outermost surfaces have lost two-nine millimetres in thickness as a result of cold-rolling. This meant that the gripper system had insufficient horizontal orientation to the skid beam. That in turn caused the side plate to slip outwards with a force exerted at 90 degrees from the beam. This has imposed big stresses on the two bolts, which are only intended to keep the plate in place.

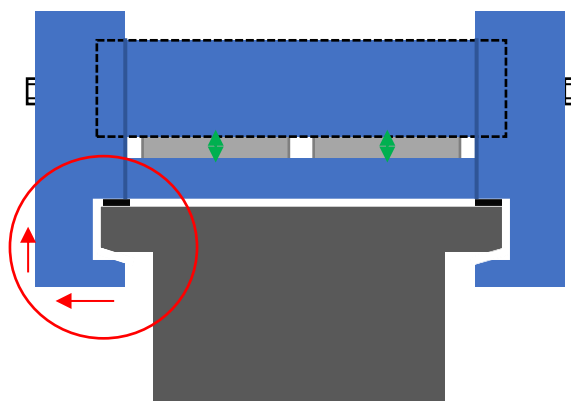


Figure 8 : Cross-section of the gripper system and skid beam. The circle indicates the area shown in greater detail in figure 9.

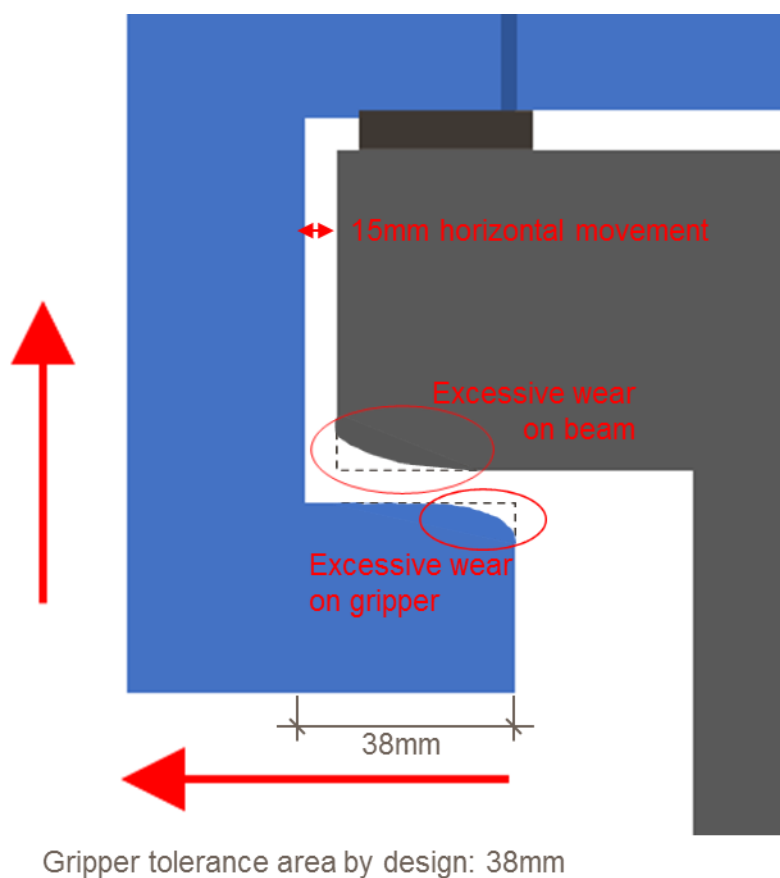


Figure 9 : Detailed cross-section showing wear and direction of force.

6.2 Underlying causes

6.2.1 Location of control panel

The control panel is positioned immediately beneath the east-west skid beam. In certain well positions, the panel will be located immediately under the skidding clamp.

6.2.2 Maintenance

The skidding system is viewed in criticality terms as “green tag” – in other words, not safety-critical equipment – and all preventive maintenance jobs have medium priority regardless of their criticality assessment. Both skidding system and skid beams lacked equipment-number plates out in the field.

Maintenance of the skidding system is done by contractor Archer, while Repsol inspects the skid beams. Monthly maintenance routines are established. These focus on the hydraulic system, which includes hoses, piping, cylinders and the operator panel. All routines were conducted as planned over the past three years. The same routines were also included as a document for training maintenance personnel.

The manufacturer’s operating and maintenance manual is available on board, but is not fully reflected in the maintenance routines. Nor did the manual contain information which could form the basis for assessing wear. It emerged during the investigation that the manufacturer has prepared a document describing wear and acceptance criteria. This was drawn up after an incident on Snorre A in 2017, but was not known to Repsol or Archer personnel on Gyda.

The equipment involved was overhauled in 2018 ahead of the plugging campaign. Attention concentrated solely on the skidding jacks with their hydraulic system. The equipment history shows that planned work orders were implemented, but the team found few corrective work orders in the WorkMate maintenance system even though slipping grippers are a known problem. No registered cases were found in Synergi related to problems with the skidding system.

A 2004 inspection report identified wear on the east-west skid beam. Based on this report, a modification was made in 2005 to improve the skidding operation. Lengthening the gripper was also supposed to compensate for wear on both side plates and beam. No verification or follow-up of this modification was carried out subsequently to check whether it was effective.

6.2.3 Operational procedures

When operations in one well are completed, the derrick is skidded to the next well to be drilled, maintained or plugged. Toolbox talks are conducted and work permits activated. The work is done in accordance with a checklist which forms part of Archer’s management system. A mechanic operates the control panel for the skidding jacks, while an electrician monitors cable trays in the dragchain. Roughnecks and roustabouts participate as banksmen who check that the derrick is not being driven into other equipment.

Archer’s procedure/checklist specifies that the beams should be lubricated with oil – but not where on the beams. The manufacturer’s manual specifies that contact surfaces for the gripper must be clean and free of lubricant, and calls for a pre-skidding check of loads in the drilling module. A new routine was introduced in 2019 where the module is moved with the BOP suspended in the derrick. The checklist had not been revised to reflect this change. Nor does the work permit contain any reference or measures related to moving the derrick with the BOP suspended in it.

In connection with the investigation, Repsol has contacted the manufacturer of the skidding system and had confirmed that the weight of the drilling module as now operated lies within the relevant design criteria.

6.2.4 Operator training

Archer has a training system intended to provide operators with skidding-system expertise. This comprises practical training with a mentor scheme. Archer also uses its checklist as a basis. This is the only written document utilised in the training. It emerged from interviews that the manufacturer's operation and maintenance manual was not used.

6.2.5 Learning and experience transfer

It emerged from interviews that problems have been experienced with east-west skidding since the mid-1990s. These continued after the 2005 modification. Through conversations, it emerged that many people on the facility were familiar with the problems.

When investigating this incident, Repsol learnt about a similar event on Snorre A in July 2017, when a 1.5-tonne side plate dropped from a similar skidding system from the same manufacturer. This incident was not picked up by Repsol when planning the plugging campaign. Although Snorre A and Gyda have the same drilling contractor, personnel on the latter field did not know of the incident. It was therefore not taken into account when planning maintenance and operation on Gyda.

The skidding system manufacturer produced a supplement (document no TB-2088) to the operation and maintenance manual in May 2017 which in part addressed wear and tolerances. This document was not known to the operator.

7 Emergency response

The control room was immediately informed of the incident by personnel on deck. It notified the platform management and nurse in turn. The injured person was able to walk and was accompanied to the hospital by a colleague.

Repsol's operations management on land was quickly informed, while the first notification to the onshore emergency response organisation was given about 40 minutes after the incident.

8 Observations

The PSA's observations fall generally into two categories.

- Nonconformities: this category embraces observations which the PSA believes to be a breach 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.

8.1 Nonconformities

8.1.1 Inadequate maintenance

Nonconformity

Inadequate maintenance of the skidding system and skid beams.

Grounds

Maintenance routines related to the skidding system are concentrated on the hydraulic system. No routines relate to wear on grippers and beams. Problems have affected operation of the skidding system since the mid-1990s. Wear was identified in the form of an inspection report

in 2004. A modification was made in 2005, but the problems with wear on skid beams and grippers continued. While the skidding system was overhauled in connection with planning the drilling operation in 2017, the problems with wear on grippers and beams were not addressed.

Requirement

Section 45 of the activities regulations on maintenance

8.1.2 Inadequate acquisition of information related to operation and maintenance of the skidding system

Nonconformity

Insufficient efforts were made to acquire information about similar incidents with the same type of equipment. In-house experience from operating the skidding system and information from the equipment manufacturer were not included in maintenance planning.

Grounds

Inadequate provision was made for experience transfer from operations both internally and at others with similar equipment. A similar incident occurred on Snorre A in 2017, but this was not known to Repsol or Archer personnel on Gyda. Archer was also the drilling contractor on Snorre A in 2017.

The skidding-system manufacturer produced a document in 2017 which included a description of wear tolerances. This was not known to Repsol. Wear on Gyda equipment lies outside these tolerances.

Requirement

Section 15 of the management regulations on information

8.2 Improvement points

8.2.1 Lack of information on operational conditions

Improvement point

Access to adequate information on using and maintaining the skidding system by users appears to be deficient.

Grounds

The checklist used to plan and execute skidding operations did not accord with the manufacturer's operation and maintenance manual. For example, the latter calls for an assessment when increasing weight in the drilling module. No variation assessment related to skidding-system capacity was made when adding weight in the derrick. The checklist lacked a clear description of how to lubricate the skid beams, and crew had different views about the way this should be done. The checklist calls for lubrication with oil. Part of the text on this item was crossed out by hand.

Requirement

Section 15 of the management regulations on information

8.2.2 Inadequate training

Improvement point

Training for personnel involved in maintenance and operation of the skidding systems appears to be deficient.

Grounds

The training system comprises a practical part with a mentor scheme. Archer's checklist is also used as a basis. The latter is deficient in relation to the information given in the manufacturer's operation and maintenance manual. The latter was not utilised in the training.

Requirements

Section 21, paragraph 1, first sentence, of the activities regulations on competence

8.2.3 Inadequate risk assessment

Improvement point

The risk assessment on positioning the control panel appears to be inadequate.

Grounds

The control panel is positioned immediately alongside the east-west skid beam and, in certain well positions, lies immediately below the skidding clamp. The risk associated with dropped objects from the skidding system has not been addressed.

Requirements

Section 4, paragraph 1 of the management regulations on risk reduction

9 Other comments

The second-line incident management team was notified of the incident about 40 minutes after it occurred. Initial notification should be given as soon as possible.

10 Barriers which have functioned

The incident involved two barriers

- the work permit system
- action plan DSHA G71: personal injury – work accident or acute illness with the need for external assistance.

11 Assessment of the player's investigation report

Repsol investigate the incident itself and produced its report on 1 July 2019. This identifies that wear on both skid beams and side plates, as well as the erroneous position of the control panel, were the main causes of the incident.

Several underlying causes are identified, which cover:

- design limitations
- faulty operation of the skidding system
- lack of risk awareness

- a maintenance programme not specific for wear tolerance in side plates on the skidding system and skid beams
- lack of knowledge transfer from similar incidents.

The report also takes a closer look at the project organisation responsible for readying the drilling systems for operation. While the original budget and scope of work increased substantially during the project, manning remained unchanged. The project lacked the funds to implement a full review of all the systems.

Several specific recommendations are made by the investigation for further follow-up to avoid similar incidents recurring.

The PSA team considers that this report by and large conforms with the observations in its own investigation report.

12 Appendices

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

- Drawing no 32436 rev A - gripper assembly drawing
- P&ID skidding system
- Drawing of railings
- Well slots Gyda platform P&A
- Presentation 19052019 – HPI jacking grippers at Gyda
- Action plan – DHS A G71
- AFA 203311 - authorisation of alteration AFA 203311
- CP-03-04.02-GYDA.01 – checklist – rig skidding
- WP 398688 – work permit, skidding of derrick from well A-04 to A-07
- Work permit log – WP 398688
- Rig skidding grippers installation, operation and maintenance manual
- TB-2088 rev 1 – skid beam flange condition and safe gripper jack operation
- Safety flash – Snorre A – “Ifm skidding falt sideplate til skiddejekk ned”
- Gyda phase II PP&A Well 2/1-A-4 ITD
- Inspection report 2004
- Risk review for jumping BOP
- Investigation report Snorre A

B: Overview of personnel interviewed