

Investigation report

Report	
Report title Report of an investigation – Equinor Mongstad – Person fallen from scaffolding	Activity number 001902065 Case 2023/116

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Involved	
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1 Summary

A serious work accident occurred on 18 January 2023 when installing scaffolding at Equinor's onshore plant at Mongstad. The Petroleum Safety Authority Norway (PSA) decided on 19 January 2023 to investigate this incident.

At 13.34 on 18 January 2023, a person fell from scaffolding at Equinor Mongstad. This was reported as a serious work accident, involving a fall of 23.5 metres to a concrete floor. The PSA was also informed that the injured party (IP) was tended by Equinor's emergency response personnel and transported to hospital.

The direct cause of the incident was that the IP had attached their fall-arrest harness to a ledger which came loose from the standard at one end of the scaffolding. When the IP lost their balance on the ledger they were standing on, they fell backwards and the hook at the other end of the ledger holding the harness was bent and became detached from its standard.

Under slightly different circumstances, the fall would have caused the death of the IP.

Given the circumstances, the emergency response was handled in a good and effective way by the health and safety (H&S) service at Mongstad.

In connection with the investigation, Beerenberg Services AS (BBS) was given an order from the PSA to halt all installation, disassembly and alteration of scaffolding at Mongstad until the following have been implemented.

- The procedure for installation, disassembly and alteration of scaffolding is formulated in such a way that the specific risks related to the activity are handled for all types of scaffolding. The procedure must describe how the work is to be conducted and which safety measures must be implemented. *See section 45, second paragraph, of the technical and operational regulations on procedures, and section 3-2, paragraph 3, of the Working Environment Act.*
- All personnel involved in planning and constructing scaffolding at Mongstad are familiarised with the accident and health risks which could be associated with the work, and have received training in the procedure for scaffold-building, see the first bullet point above. *See section 3-2, paragraph 1, litera a, of the Working Environment Act and section 50 of the technical and operational regulations on competence.*

BBS complied with the order and confirmed its implementation on 30 January 2023 through updating of procedures and information to employees.

A review of incidents reported to the PSA shows that falls from scaffolding occur during installation or dismantling. See section 2.8. In most cases, these have involved low heights and minor occupational injuries.

The investigation has revealed some degree of failure to incorporate adequate routines for conducting risk assessments when assembling or dismantling scaffolding, and that the company and the employer have not sufficiently learnt lessons after incidents on Oseberg B and elsewhere.

Nonconformities and improvement points were identified by the investigation at both Equinor and BBS.

Nonconformities related to Equinor

- 9.1.1 Inadequate risk assessment
- 9.1.2 Follow-up of other participants
- 9.1.3 Failure to ensure conformity between its own emergency plans and response, and those of other participants
- 9.1.4 Emergency response plan does not cover rescue at height

Improvement points related to Equinor

- 9.2.1 Inadequate manning in the H&S service
- 9.2.2 Inadequate emergency drills and training involving ISS trades/BBS

Nonconformities related to BBS

- 9.3.1 Risk assessment and organisation of the work
- 9.3.2 Organisation and execution of maintenance
- 9.3.3 Expertise
- 9.3.4 Communication of information
- 9.3.5 Self-rescue, fall rescue and rescue at height are not planned and prepared for, or described in the emergency response plan
- 9.3.6 Emergency drills and training are not carried out systematically for BBS personnel
- 9.3.7 Management of the psychosocial working environment.

The investigation has revealed a lack of understanding of and compliance with regulations and standards/norms referenced in these in order to achieve the desired level of health, safety and the environment (HSE). These elements are regarded as contributory causes of the incident.

Understanding the Norwegian safety regime and making provision for the necessary capacity and expertise are the key to safety, and two important elements which are also regarded as underlying causes by this investigation.

The industry is recommended to work through the tripartite collaboration between companies, unions and government to ensure future learning, risk understanding and competence.

2 Background information

When installing scaffolding in job package 20A02 A-5100, a work accident with a serious personal injury occurred on 18 January 2023 through a fall from scaffolding at Equinor's onshore plant at Mongstad. Scaffolding was to be installed to a height of 30 metres. It would be clad in fabric, but not have boards internally so that a goods lift could run up and down without obstruction inside the framework.

The work of assembling/dismantling the scaffolding in job package 20A02 was based on a framework agreement involving unit rates. It was executed by BBS as part of a surface and maintenance programme under way at Mongstad since 2017. Work on the scaffolding from which the IP fell involved installing a framework of scaffolding materials which would be clad in fabric to protect the area from dropped objects when using a goods lift. The scaffolding had a footprint of 3 x 4.7 metres and was to be raised to 30 metres. It was installed on the outside of an existing scaffolding for executing the actual maintenance work, and would contain no scaffold boards when installed so that the lift was free of obstructions.

Work by BBS on assembling and dismantling scaffolding is performed by a mix of permanent and temporary scaffolders. Virtually all its scaffolders and foremen are of Polish origin. All members of the work team involved in the incident were Polish and permanently employed by BBS. The team comprised three scaffolders in addition to a foreman who was responsible for following up several activities.

2.1 Position before the incident

The working day began with a new team being assigned to complete the scaffolding in module A-5100. This team comprised two scaffolders who normally worked together plus one who had not worked with the others previously. Work permits (WPs) were distributed before the work, and the team conducted an on-site review of the WP, the A standard and the generic risk form for work at height.

BBS had not carried out the required risk assessment, drawn up an installation plan or assessed rescue requirements ahead of the actual scaffolding work, as referenced in the norm.

None of the three scaffolders in the team held a trade certificate for such work pursuant to Equinor's internal requirements in R-109655. This requires at least one member of a scaffolding team to be a skilled scaffolder, who must also have basic

first-aid competence. Other members must have received scaffolder training. At least half the team members must have more than two years of documented experience. If the team comprises more than four people, two must be skilled scaffolders. BBS has confirmed in interviews that its own internal requirements have been compared with Equinor's. The BBS requirements are covered in procedures and governing documents, and those set by Equinor become the minimum for BBS.

Weather conditions are described in internal emergency response logs in prose, which state that they were good when the incident occurred without special factors related to temperature, possible precipitation, wind and wind direction.

The Met.no meteorological service has reported that it does not have measuring stations at Mongstad and that the closest is at Fedje, about 30 kilometres away as the crow flies. Weather data from there show that the temperature was 2.2-3.0°C between 01.00 and 14.00 on the day in question, without precipitation during that period. Nor were there any indications of temperatures below zero or precipitation in the hours before which could have caused ice formation at the incident site or on equipment involved.

2.2 Description of the plant and its organisation

The Mongstad plant comprises an oil refinery, a natural gas liquids facility (Vestprosess NGL) and a crude oil terminal (MTDA). The Technology Centre Mongstad (TCM), the world's largest facility for research on CO₂ treatment, is a neighbour with Equinor Mongstad responsible for its emergency preparedness.

With an annual capacity of almost 12 million tonnes of crude oil, the refinery is the only one in Norway.



Figure 1. Panoramic view of the Mongstad plant. (Source: Equinor.com)

The Mongstad plant is operated by Equinor, and has some 900 directly employed personnel, including roughly 310 shift workers divided into six shifts responsible for safety, production, emergency preparedness and maintenance. The remaining personnel work days and are responsible for planning and development, operational follow-up, laboratories, engineering and technical information support, maintenance support, warehousing, workshops, procurement and administration. In addition come some 65 apprentices.

Maintenance is a significant activity. This work is performed by shift personnel, maintenance staff in the daytime organisation and contractors. The latter account for more 300 full-time equivalents annual during normal operation at the refinery, mainly within maintenance, modification, catering, cleaning and security duties (*source: www.equinor.com/no/energi/landanlegg*). BBS is one of the principal contractors at Mongstad under a 10-year frame agreement with Equinor covering maintenance services for insulation, scaffolding and surface treatment (ISS) at Mongstad. This contract was awarded in 2015 and commenced at 1 January 2016.

The top-level organogram for Equinor Mongstad (MMP OPL MON) is presented in figure 2.

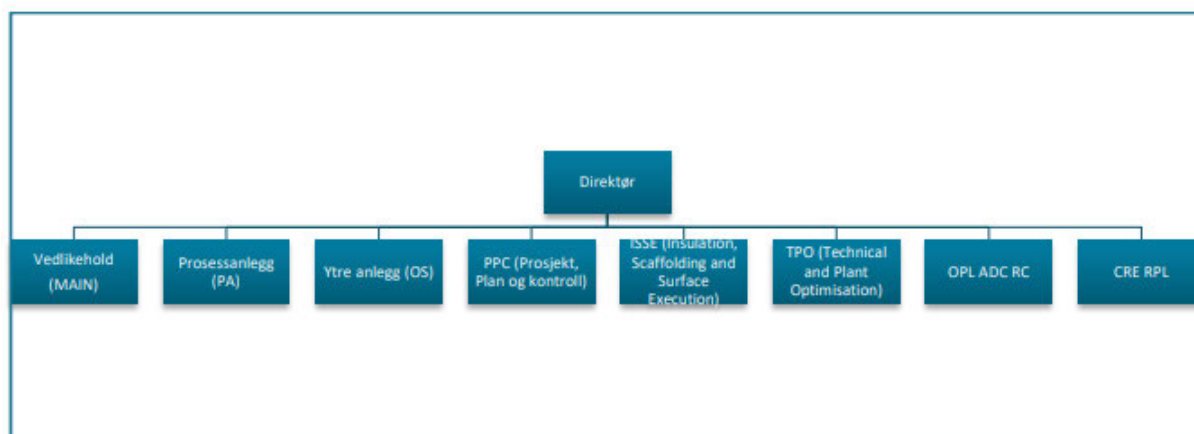


Figure 2. Organogram for Equinor Mongstad

Area A-5100, where the work was carried out, forms part of Equinor's surface treatment project and is broken down into smaller sections. The relevant area where the incident occurred is 20A02. See figure 3.



Figure 3. Area A-5100 (Source: Equinor risk analysis job package ISS)

A-5100 is a plant for removing sulphur from gas oil (diesel).

2.2.0 Emergency response organisation – Equinor and BBS at Mongstad

Equinor

Mongstad has organised its emergency response in two levels, with the first-line emergency response team as the operational level led by the first-line response management and the H&S service. The second-line organisation is the response management at Mongstad for assisting the first line. It also deals with internal and external information, general media relations and personnel care.

The third line organisation is the group management and board of Equinor.

Equinor's emergency response department with the H&S service at Mongstad comprises a permanent team of 16 plus other response personnel as described in *Referansedokument til beredskapsplan WR9007 Beredskapsplan MMP OPL Mongstad, App E Dimensjoneringsanalyse 1. linje beredskap*.

Emergency response is organised as follows.

- Manager H&S/emergency response
- Technical manager, H&S service
- Consultant emergency preparedness
- 12 shift workers, with six in the role as the technical manager H&S service and six as the fire commander
- One trainee.

The organogram for Equinor's emergency response at Mongstad is presented in chapter 7 on emergency response.

BBS

The BBS emergency response organisation at Mongstad primarily comprises the site manager, the HMS/Q manager and the manager for surface treatment project (OFP).

They are to perform their emergency duties on the basis of GOV-AP17-00175, BBS's own emergency preparedness plan. This primarily involves internal notification to a higher level in their own company, which is the head office at Kokstad. Notification to the local operator company at Mongstad is described as being transmitted via the BBS second line at Kokstad, which could be a source of delay.

In addition to its own response plan, BBS has a notification poster for Mongstad which states in part that incidents are notified as first priority to Mongstad's control room via radio or emergency phone, and to the company's own foreman as second priority. This poster is not included in the BBS emergency preparedness plan.

An emergency log is not kept by BBS at Mongstad, but by the second line at Kokstad, which has made it demanding to obtain a better understanding of the details related to the BBS response during the incident.

The BBS preparedness plan does not describe any measures for rescuing personnel at height or conducting first aid, and has not defined or described the organisation or use of its own response team for executing various response measures.

2.3 Work at height

Work at height is conducted in connection with erecting safe workplaces for personnel who are to carry out maintenance, repair and inspection. Safety work largely comprises manual labour. When assembling/dismantling scaffolding, a potential exists for people falling and for dropped objects. Many reported incidents involving dropped objects can also be found in connection with assembling/dismantling scaffolding. That emerges, too, in the trends in risk level in the petroleum activity (RNNP) reports issued by the PSA. The background is that this work involves manual handling and that many components are involved in assembly/dismantling.

2.3.0 Risk assessments

Risk means the consequences of an activity with their associated uncertainty. The concept of "consequences" is used here as a collective term for all potential outcomes which the activity could give rise to. It is not confined to the final consequences of the activity, in the form of injury to or loss of human life and health, harm to the environment or loss of material assets, for example, but also includes conditions and incidents which can cause or lead to such types of consequences.

The requirement to conduct a risk assessment involves in part reducing the risk even further than the established minimum requirement for HSE which follows from the regulations.

Generally speaking, work at height is regarded as risky and entails more stringent requirements for risk assessments. That applies not only to executing work at height but also to personnel assembling/dismantling scaffolding built to provide a secure work platform for other activity.

Basic requirements for the employer concerning risk assessments are enshrined in section 17-1 of the regulations on the performance of work (FUA) with regard to the norms referenced by both Equinor and BBS in governing documentation.

The PSA sets requirements for players in section 4 of the *management regulations* on risk reduction:

"[T]he responsible party shall select technical, operational and organisational solutions that reduce the likelihood that harm, errors and hazard and accident situations occur.

"The solutions and barriers that have the greatest risk-reducing effect shall be chosen based on an individual as well as an overall evaluation. Collective protective measures shall be preferred over protective measures aimed at individuals."

Equinor and BBS refer to section 17 of the FUA on work at height. This section is referenced by the PSA as the norm for work at height, and by Offshore Norge as an employer organisation in guideline 105 – Recommended guidelines on competence requirements for scaffolders. Training materials from the Norwegian Scaffolders Association (SEF) also refer to section 17 of the FUA in the scaffolding manual used by the industry for training scaffolders.

In addition, the Norwegian Labour Inspection Authority, the PSA and Offshore Norge refer through this regulation to NS 9700-1 Scaffolds and encapsulation constructions - Part 1: Technical requirements and requirements for training, assembly and use as the norm for theoretical and practical training of personnel assembling and dismantling scaffolding.

When planning and executing work at height, the employer must assess the risk for the job to be conducted in a safe way. That also applies to work in connection with assembling/dismantling scaffolding which the employee is assigned to execute. The assessment also covers the risk that people might fall or objects drop. Conditions with significance for the risk could include fall-arrest measures, including equipment and rescue, or other hazards presented by the relevant work and workplace.

Through its "Safety analysis BBS Mongstad job package 20A02", BBS has defined the following top three risk areas related to scaffolding.

- Work at height Measure: use of fall-arrest harness
- Dropped objects Measure: cordoning-off and securing tools
- Crush injuries Measure: use of impact-resistant gloves

Interviews revealed that this information was given to the scaffolders involved with the work in job package 20A02.

The investigation team does not regard the content in the analysis above as a risk assessment but more as consequence-reducing measures. The measures do not ensure the necessary overall assessment required from the company when planning work. Equinor and BBS apply section 17 of the FUA as the norm for working at height.

Risk analyses and assessments for work on installing the scaffolding were largely conducted through fall-identification methods. The norms applied for risk assessment specify that fall-prevention (collective fall-arrest) methods must be given priority over personal fall-arrest equipment. Section 4 of the PSA's management regulations on risk reduction refers to technical, operational and organisational solutions which reduce the likelihood that harm, errors, and hazard and accident situations occur. The investigation team has repeatedly sought, through requests for documentation and in interviews, to discover whether the BBS management has conducted risk assessments in accordance with the regulatory requirements, without succeeding in having this documented. BBS reports that it assigns the job of following up risk assessments and choice of methods to the scaffolding foreman and scaffolders when this is not described in the installation guides from the manufacturer of the scaffolding materials.

Equinor carries out risk assessments for other hazards at the plant, depending on the workplace, and these are attached to the WP.

Through governing documentation, Equinor has prepared generic forms for conducting work at height in order to assist workers in conducting a review of the risks involved in such jobs.

Equinor's risk assessment requirements for scaffolding activities, from R-108499:

- the risk assessment form for scaffolding activities must be used for all scaffolding activities at the plant where fall-arrest equipment is required
- the risk assessment must be attached to the WP in the field and form part of the conversation in the field
- the risk assessment form for planning scaffolding activities must be filled in and signed by the person planning the job

- the risk assessment form for executing scaffolding activities must be filled in by the executing person and signed by all members of the work team
- the risk assessment form for planning scaffolding activities must be read by the executing person before execution and form part of the conversation in the field
- the work order (WO), WP, safe job analysis (SJA), toolbox talk and risk-assessment form for scaffolding activities must be reviewed with the whole scaffolding team to ensure shared understanding of the work's content.

The information received by the investigation team through interviews and document reviews indicates that risk assessments by BBS and Equinor do not contain necessary assessments of the inherent risk associated with the choice of method when scaffolding is not installed in accordance with the manufacturer's installation guide. Equinor's standardised forms in the management system cover general risk to be assessed before work actually begins. Reviewing a standardised format is furthermore intended to serve as an aid for the scaffolder.

As the provider of scaffolding services, BBS must review risk conditions specific to the individual job at an overall level when planning scaffolding installation. In addition, an installation guide must be prepared when the work is not to be done in accordance with the scaffolding manufacture's installation instructions. This installation guide must ensure safe execution and assembly of the scaffolding as well as dismantling after use.

2.3.1 Collective protective measures

Collective protective measures mean those intended to reduce workplace risk at source. That can be achieved by technical or organisational means, or by providing protection for a whole group. It can be accomplished, for example, by offering scaffolding rather than fall-arrest harnesses. The former takes priority over the latter as a protective measure.

Choosing protective measures for work at height also applies to personnel whose job it is to assemble/dismantle scaffolding.

Interviews revealed that the choice of collective protective measures is left to the scaffolding foreman, and in some cases to the scaffolding team alone. Such measures could include installing an extra floor of scaffold boards, the personal protective equipment (PPE) to be used, and where this is to be attached. Assessment of protective measures must form part of the overall risk assessment which the person responsible is required to conduct before planning the work.

2.3.2 Choice of method for installing/removing scaffolding

The responsible person ensures that safe methods are chosen on the basis of risk assessments for scaffolding assembly/dismantling, and that installation guidelines are prepared with reference to section 17.8 of the FUA as the norm.

Guidance on solutions and choice of barriers is provided by the PSA in section 4, last paragraph of the management regulations on risk reduction: "Collective protective measures shall be preferred over protective measures aimed at individuals".

Section 17-8 of the FUA on assembly, use and dismantling of scaffolding has been selected as the normative reference when choosing the assembly/dismantling method for scaffolding. This states:

"The employer shall ensure that scaffolders are issued with installation guidelines and written work instructions. The requirement for use of appropriate personal protective equipment during installation work shall be stated in particular.

"A qualified person who is knowledgeable about the complexity of the scaffolding in question shall prepare guidelines for assembly, use and dismantling of it. The guidelines may be a general guide from the manufacturer, but shall, if necessary, include complementary and detailed information about the scaffolding in question, to ensure that assembly, use and dismantling of the scaffolding take place safely."

The scaffolding foreman and scaffolder are responsible for choosing methods and executing actual assembly/dismantling for BBS jobs at Mongstad which are not performed in accordance with the installation guidelines from the manufacturer.

During interviews with scaffolders, it emerged that they believe it is lawful in Norway to climb in scaffolding and stand on ledgers protected only by fall-arrest equipment. Several of those interviewed said that they have questioned the employer about this practice for assembly/dismantling on the basis of their experience in other countries where this is not permitted. They said the feedback they had received was that this was permitted in Norway

These interview statements do not accord with the regulations, where the employer is responsible for seeing to it that a scaffolder receives installation guidance which ensures that the scaffolding can be assembled/dismantled in a safe way.

2.4 Scaffolding materials

Equipment used in scaffolding must be certified by a certification authority within the European Economic Area (EEA) which is accredited for this work under the producer responsibility regulations, which are to be regarded as a norm in the petroleum

industry. Scaffolding components are manufactured in seawater-resistant aluminium in classes 6082-TK and TK.

BBS uses materials from the best-known manufacturers, including Aluhak, Aluscaff, Delta/Solideq and Haki. These materials fit together but have small differences in terms of dimensions and of attaching standards to ledgers and ledgers to boards. BBS at Mongstad used a mix of materials from these manufacturers.

Much of the material used in the scaffolding being built when the incident occurred was old, and manufactured before the EEA certification scheme came into operation. Inspection revealed that seven different types of three-metre ledgers were in use.

Scaffolding materials involved in the actual incident were:

- scaffolding standards from Delta – three-metre lengths
- scaffolding ledgers from Aluhak – three-metre lengths

2.4.0 Installation guide from Solideq (Delta) – Aluscaff 2022-02

Information taken from the manufacturer's installation guide:

"Static calculations must be conducted for the following types of scaffolding:

- wind load pursuant to EN 1991-1-4
- installation carried out in a way other than usual assembly against a wall as described in this installation guide".

If a scaffolding is built with a mix of components from various manufacturers, special assessments and calculations are required pursuant to section 17 of the FUA, since this is not a standard construction method in accordance with the installation guide.

Confirmation from Solideq on mixing scaffolding materials (from 2021)

"Solideq AS has no objections to mixing equipment, but scaffolders must pay close attention to the different installation guides and use the load tables which apply to the scaffolding with the lowest values in its tables."

2.4.1 Installation guide Haki 2022

Information from the manufacturer's installation guide: "Haki's product responsibility and installation guide apply only to structures containing components manufactured and delivered by Haki.

"If the scaffolding is built with the inclusion of components from other manufacturers, a special assessment and calculation of the scaffolding must be conducted pursuant to section 17.8 of the FUA, since this is not the standard building method pursuant to the installation guide. Mixing products from different manufacturers could invalidate insurance."

2.4.2 Installation guide for Aluhak systems from the net, February 2023

Information from the manufacturer's installation guide:

"Scaffolding components can be combined with a number of other aluminium scaffolding types, providing the installation guide from the other manufacturer is studied. The Aluhak scaffolding system can also be combined with a number of steel scaffoldings. That assumes this is hot-galvanised equipment, that the zinc coating is intact at the contact surface with the aluminium components, and that the scaffolding stands for a short time.

"IMPORTANT: the dealer must be contacted for heights above 30 metres. Calculations should be done by qualified personnel, with extra emphasis on wind loads in the winter season and in stormy coastal areas. Scaffolding exposed to wind offshore should always be calculated with regard to strong wind forces, and should therefore have particularly solid anchoring and good stiffening. Wind loads of two-three kN/square metre could occur."

Confirmation on mixing equipment from various suppliers (from 2021)

Aluhak has taken note of the fact that scaffolding contractors possess and choose to mix systems from various suppliers in their everyday operations.

Their certificates and installation guides cover only products manufactured and distributed by Aluhak, and will accordingly only provide information on its products. It is important that their scaffolders address the safety of such mixing and calculations for the finished scaffolding, and that the contractor provides adequate training for the scaffolders.

Aluhak would not object to anyone mixing different products, but they must be aware of what they are doing and take responsibility themselves for the components being compatibility and having the same capacity.

2.4.3 Level of competence for training scaffolders in assembly/dismantling in the petroleum industry

Equinor's requirements for a scaffolding team and foreman team, R-112564 (Norway)

"A scaffolding team must have a minimum of one skilled scaffolder. Other members of the team must have received training as scaffolders. At least half the members of a scaffolding team must have more than two years of documented experience. A skilled scaffolder is a person with a trade certificate in scaffolding pursuant to the Norwegian Education Act."

Equinor – competence must as a minimum satisfy Offshore Norge guideline 105, Recommended guidelines on competence requirements for scaffolders:

- prior course in fall-arrest procedures (Offshore Norge requirement 3.5 hours of theory and four hours of practical exercises)

Equinor training requirement:

- Person who has completed training pursuant to the learning outcomes in modules 1 and 4 and supplementary module 4.2 in chapter 5, NS 9700.

Equinor's requirements for skilled scaffolder R-112340 for scaffolding-building in Norway:

- prior course in fall-arrest procedures (Offshore Norge requirement 3.5 hours of theory and four hours of practical exercises)

Equinor's training requirements:

- section 17, FUA (Lovdata)
- guideline 105 – Recommended guidelines on competence requirements for scaffolders (Offshore Norge)
- NS 9700-1:2016 Scaffolds and encapsulation constructions - Part 1: Technical requirements and requirements for training, assembly and use
- trade certificate in scaffolding pursuant to the Norwegian Education Act.

The scaffolders involved in the incident had the following training.

- Duration of the theory course for assembling/dismantling scaffolding was two days. The course was given in Polish in Poland. No practical exercises in scaffolding installation were conducted during the course, only theory. Reportedly, experience of installing scaffolding in Poland was documented in advance. The PSA team has not had access to this documentation.
- The fall-arrest course was held virtually, without practical exercises. Duration of and learning content in the course are not known to the investigation team. The course was taken several years ago. It does not meet the training requirements specified by Equinor and BBS.

Information on training emerged during interviews with personnel.

A team which assembles and dismantles scaffolding is required to include at least one skilled scaffolder. Other members must have training as scaffolders. BBS is unable to fulfil this requirement in relation to Equinor for scaffolding teams which do the physical work because of their lack of competence in Norwegian. Training which leads to a skill qualification is no longer provided in English because of a shortage of participants and low interest in the sector. BBS compensates for the requirement for skilled scaffolders by ensuring that some of the foremen and supervisors have a skill qualification. To ensure safe assembling/dismantling of scaffolding, on the other hand, one member of the team executing the physical work with the scaffolding must be a skilled worker. Foremen and other employees cannot be regarded as part of the actual team when they do not participate actively in the scaffolding activities.

The definition of a skilled scaffolder in recommended guideline 105 from Offshore Norge is a person with a trade certificate in scaffolding pursuant to the Norwegian Education Act.

2.4.4 Maintenance of scaffolding materials

Equinor specifies requirements for inspection and maintenance of scaffolding materials in R-109721, based on pre- and post-installation checks and maintenance. In addition, scaffolding must be checked and approved before being transferred to the user. It must then be checked at 14-day intervals while in use. Checks must also be tailored to weather conditions.

From Equinor's R-109721 requirements.

Random checks must be conducted with assembled scaffolding which has stood for more than three months.

Safety latches must be tightened during pre- and post-installation checks of scaffolding materials. This requirement is also included in the installation guide from the manufacturer.

The inspection and maintenance plan for scaffolding materials must be conducted in accordance with the manufacturer's user manual. Repairs must accord with manufacturer guidelines.

When reviewing scaffolding materials during the investigation, it emerged that a mix of old and new materials are in use. The PSA team noted that some were more than 25 years old. Employers are required to conduct adequate inspection and maintenance of scaffolding materials and to ensure that the quality of materials used meets safety standards in use. Checks are confined to visual inspection, which in turn calls for competence, alertness and careful checking. Scaffolding materials are complex, with many welded connections. Maintaining and checking such materials are a permanent activity which continues throughout the commercial life of the plant, and must be organised so that checks can be made in a satisfactory way and ensures the quality of the material.

BBS reports that scaffolding materials are checked on dismantling before being taken to storage, and on installation when taken to the construction site. As explained to the investigation team, these checks appear to be conducted in a phase which could be subject to pressure to finish work related to scaffolding assembly/dismantling. The PSA has noted organisation of findings on maintenance and checks as well as faults and deficiencies in scaffolding materials in earlier audit reports at Mongstad.

When reviewing the incident at the plant, the team found damage and defects in scaffolding materials which had been transported out and positioned ready for use. It

was informed that the scaffolding team checked materials before these were taken into use. The ledger involved in the incident had not been maintained by tightening its safety latches. Other material on the same scaffolding was observed to have similar shortcomings.

2.5 Fall-arrest and rescue

The need for necessary equipment for fall-arrest and rescue must be identified in risk assessments during early planning and in the workplace review before the work starts and after breaks in the work. Fall-arrest equipment is regarded as PPE and as the final barrier against falling to a lower level.

Responsibility for general emergency response and rescue of personnel at Mongstad rests with the H&S service. A review of Equinor's rescue plans revealed that the service is to carry out rescue from ground level. The possible need for rescue at height must be included in the risk assessment of the work, and is normally carried out by the relevant ISS contractor. It is an item in the checklist for working at height.

Interviews revealed that BBS notifies its employees on arrival at the plant that the H&S service must be called by phone or radio in the event of incidents where rescue is required. See the notification poster mentioned in section 2.2.1 above.

Rescue in connection with the actual work being done when the incident occurred had not been assessed, and no provision was made for rescue at height. Interviews revealed that nobody in the scaffolding team had received training in self-rescue, use of rescue equipment or basic first aid.

The rescue and response work is also described in chapter 7.

2.5.0 Requirement for training in use of fall-arrest equipment

Equinor specifies competence requirements for safe use of fall-arrest equipment through R-4551, which refers to guideline 113 – Recommended guidelines for fall-arrest and rescue (Offshore Norge - in Norwegian only)

- Fall-arrest: target group – users of fall-arrest equipment – theory and practical training. Theory: at least 3.5 hours. Practical exercises: at least four hours.
- Rescue: rope-based fall rescue – basic course – Theory: six hours. Practical exercises: 14 hours.

In addition, specific training must be provided for equipment which has not been included in the individual's training.

Interviews revealed that the scaffolders involved in the incident had the following documented training: virtual fall-arrest course without practical exercises. Duration of the course unknown. This is also described in section 2.4.4.

2.5.1 Fall-arrest equipment in use with BBS

BBS had standardised fall-arrest equipment for scaffolders which comprised:

- fall-arrest harness EN 361, brand Singing Rock Basic, three-year guarantee
- fall-arrest Y lanyard EN 358, brand Singing Rock Ring Y 155 cm with large hook K353
- shock absorber, Reactor 140

According to the table from Singing Rock, the total length of the Y lanyard with Reactor 140 shock absorber and large hook is 180 centimetres.

Maximum reaction length is 1.75 metres, with a maximum load of 140 kilograms.

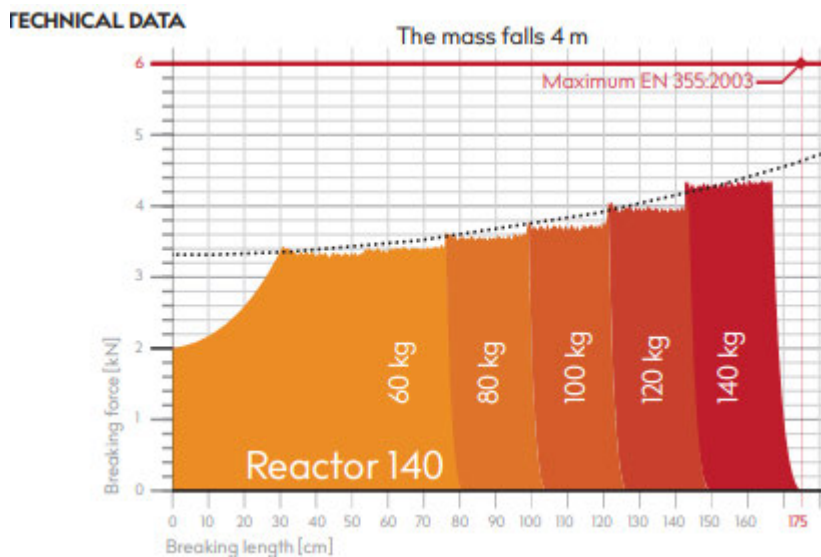


Figure 4. Source: Singing Rock W4400WW00

It was also reported that two types of fall-arrest block and one type of rescue block were available in store. Several of those interviewed were not aware that this equipment was available. Furthermore, personnel interviewed had not been trained in using the rescue block.

2.5.2 Use of fall-arrest equipment when assembling/dismantling scaffolding

Fall-arrest equipment can be attached to scaffolding materials during assembly, use and dismantling, but the various scaffolding manufacturers differ somewhat in their guidelines on attaching such devices.

The examples below have been taken from assembly instructions issued in 2022.

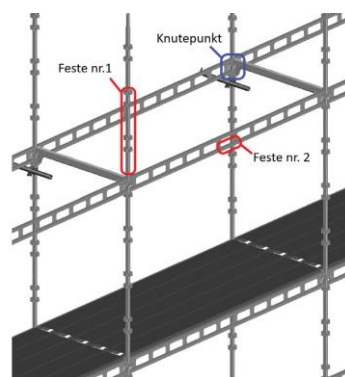


Figure 5. Example from Aluscaff

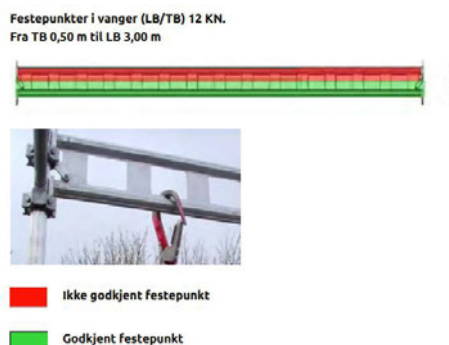


Figure 6. Example from Aluhak

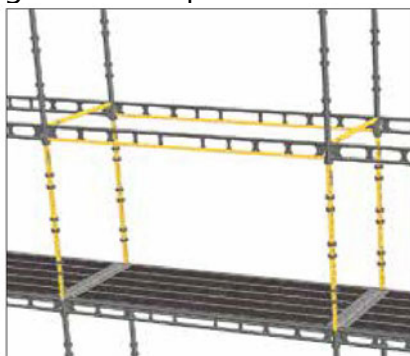


Figure 7. Example from Haki



Figure 8. Example from Haki

BBS says it has tested attachments on ledgers, and states that it can attach the Y lanyard hooks at all points on the lower part of the ledger. The investigation team requested documentation on testing attachment points for hooks which exceed the recommendations from the manufacturer, but this could not be produced.

In addition, old versions of ledgers were used which had no form of documentation about attaching safety lanyards with hooks.

2.5.3 Maintenance of fall-arrest equipment

Fall-arrest equipment is cleaned by washing and drying at a maximum of 30°C. All chemical products, corrosive materials and cleaning fluids should be regarded as harmful. Inspection of the equipment before and after use is recommended. Furthermore, a detailed inspection is recommended every three months. Interviews revealed that BBS regarded this thorough check as one the user makes when the fall-arrest equipment is mobilised at the start of the work period.

The working life of the fall-arrest equipment depends on the frequency of use and the environment it has been used in (salt, sand, humidity and chemicals). Without taking that into account, or damage caused to it, the product can be used over a period of no more than 10 years from the date it was taken into use. Source:

www.singingrock.com.

The fall-arrest equipment made available at Mongstad is a fall-arrest harness with a double safety lanyard with shock absorber and large hook. Use of this equipment has restrictions on the minimum height above ground where it can be used to avoid the wearer hitting the ground when falling. This is described in the English user guide to the Reactor 140.

It emerged during interviews that fall-arrest equipment in BBS is not personal and is not cleaned after each time it is used by other people. The harness and lanyard is taken out by the scaffolder when the work period starts and returned at its end.

BBS points out that the equipment gets checked by the user when it is taken out for use at the start of a work period, and regards this as sufficient pursuant to the requirements in the user guide for a thorough check every three months.

BBS document GOV-WI36-00073 Routines for TT and fall-arrest equipment states that BBS uses Vedos software to follow up fall-arrest equipment for periodic checks.

As presented in interviews and reviews of training documentation, training in the use of personal fall-arrest equipment does not appear to be adequate because it is provided virtually. That does not satisfy the requirements set by Equinor for users of fall-arrest equipment. BBS's routines are therefore inadequate for checking and maintaining work equipment.

2.6 Language

Workers from different countries are not necessarily conversant with each other's language or familiar with their respective cultures. This makes particularly heavy demands on employers for systematic HSE work. They must therefore ensure safety training in a language the workers understand in order to ensure good communication about safety.

When a worker who does not understand Norwegian is to use the equipment, the employer must consider making relevant parts of the user guide available in a language the worker does understand.

According to topic 1 for 2015 on experience of the authority's supervision against social dumping in the Labour Inspection Authority's Kompass series, foreign workers are exposed to greater risk in the workplace than their Norwegian colleagues. This study also shows that foreign workers lack training and necessary PPE, and that language and communication problems represent a real risk.

BBS has largely chosen to use Polish workers to assemble and dismantle scaffolding and to perform other work related to its ISS contract with Equinor. This applies to both the company's own personnel and temporary hires.

Equinor requires personnel working at Mongstad to have a command of a Scandinavian language or English. Foreign workers whose mother tongue is not a Scandinavian language must document through a test that they have a command of English. A test of competence in English will not explicitly be sufficient to document that people who are to do the work are familiar with technical procedures and the necessary governing documentation concerning the execution and safety of work activities. Where work operations pose a risk of serious incidents, the employer must ensure that everyone involved can understand danger signals and act correctly to avoid undesirable incidents.

The employer must take account of communication challenges in the planning and execution phases of construction work.

During interviews by the PSA team as part of its investigation, a distinction has been perceived between a command of English and an understanding of it. BBS management, HSE personnel and planners preparing work at Mongstad are largely Norwegians. Much of the information reviewed by the team is either only in Norwegian or in Norwegian/English. While foremen largely hail from Poland, some are Norwegian. They use English to communicate between them. At this middle management level, cultural difference exist about *what* is communicated and *how* this is done. Scaffolders largely use their mother tongue to communicate between each other and Polish foremen.

BBS has chosen to use only Norwegian and English in its information to and procedures for personnel involved in scaffolding work.

Companies with a multilingual workforce must constantly ask themselves when communication becomes a safety risk. Where employees or temporary hires have different languages and cultures, the company should have guidelines in this area. When employees speak different languages, safety must be handled in such a way that linguistic differences do not obstruct good and safe working.

Section 14 of the framework regulations specifies that the Norwegian language shall be used in the activities to the extent possible, but allows other languages to be used if necessary or practical for carrying out activities provided that this does not compromise safety. That also applies to routines, safety-critical procedures and checklists.

If an employer opts to use a language other than Norwegian in its operations, it must ensure that safety training is provided, on the same terms required for the Norwegian language, in a language which the workers understand so that good safety communication is achieved.

2.7 Mandate for the investigation

The following mandate has formed the basis for the investigation team's work.

- a. Clarify the incident's scope and course of events with the aid of a systematic review which typically describes the time line and events
- b. Assess the actual and potential consequences
- c. Assess direct and underlying causes
- d. Assess the emergency response to the incident, including interaction with external emergency services
- e. Identify nonconformities and improvement points related to the regulations
- f. Discuss and describe possible uncertainties/unclear aspects
- g. Discuss barriers which have functioned – in other words, those which have helped to prevent a hazard from developing, or which have reduced the consequences of an accident
- h. Assess Equinor and the supplier's own learning and experience transfer from earlier incidents
- i. Prepare a report and a covering letter, possibly with proposals for the use of reactions, in accordance with the template
- j. Recommend – and normally contribute to – further follow-up

2.8 Reported incidents with a similar pattern

The following section presented incidents reported to the PSA related to falls during assembly/dismantling of scaffolding and dropped objects where scaffolding is involved. Where onshore plants are concerned, the investigation team has looked at reported incidents from 2009 until February 2023. Incidents in the offshore petroleum sector have been taken from a sample of facilities and cover the same period. The weakness here is that not all dropped objects above 40 J were reported to the PSA before 2020 if they did not cause personal injury.

Case 2009/602 StatoilHydro – Oseberg B 7 May 2009 – fatal accident

The most serious incident occurred on Oseberg B on 7 May 2009. During dismantling, a scaffolder was seriously injured when he fell 14 metres from the scaffolding to the cellar deck. He was flown to Bergen's Haukeland Hospital by rescue helicopter and later died at the hospital from his injuries.

Case 2023/179 Equinor – Hammerfest LNG 27 January 2023 – work accident

The incident occurred when a scaffolding had been dismantled to a height of four metres. The scaffolder attached their fall-arrest equipment to the ledger at that height and stood on the one at two metres. They balanced across and released the ledger latch on one side but, on the way to the other side, the ledger "jumped" and the scaffolder fell two metres.

Case 2022/1248 Equinor – Grane 28 July 2022 – work accident (information from Equinor’s investigation report)

Loose ledger could have caused an accidental fall on C32N.

Approved scaffolding was entered in connection with a job on a cable tray.

When the person involved passed the tray to a colleague, they became unbalanced and gripped at the ledger to recover. They observed that the ledger was loose, and seized the structure with their left hand to restore their balance.

Case 2019/1291 Gassco – Kårstø 10 October 2019 – work accident

Scaffolder fell backwards (0.5 metres) while dismantling scaffolding. Their back hit an object and they complained afterwards of substantial back pain.

Case 2018/997 Aker BP – Alvheim FPSO 29 July 2018 – work accident

The IP was engaged in dismantling scaffolding. When dismantling the last ledger/standard, they overbalanced and fell to the deck (drop one metre).

Case 2018/1367 Equinor – Hammerfest LNG 21 October 2018 – work accident

Scaffolder was demolishing a lifting jack. They leant against a ledger which proved loose, and fell about 1.5 metres to the ground.

Case 2015/975 Lundin – Edvard Grieg 22 August 2015 – work accident

While constructing a scaffolding, a scaffolder was changing the attachment point for a harness lanyard hook. The hook slipped and hit them in the mouth, breaking part of one front tooth.

Case 2012/785 Statoil – Grane 17 April 2012 – work accident (i(information from Equinor’s investigation report)

A scaffolder fell 2.4 metres during dismantling of a scaffolding. They were a bit bruised and received normal first aid before returning to work. To be proactive, the Oseberg and Miller search and rescue (SAR) helicopters were requisitioned but released after four-five minutes. An in-depth study was initiated to determine whether the position/actions which led to the fall related to the industry, Grane or the individual involved. It will also see whether Grane has actually learnt lessons from the fatal accident on Oseberg B i 2009.

Statoil looked at nine incidents related to falls from scaffolding which were registered in Synergi in connection with its investigation. Similar cases mentioned in the investigation report following the Oseberg B accident in 2009 are as follows.

Case 2004/- Kårstø 7 April 2004. This case was not reported to the PSA but is mentioned in the investigation report on the Oseberg B incident.

Case 2001/- Statoil – Gullfaks A 15 September 2001

Scaffolding was to be dismantled after painting under the helideck. A standard came loose and a person fell until stopped by the fall-arrest harness. This became very constricted, causing injuries and pain, particularly in the groin. The IP was treated in the hospital. The potential fall height was eight-nine metres.

The PSA began registering dropped objects as DSHA21C scaffolding in 2015. In 2015-23, the following have been reported to the PSA:

- 92 incidents from activities in petroleum operations offshore
- 52 incidents from activities at onshore plants

2.9 Abbreviations

AMK – Emergency medical communication centre

Area A-5100 – Area within Mongstad where the incident occurred

BBS – Beerenberg Services AS

CCR – Central control room

CMT – Crisis management team (third line)

DSHA – Defined situations of hazards and accidents

ERT – Emergency response team

FUA – Regulations on the performance of work

GL – Guideline

H&S service – Health and safety service

HSE – Health, safety and the environment

HSE&Q – Health, safety, the environment and quality

IMT – Incident management team

IP – Injured party

NS – Norwegian standard

PPE – Personal protective equipment

Pext – Equinor tool for job-package management

PR – Performance requirement

PSA – Petroleum Safety Authority Norway

QA – Quality assurance

RNNP – Trends in risk level in the petroleum activity

SAP – Maintenance administration tool in Equinor

SEF – Norwegian Scaffolders Association

SO – System and operations

ISS – Insulation, scaffolding and surface treatment

Synergi – System for registering, analysing, processing and following up accidents, near-misses and undesirable incidents

Timp – Technical integrity management programme

TR – Technical requirement – internal Equinor standard

TRA – Total risk analysis

WP – Equinor work permit

3 The PSA investigation

Composition of the investigation team.

- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]

3.1 Approach

The investigation team has interviewed personnel from Equinor and BBS associated with management, scaffolding and emergency preparedness activities.

It participated in an inspection of the accident site with the police and Equinor's internal investigation team on 23 January 2023. A reconstruction of the incident was staged on 14 February 2023 with Equinor's internal investigation team and the two scaffolders involved in the incident with the IP. Interviews with personnel took place in three rounds – 24-26 January, 14-15 February and virtually on 6 March 2023.

The team has emphasised establishing the position on the day the incident occurred.

4 Course of events

The description of the course of events is based on interviews and documentation received.

4.1 Description of the incident

The incident occurred during building of a scaffolding to house a goods lift in job package 20A02 A-5100. This lift was to be used to transport equipment and materials to a height. Installing a scaffolding around a goods lift is normal practice at Mongstad and is intended to protect the surroundings – both personnel and materials – when working at height. The completed scaffolding was to be 30 metres high and clad with fabric.

All scaffolding activities associated with BBS are basically planned and priced in accordance with the unit price format. Hours for building this scaffolding were neither planned nor priced because it had originally been installed in the wrong place. The goods lift was a new type and, according to interviewees, BBS's lack of experience with it probably explains why the first scaffolding was incorrectly positioned. The completed first scaffolding stood alongside the new one.

4.2 Timeline

Date/ time	What was done	Remarks
08-09 Dec 2022	Work began on building scaffolding around the goods lift at 20A02.	The work team comprised four scaffolders, two of whom built the scaffolding together. The team stood on scaffold planks during assembly.
Before Xmas 2022	Building the scaffolding was temporarily halted because of other priority work, holidays and sickness absence in the work team.	At this point, the work team had built the scaffolding to a height of 13-14 metres, about 45 per cent of its full size.
After Xmas 2022	BBS had to postpone building the scaffolding because of a surface treatment job (sandblasting in a column) which had to be completed before scaffold-building could resume.	
Friday 13 Jan 2023	BBS began building the rest of the scaffolding with a work team of three scaffolders.	<p>According to BBS, composition of a work team is planned when preparing the WP. Furthermore, it reports that the complexity and scope of the assignment determines how many members are needed in each team. The PSA team received no answer when it asked why the decision was taken to continue work with a team of three scaffolders instead of the four used when building began originally.</p> <p>The three scaffolders belonged to a permanent scaffolding team and knew each other well. It is normal practice at BBS to operate with permanent work teams. Interviews revealed that deciding the method for a scaffolding activity is up to each team. According to the company's scaffolding manual, the team must assess whether the method chosen for the activity meets risk and efficiency requirements. The permanent work team's method involved two scaffolders always building the scaffolding together. They also decided on this occasion that two scaffolders building</p>

		together was safer. One of this pair had the role of "ganger" or team leader.
Sunday 15 Jan 2023, 18.30	The whole job package was registered with 98 per cent progress in Pext, the computer tool used by Equinor to manage job packages for all suppliers and disciplines. The remaining two per cent could in principle represent building the scaffolding.	BBS's foremen are responsible for reporting progress with job packages in Pext.
Tuesday 17 Jan 2023	The IP returned to work after time off. The permanent scaffolding team was told by its foreman that one member was to be replaced. The ganger and their colleague had built scaffolding together for more than 10 years. On 18 January, they were to continue their work with the IP. The two scaffolders and the IP would be working together for the first time.	The ganger and their colleague had never worked with the IP before, but the latter was known among the scaffolders at Mongstad as experienced and professionally able. Work on building the scaffolding was to be completed on 18 January. This was the last day on rotation for the ganger and their colleague, and the second day on for the IP. The reason for the change of personnel was that, if the team failed to complete the scaffolding on 18 January, the IP would continue the work with a new team. The IP was therefore moved from a different scaffolding activity to ensure a good overlap.
Wednesday 18 Jan 2023, 07.15	The working day began with a morning meeting, when the foreman handed over job package and WP no 770, and agreed to meet the team at the work site.	
Wednesday 18 Jan 2023, 07.30	The work team went to the site and reviewed the WP and the generic risk form for work at height. The A standard was conducted by the team without the foreman present. The ganger had played the same role for the earlier part of the job on 13-17 January 2023. The WP was activated on site at 08.00.	The IP was to build the scaffolding that day. The PSA team was told that the IP was named scaffolding team leader that day, and that the person building is usually assigned that role. This does not accord with the information in the form on risk assessment – carrying out scaffolding activity, where the ganger was named as team leader. The same applied to the completed A standard form.

		<p>BBS explained that the team members agree between themselves on who does what before the work starts, under the leadership of the foreman or ganger. The scaffolding team divided the job between them as follows. The IP was to build the scaffolding, the ganger was to be up with the IP and pass scaffolding materials to them. The latter was to build alone, but stood with one foot on a support board and the other on a ledger, while also moving along the ledger. The third scaffolder would load materials into the lift and hoist it up to the ganger, and would also check materials before placing them in the lift.</p> <p>No work rotation was planned in the team. According to BBS, it is up to the team to agree on work rotation and how it is to be implemented.</p>
Wednesday 18 Jan 2023, 09.15-09.30	The work team took a coffee break.	
Wednesday 18 Jan 2023, 09.30-11.30	The team resumed work. The IP handled the scaffolding materials and built alone while standing and moving about on the ledger below.	During the investigation, the PSA team was told that the safest way to build the scaffolding would have been to install a temporary platform of scaffold boards. That would have provided the IP with a good foothold and reduced the need to stand and move about on the ledger below. One scaffold board was installed, which the ganger used to stand on and pass materials to the IP. Both the IP and the ganger used fall-arrest equipment.
Wednesday 18 Jan 2023, 11.30-12.00	The work team took lunch. At this point, the scaffolding was about 20 metres high.	
Wednesday 18 Jan 2023, 12.00-13.34	The team continued work with the same division of labour. The IP built alone and the ganger supplied scaffolding materials.	

<p>Wednesday 18 Jan 2023, 13.34</p>	<p>According to the ganger, the IP lost their balance while trying to install a ledger at the next level, and fell from 23.5 metres inside the scaffolding. The ledger to which both fall-arrest harnesses were attached fell down together with the IP. The IP and ledger hit scaffolding components when falling.</p>	<p>The safety latch at one end of the ledger must at some point have opened unintentionally, since the latch on the relevant ledger was very loose and was easy to flip up at the slightest touch during the technical investigation of the scaffolding materials after the incident.</p>
<p>Wednesday 18 Jan 2023 After the fall</p>	<p>The scaffolding team immediately reported the incident by radio. The fire station was alerted at once about a fall from height in the process plant. Mongstad's response organisation was activated along with BBS's response organisation, which comprised the local management and the next level at the BBS head office in Kokstad.</p>	<p>The IP, who was seriously injured but had a pulse and was partly conscious, was immediately dealt with by personnel present and eventually by response personnel. They were transported to Bergen's Haukeland Hospital with life-threatening injuries. Next of kin were notified. Equinor halted all scaffolding activity at Mongstad, and all work at height ceased. A town hall meeting was held with all ISS personnel at Mongstad. A similar meeting was held with all contractors on 19 January 2023.</p>

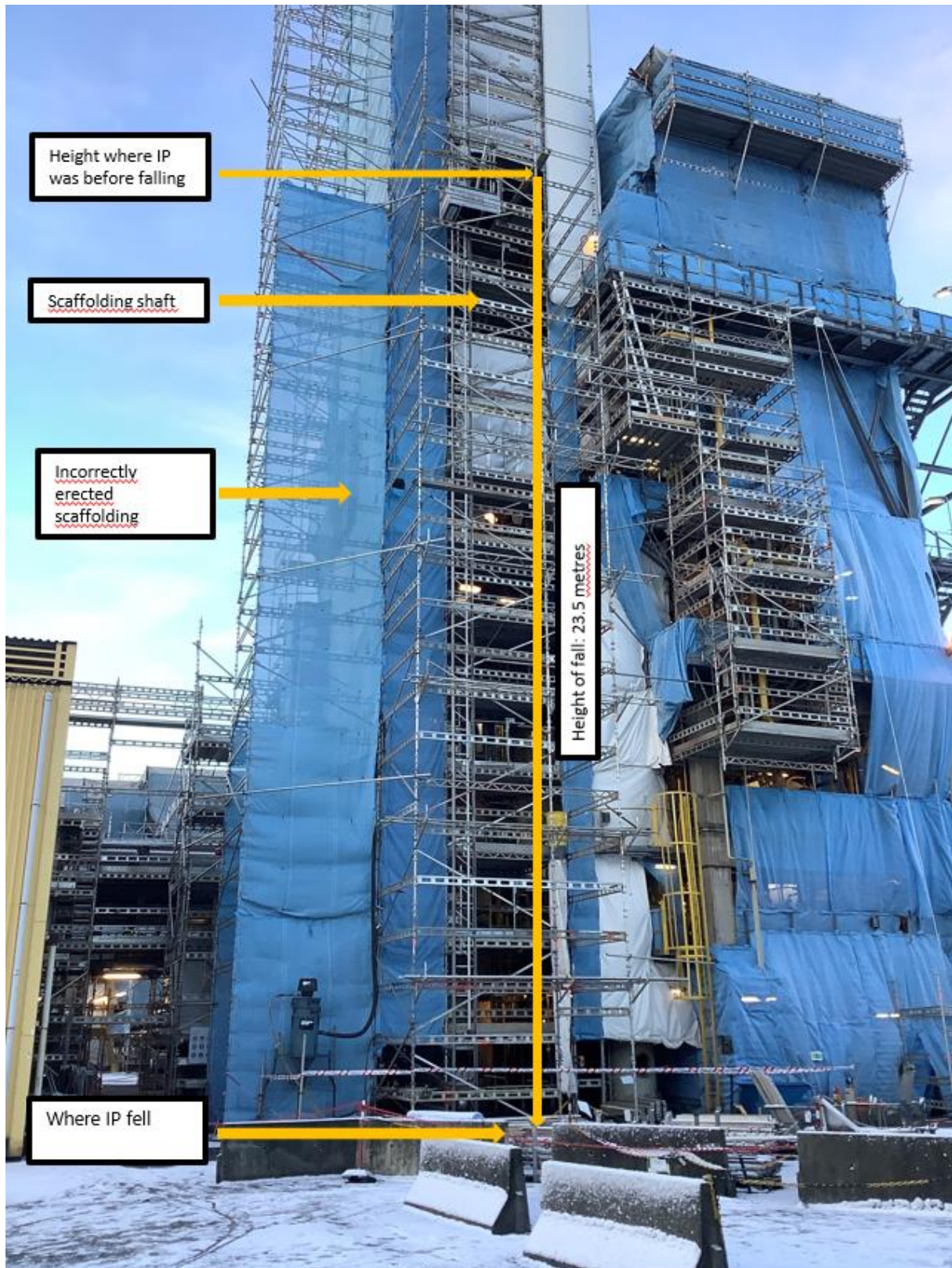


Figure 9. Scaffolding and injury site

4.3 Results from testing scaffolding materials involved

Equinor's centre of expertise for materials and corrosion technology (FOS SMT MCT) has carried out technical investigations of the scaffolding materials involved in the incident, and has compared similar materials from various manufacturers with an eye to compatibility between the various types. The shock absorber on the fall-arrest harness has also been function-tested.

These investigations have been performed by agreement with the police and the PSA, and the report has been shared between the parties.

Conclusions from the MAT-2023021 report:

"Fractures in the standard locking collar and ledger hook on the scaffolding components involved in the accidental fall at Mongstad during January 2023 were caused by ductile overloading. This overloading occurred because the ledger at the time of the fall was only attached to one standard, so that collar and hook were subjected to a substantial bending moment.

"None of the fractures which occurred were related to the material quality of the components and none are associated with material faults, preceding degradation or crack propagation.

"Results from the investigation covered by report MAT-2023021 are similar to mechanical testing of scaffolding in connection with the investigation of the accidental fall on Oseberg B, 7 May 2009, MAT-2009048."

Fall-arrest equipment in use when the incident occurred comprised:

- fall-arrest harness EN 361, brand Singing Rock Basic, three-year guarantee
- fall-arrest Y lanyard EN 358, brand Singing Rock Ring Y 155 cm with large hook K353
- shock absorber, Reactor 140

According to the table from Singing Rock, the total length of the Y lanyard with Reactor 140 shock absorber and large hook is 180 centimetres.

Maximum reaction length is 1.75 metres, with a maximum load of 140 kilograms.

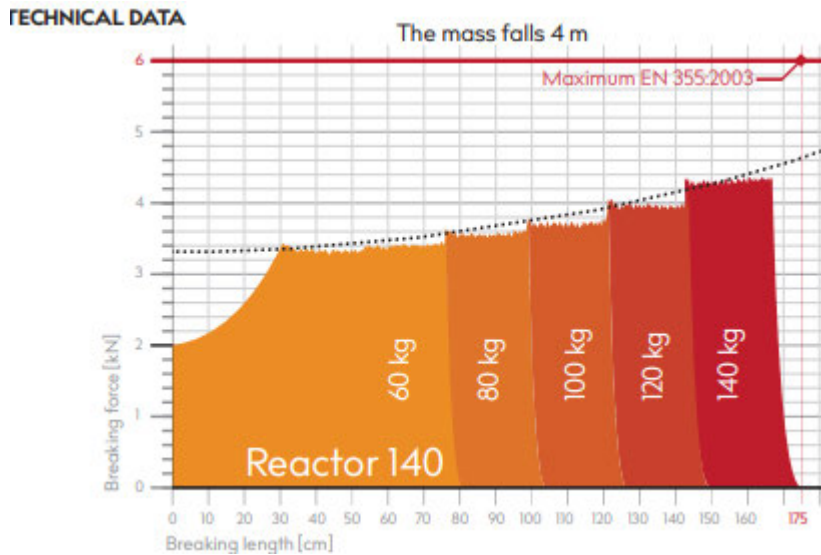


Figure 10. Source: Singing Rock W4400WW00

The Reactor 140 shock absorber involved in the incident was function-tested at Equinor's FOS SMT MCT centre of expertise for materials and corrosion technology. See report MAT-2023021:

"Function testing of the shock absorber has aimed to come as close as possible in practice to the actual conditions at the accident. The simulated fall height accordingly comes to about 1.5 metres, which corresponds to the lanyard length. After a 1.5-metre fall, the shock absorber is then subjected to a "jerk" corresponding to the one which would be experienced by a person protected by a harness. The shock absorber was subject to testing with 80 kilograms of weight, when it activated with a breaking length of about 35-40 centimetres.

"The outcome of the function test shows that the shock absorber would have activated were it subject to the required load."

5 Potential of the incident

5.1 Actual consequence

Serious personal injury after a fall from a height of about 23.5 metres to a flat concrete floor. Pursuant to Equinor's matrix for actual consequences, the incident was classified as an actual level of seriousness of "red 2: serious lost-time injury/personal injury" on a scale from 1 to 5, where 1 is the highest category.

When the IP fell inside the scaffolding, the ledger to which the safety lanyard was attached fell with them. The ledger was bent in the horizontal plane (sideways) and

suffered a fracture in the lower hook where the lanyard was attached. The upper locking collar on the standard fractured.

The IP came into contact with another ledger during their fall, which probably slowed the fall. Clear signs of damage to this ledger could be seen. The ledger was bent from contact with the falling IP, and suffered fractures and cracking in a total of five bracings towards the one end.



Figure 11. Ledger attachment site marked by red circle.

5.2 Potential consequence

Under slightly different circumstances, the incident could have had a fatal outcome. Both the ledger which the IP held in their hands immediately before they fell, and the ledger they were attached to, could have struck the IP during the fall and caused death or lasting disability from a direct hit.

6 Direct and underlying causes

6.1 Direct causes

The direct cause of the incident was that one end of the ledger came loose from the standard and the IP lost their balance on the ledger they were standing on, causing them to fall backwards, and the ledger hook at the other end was bent out of the collar and detached.

6.2 Underlying cause

Inadequate overall risk assessments (see section 2.3.1) for work assignments and choice of safe methods for assembling/dismantling scaffolding materials. Preparation of necessary installation guide. Lack of maintenance and checks of scaffolding materials are a contributory cause of the incident.

Investigation of the accident at Mongstad reveals indications that operating parameters which are cultural and organisational in nature may affect scaffolder safety. The work team assembling and dismantling scaffolding communicates through foremen, who communicate in turn with the supervisor and then the project manager, who communicates with the department head.

Challenges and concerns are kept at the lowest possible level, where the foreman exerts an influence over the information passed on up the organisation.

Risk assessment of work assignments is left to the work team and foremen, who rely in turn on established practice and generic risk assessment forms which do not address the risk of the specific scaffolding to be assembled/dismantled.

Interviews revealed that standing on or securing oneself to a ledger, which could come loose if not adequately latched or where the latch is opened during dismantling, is "normal practice" at Mongstad. It is uncertain how far the risk of this work method is communicated to the scaffolder.

6.3 Direct cause, fracture in attachment to standard and lower hook on ledger

The hooks on the fall-arrest equipment were attached to ledger holes two and three from the one end, marked in red in figure 12. When the ledger is only attached to the standard at one end, marked by a rectangle with dashed lines in figure 12, a load of about 100 kilograms can cause the standard's locking collar to fracture. In the event of a fall, the load can then cause fractures in the collar and ledger hook.



Figure 12. Source: Equinor report MAT-2023021.



Figure 13. Source: Equinor report MAT-2023021. Standard which failed.



Figure 14. Ledger with fracture in lower hook.

Information from the MAT-2009048 report on mechanical testing of scaffolding in connection with investigation an accidental fall on Oseberg B, 7 May 2009:

Test load with load point on beam at a distance of 1.18 metres from the locking collar. Longitudinal girder 90 degrees out from the standard at the collar.

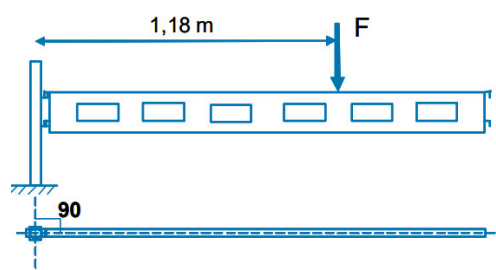


Figure 15. Source: Equinor report MAT-2009048.

Load test of horizontal beam attached at one end to a vertical standard with the other end free gives low maximum force. The locking collar on the standard can cope with a low moment load of about 1 780 Nm. Detachment and deformation of the collar profile then occurs.

6.4 Fulfilling the operators' see-to-it duty

Equinor established a "discipline lead scaffolding" post at Mongstad in 2015. This person was to follow up all scaffolding activity there. Follow-up in the field comprised verification and management inspections together with HSE&Q, where good order and tidiness, execution of scaffolding activities and working environment conditions were followed up. The discipline lead could halt scaffolding activity if they considered it was not being executed in a safe and acceptable manner.

Equinor Mongstad has not had a discipline lead scaffolding since the first half of 2021, and has faced challenges recruiting to the post. The investigation team was informed that Equinor Mongstad had worked over the past year to reduce its earlier close follow-up of scaffolding activities and to transfer more of the responsibility to BBS. During this period, the team was told, misunderstandings had arisen over what was BBS's responsibility and what was Equinor's with regard to delivery and follow-up of scaffolding activities. The team's assessment is that Equinor has not followed-up scaffolding activities adequately at Mongstad since 2021.

6.5 Understanding of the position and decision-making by those involved

All scaffolding activity and work at height involve risk. Interviews revealed that it was up to each work team to determine the method to be used for scaffolding work. As a result, each team has its own method for each activity to be executed. According to 27.01 GOV-MA31-00418, the BBS scaffolding manual, the team must assess whether the chosen method for the activity to be executed "meets risk and efficiency requirements". Assigning responsibility for the choice of method to the work team was regarded by BBS personnel as challenging and burdensome for striking the right balance between risk and efficiency.

Detailed planning, organisation and risk assessment of building the scaffolding was allocated in its entirety to the scaffolding team. According to information received from BBS during the investigation, the team decides which method to choose within the applicable requirements and depending on the complexity of the work. BBS reported furthermore that the foreman prioritises time for follow-up and support in the field on the basis of the complexity of execution and the team's competence and experience. During its investigation, the PSA team was also told that, on the basis of the available information, the foreman and executing personnel had an understanding that the job of building the scaffolding around the goods lift was a simple job with a great need for efficiency since BBS had originally got the installation wrong and was now losing money on this activity.

Understanding the complexity of a job has a lot to say for the decisions taken, and thereby also for which actions are taken. The PSA team's view is that interactions between several different factors related to organisational and human conditions influenced decisions and actions with regard to planning, organising and executing the scaffolding job, choice of method, team composition, and number of scaffolders.

The following conditions can be related to operational factors.

- According to BBS, the composition of the work team is planned when drawing up the WP. The company explained that the complexity and scope of the job determines how many people are needed in each team. Installation of the scaffolding began in December 2022 with a team of four scaffolders, two of

whom built the scaffolding together. After a break of almost a month, building the scaffolding resumed in January 2023 with a permanent team of three scaffolders, of whom two built the structure together. Changes to the work team and the division of roles within it on 18 January 2023 resulted in the IP building the scaffolding alone. It emerged from the investigation that it would be safer for two scaffolders to do this work, one on each side. Building a scaffolding alone increases the risk of becoming unbalanced and falling, since the IP has to move more on the structure and to lift and install material without the opportunity of holding onto the scaffolding.

- Interviews revealed that the safest approach from a risk management perspective would be to build the scaffolding from a temporary platform formed of scaffold boards. That would have provided the IP with a good footing and reduced the need to stand and move about on the ledger below. Installing a temporary platform was not considered during planning or in the generic risk assessments produced by the work team for the relevant job. The PSA team was told by interviewees that building the scaffolding in this way would have taken longer. However, it observed during the inspection that one scaffold board had been installed, which the ganger stood on when passing scaffolding material to the IP. It was reported that the IP stood with one foot on the board and the other on the ledger while building, and moved around using the ledgers.

The investigation has identified the following conditions related to operational parameters.

- In November 2015, BBS was awarded a 10-year frame contract by Equinor for maintenance services related to ISS at Mongstad. A key operational parameter in this agreement was the unit-rate format. All scaffolding activities were basically planned and priced in accordance with this. That means scaffolding activities are priced on estimated cubic metres. Hours for building this scaffolding were neither planned nor priced because it had originally been installed in the wrong place. The goods lift was a new type and, according to interviewees, BBS's lack of experience with it probably explains why the first scaffolding was incorrectly positioned. The completed first scaffolding stood alongside the new one.
- BBS carried out a causal analysis in 2022 following an increase in the number of incidents from July 2022. Where the scaffolding discipline was concerned, a significant negative trend for incidents and productivity in 2021-22 was identified. According to information from BBS, the number of ongoing job packages increased by almost 250 per cent from the beginning of the year and up to November 2022. The causal analysis indicated that the rise in incident

frequency appeared to be related to an increase in the complexity of the execution model as well as in the scope of work.

- BBS foremen are responsible for reporting progress with job packages in Equinor's Pext computer programme. It emerged during the investigation that greater progress is reported than has actually occurred, and that this leads to stress and unrest in the workforce. Excessive attention to efficiency and costs may thereby have had a negative effect on planning, organisation, choice of method and execution of the actual work operation.

The PSA has noted in a number of audits that operating parameters specified in contracts and through contract follow-up can have consequences for HSE. A recent Safetec research project on operating parameters in the Norwegian petroleum industry identified possible relationships between organisational changes and working environment risk. Where the ISS trades are concerned, results from the project showed clear indications that the use of unit rates, campaign-based maintenance and staffing practice at supplier companies had been significant for increased pressure of time, stress and use of overtime for ISS workers. The project also revealed that these conditions might contribute to a higher risk of personal injuries and incidents. (Safetec (2023) - *Endrede rammebetingelser - konsekvenser for arbeidsmiljø og sikkerhet i petroleumsvirksomheten*).

Through the document review and interviews, the investigation has revealed that:

- BBS personnel had experienced a high workload over a long period, but also direct and indirect pressure on progress in terms of delivering efficient operations. The scaffolding team, for example, could see that the surface treatment team was already ready and waiting to use the scaffolding while they were assembling it.
- When a time-out was held in October 2022 at Mongstad, BBS personnel commented that pressure on progress and productivity could explain the negative trend for incidents.
- Poor productivity and working conditions had found expression in the form of stress and pressure in the organisation. BBS personnel constantly received reminders that the company was making a loss on this contract. According to interviewees, this resulted in uncertainty among employees over their own job position and a feeling that they had to perform better or work faster
- BBS reported that the company received feedback on the a high level of stress in its monthly measurements of temperature in the psychosocial working environment at Mongstad, and reference was made to the concentration on progress as the main reason for the pressure and stress experienced.
- Equinor conducted a human rights assessment of BBS personnel at Mongstad in July 2022. The results revealed specific risk factors for these employees, related in part to organisational and psychosocial conditions such as

discriminatory treatment of foreign personnel and temporary hires compared with Norwegian employees, management pressure to work faster, and incidents of harassment. The investigation team was told that some of the findings in this assessment were still relevant for BBS personnel at Mongstad.

- It emerged from the investigation that foreign BBS personnel had been subject over a long period to bullying, harassment and lack of management support. Personnel who failed to deliver as expected found themselves being abused, threatened with dismissal or called in to management and reminded that they worked too slowly. The PSA team was told that the IP had personally witnessed such behaviour the day before the incident.

Understanding of the job's complexity and the factors which have influenced it among those involved has led to inadequate planning, organisation and execution of the scaffolding activity. The PSA team takes the view that inadequate planning, organisation and execution of the activity, together with the contract format, high workload and stress, were contributory causes of the incident.

7 Emergency response

Emergency response is described overall in this report through the measures initiated during the alarm/notification, mobilisation and rescue phases up to transport of the IP in Mongstad's own ambulance to Haukeland Hospital, as these actions emerge from logs, interviews and inspection at the incident site.

The description of the normalisation phase is confined to the return of the ambulance involved with crew to Mongstad immediately after the transport to hospital at about 15.05. In addition, the incident site was cordoned off on the orders of the police immediately after the incident to secure scaffolding materials and other evidence.

BBS halted all scaffolding work at Mongstad immediately after the incident, assembled its personnel for a briefing on what had happened, and offered them conversations and other crisis follow-up.

Two response organisations at Mongstad were activated as a result of the incident. The primary was at Equinor Mongstad, whose control room was first notified by radio about the incident, while the BBS response organisation was also notified immediately after the event.

The PSA team's overall impression is that the response functioned well from alarm to normalisation phases, and in accordance with Equinor Mongstad's emergency response plan. It has found that the H&S service responded continuously from the alarm was sounded until the important first aid function could be implemented for

the seriously injured person. The latter was then stabilised and readied for ambulance transport to Haukeland Hospital, including removal of safety harness and work garments. Transport to hospital utilised Mongstad's own ambulance in collaboration with the district medical officer/local (Austrheim) emergency medical service and the emergency medical communication centre (AMK)/Western Norway Regional Health Authority.

About 15 minutes passed from the first notification by radio until the IP was on their way out of the Mongstad plant, which is well within Equinor's WR-1920 requirements for response time and performance and also accords with section 77 of the activities regulations on handling hazard and accident situations.

The incident occurred during a shift change, which meant that double staffing was available at the fire station. Under slightly different circumstances, normal staffing there would have been two people. That could have made dealing with an incident of this scope demanding. The Mongstad ambulance and part of the response personnel were away on the transport assignment until about 16.00.

On the other hand, the PSA team sees some conditions with an improvement potential. These relate in part to collaboration between Equinor and BBS over specific response measures and response training/drills, and to clarification of which agreements have been entered into on emergency response – including first aid and rescue from height.

7.1 Equinor Mongstad's emergency response organisation

The WR-9007 emergency response plan for the first (ERT) and second (IMT) lines at Equinor Mongstad describes how DSHAs are to be handled in the various phases which follow each other in time and which will overlap to some extent. The plan is based on the regulations for land-based petroleum operations and companies required to have an H&S service as well as on Equinor's internal requirements. Performance requirements (PR)s have also been established for response measures, and are specified in the WR-1920 guideline on emergency preparedness in MMP OPL.

In addition, the emergency response organisation includes the third (CMT) line located at Equinor's Forus office.

Emergency response duties and efforts, with descriptions of roles, staffing and teams, are defined on the basis of emergency preparedness analyses for the Mongstad plant. In all, the H&S service in Mongstad's emergency response department comprises 16 people in addition to other response personnel, including firefighters/smoke divers, who can be mobilised as and when required.

7.2 BBS Mongstad's emergency response organisation

BBS's response organisation is described in a dedicated emergency preparedness plan, GOV-AP17-00175, which states that it is organised in a way which can be taken to mean that a first line is established at the actual plant, in this case Mongstad, led by the BBS project/site manager, and that the second line is BBS Kokstad, which includes other emergency functions and the emergency response duty officer.

Furthermore, the description of first-line responsibility can be taken to mean that the operator of the onshore plant or offshore facility has primary responsibility for handling the first-line response (see section 2.3 of BBS's GOV-AP17-00175 plan on notification of and communication concerning incidents with the operator/customer's first line).

See otherwise section 2.2.1 on the emergency response organisation – Equinor and BBS at Mongstad.

7.3 Cooperation with civil emergency services

Emergency response at Mongstad is based to a great extent on interaction and coordination with civil emergency services, including police, fire and rescue, and the public health system through the AMK. Generally speaking, a collective – or triple – notification will be issued to the emergency services in the event of an emergency, as was done in the initial phase of this incident.

The external services notified of and involved in this incident were the AMK/Western Norway Regional Health Authority, including the local emergency medical centre, as well as the police and the fire/rescue service.

Equinor Mongstad's own H&S service was primarily responsible for life-saving first aid and emergency response at the injury site, and for ensuring that the IP was readied and thereafter transported from the plant to Knarvik in Mongstad's own ambulance. It had initially been agreed that an air ambulance would meet the vehicle at Knarvik for onward transport to Haukeland Hospital.

By agreement, Austrheim's district medical officer accompanied the ambulance from the Mongstad gatehouse to Knarvik, where preparations had been made for onward transport by air ambulance from Florø. After a collective assessment by medical and health personnel from the air ambulance, it was decided that the Mongstad ambulance would transport the IP the whole way to Haukeland Hospital for further treatment. Medical personnel from the air ambulance joined two of Mongstad's own ambulance crew for this journey.

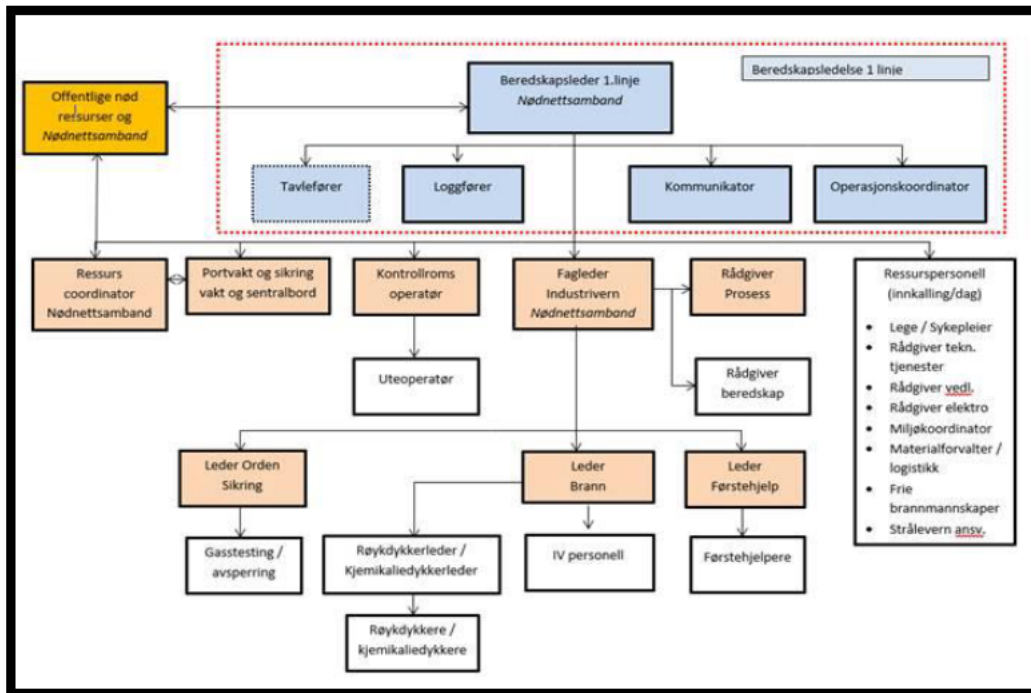


Figure 16. Emergency response organisation at Mongstad – first line (ERT) and H&S service. (Source: Equinor)

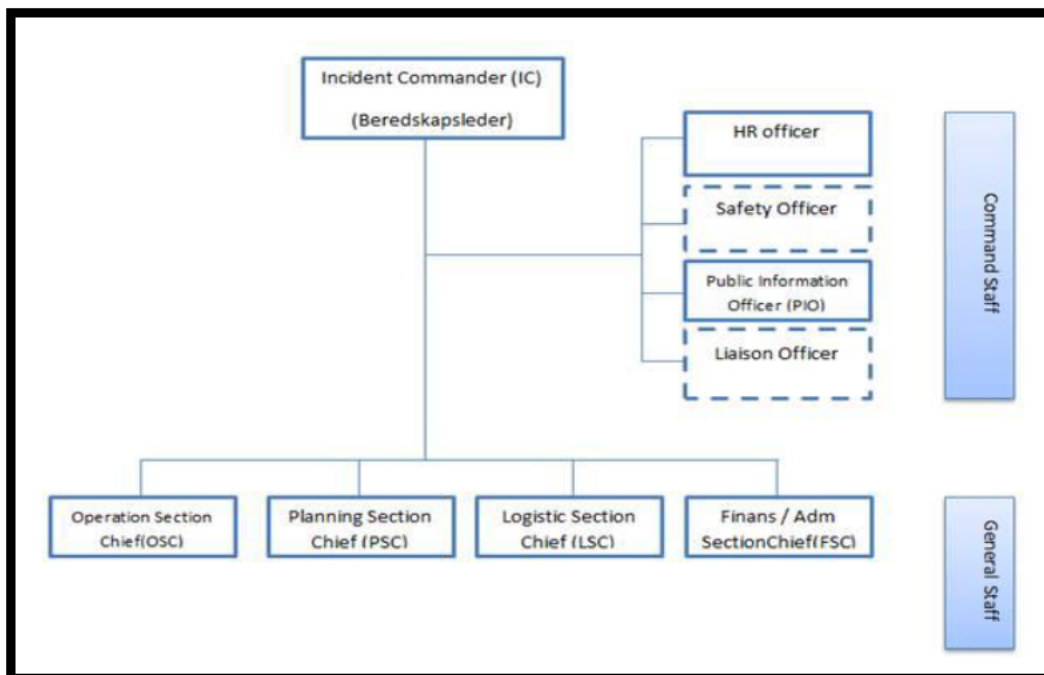


Figure 17. Emergency response organisation at Mongstad – second line (IMT) (Source: Equinor)

7.4 Alarm – notification and mobilisation

Equinor Mongstad's first line, with the H&S service as the operational unit out in the plant, was immediately notified and mobilised from the fire station. The second line was also notified and mobilised in its premises. Four safety service members from the

fire station immediately responded to the specified incident site. They encompassed the H&S supervisor and a first-aider in an ambulance and a response vehicle with personnel as well as other responders who were called in.

The following appears in the log kept by the Equinor first line while responding: "Incident in A-5100, person fell 20 metres from T-510. Occurred 13.34. DSHA 2 – acute medical treatment. Person partly unconscious, breathing and has pulse. Triple notification implemented. Further notification remains to be done."

Arriving at Mongstad at about 13.50 with several units and five officers, the police were directed to the incident site by Equinor/security personnel. The fire and rescue service also arrived after a few minutes and was stationed at the main gatehouse. In addition, a local ambulance arrived at the gatehouse but was not put into service in the plant since Mongstad's H&S service was already administering first aid and making preparations to transport the IP.

The PSA was notified by phone at about 13.40 on the same day.

7.5 Rescue of the IP

Logs show that it took about 15 minutes from mobilisation of the H&S service until the IP had been given first aid, had their harness and work garments removed, had been stabilised and made ready, and was in the ambulance on the way out of the Mongstad gate. It was agreed during this period that the district medical officer should join the ambulance before it left for Knarvik, and it was agreed a little later that the latter would continue all the way to Haukeland Hospital.

The first people to assist the IP were colleagues from BBS, who are not required to know first aid or cardiopulmonary resuscitation (CPR). That is not thought in this case to have jeopardised treatment received by the IP before the H&S personnel arrived.

See section 7.3 on cooperation with civil emergency services for further details.

7.5.0 Requirements for rescuing people from height

Equinor states the following in governing documentation for work at height, see OM 205.04 R-109206.

- When work is conducted with fall-arrest equipment, at least one assisting person must be present at the work site at all times. Rescue must be planned.
- Rescue is planned when the work team was agreed on the rescue method. In cases where the team considers rescue to require the assistance of a fall rescue team, the leader of the latter must participate in the planning.
- The leader of the fall rescue team draws up a rescue plan and installs the required equipment if necessary. They inform the rest of the fall rescue team.
- The rescue plan must be available at the workplace.

- Where a WP has been issued, the rescue plan must be attached to it.

In the PSA team's view, this requirement was not met ahead of this incident to ensure that a possible rescue had been planned if a person were left hanging – 10 metres above the ground, for example.

8 Other regulations and norms

Equinor refers in OM205.04 Work process, rev no 3.8 to:

- 113 Recommended guidelines for fall-arrest and rescue (Offshore Norge)
- section 17, *FUA*
- 105 Recommended guidelines on competence requirements for scaffolders (Offshore Norge).

OM205.04.01 Work process rev 3.3 Assemble, dismantle and cover scaffolding – midstream and downstream I-109446.

Working Environment Act regulations to be observed, see OM205.04

- Regulations on organisation, management and employee participation
- Workplace regulations
- Regulations on the performance of work
- Regulations on action and limit values
- Producer responsibility regulations
- Regulations on administrative arrangements.

Parts of these regulations do not apply to petroleum operations at onshore plants. See the area of application for the specific regulation. Equinor has nevertheless chosen to adopt the regulations as a whole as internal requirements for its activities. See section 8 of the management regulations.

Applicable standards

- NS 9700 Scaffolds and encapsulation constructions
 - Part 1: Technical requirements and requirements for training, assembly and use
 - Part 2: Requirements for certifying scaffolders.

BBS refers to the following regulations under the Working Environment Act

- Producer responsibility regulations
- Regulations on the performance of work.

Parts of these regulations do not apply to petroleum operations at land plants. See the area of application for the specific regulation. BBS has nevertheless chosen to

adopt the regulations as a whole as internal requirements for its activities. See section 8 of the management regulations.

9 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.

Nonconformities and improvement points are divided here into two categories – one related directly to Equinor in sections 9.1 and 9.2, and the other related to nonconformities at BBS in section 9.3.

9.1 Nonconformities – Equinor

9.1.0 Inadequate risk assessment

Nonconformity

The responsible person has not ensured to a sufficient extent that the general risk faced by scaffolders during assembly and dismantling has been adequately identified through internal requirements.

Grounds

The OM205.04 and OM205.04.01 procedures on executing work at height and assembling, dismantling and cladding scaffolding respectively in Equinor's governing documents were reviewed. This revealed that regulatory requirements for risk reduction from both the PSA and the Labour Inspection Authority are not adequately covered in the procedures themselves. Assurance must be obtained that assembling/dismantling work is fall-preventive where possible, rather than based on fall-arresting.

Generic risk assessment forms have been developed for completion by the executing worker, but these take little account of the relevant risk and method associated with assembling/dismantling the specific scaffolding. These forms specify that fall-arrest is to be selected for work at height, but do not take account of risks associated with choosing the right equipment or attaching fall-arrest gear to the structure.

The forms are also unclear about self-rescue and contacting the H&S service for an assessment of rescue.

A review of similar reported incidents at Equinor identifies several events with a comparable outcome to this one. In addition, the Oseberg B incident in 2009 was of the same character as this event.

- No systematic risk assessment of various scaffoldings was conducted at the plant with regard to risk to personnel executing assembling/dismantling. As a result, the relevant scaffolding was not identified as safety-critical and its installation was viewed as a routine job.
- The risk of falling and the significance of limited security opportunities were not assessed, and fall-arrest was the only barrier provided in conditions which posed a big threat of a fall. Limited opportunities were available for attaching the fall-arrest lanyard to a fixed structure, and the job required the scaffolder to balance on a longitudinal ledger (23.5 metres above a concrete floor) to install further ledgers and fix their safety latches at each end.
- No installation guidance or written instructions, with additional and detailed information on the relevant scaffolding, had been prepared to ensure that it could be assembled/dismantled in a safe manner.

Interviews revealed that the procedure chosen was the usual practice at Mongstad, and was based on efficiency rather than risk.

Adequate routines for risk-reducing measures and choice of method based on lessons learnt from incidents, including Oseberg B, have not been incorporated in Equinor's governing documents for assembling/dismantling scaffolding.

Requirements

Section 8 of the management regulations on internal requirements

Section 4 of the management regulations on risk reduction

Section 7 of the framework regulations on responsibilities pursuant to these regulations

9.1.1 Follow-up of other participants

Nonconformity

Lack of follow-up of BBS and its management system.

Grounds

Equinor has not followed up the BBS management system adequately to ensure satisfactory expertise among personnel providing scaffolding services at Mongstad.

The investigation reveals a high turnover of personnel and the need for a large number of scaffolders at times.

Much use is made of foreign personnel, who must be able to speak English. Interviews reveal that the quality of English skills varies. This has also been noted by the investigation team during interviews.

Interviews reveal that new personnel receive inaccurate information about rescue on first arrival at the plant. That emerges clearly in risk assessments for executing

personnel. These state that the H&S service must be notified in the event of an incident. Contacting the H&S service if an incident occurred was regarded by the work team as adequate rescue planning. That also emerges from the A standard and the generic risk form which scaffolders were to complete before work began. The H&S service is only responsible for treating an injured person from ground level and out of the plant. It is not involved with rescue up in the actual scaffolding, but from a safe platform.

The investigation has also found that inadequate training is provided on using PPE, such as fall-arrest equipment. Nor is any training given on self-rescue, contrary to the Equinor requirement in its governing documentation.

It emerged from the investigation and interviews that BBS does not comply with the requirements set by Equinor for the composition of a scaffolding team, which calls for a skilled scaffolder. This was made known to Equinor, which in turn required BBS to report on the coverage of skilled scaffolders. The investigation team has observed that BBS counts foremen who do not actively participate in the work as part of the actual scaffolding team, and reports them among the skilled scaffolders to Equinor in order to satisfy the requirements. The latter are that a scaffolding team must include at least one skilled scaffolder, while other members must have training as scaffolders to ensure quality and professional work.

Requirement

Section 21 of the management regulations on follow-up, see section 1 of the management regulations 5 on information and section 50 of the technical and operational regulations (TOF) on competence

9.1.2 Failure to ensure conformity between its own emergency plans and response, and those of other participants

Nonconformity

No written or formal agreement has been entered into on how Equinor should exercise responsibility for emergency response at Mongstad for BBS personnel, or what that involves in terms of specific response measures.

Grounds

Interviews and document reviews, including response plans for both companies, show that these are unclear and that no clear agreements and plans exist about what support Equinor should provide, and in what way, for any emergency response at Mongstad where BBS personnel are involved. It has not been clarified to what extent, and how, BBS itself will ensure self-rescue and its own response measures in the event that, for example, fall rescue, rescue at height or first aid are required.

Requirements

Section 66 of the TOF on emergency preparedness plans, see section 67 of the TOF on handling hazard and emergency situations

Section 6 of the management regulations on management of health, safety and the environment (clarification of responsibility)

9.1.3 Emergency response plan does not cover rescue at height**Nonconformity**

The WR-9007 emergency response plan for Mongstad provides no specific information on what planned measures are in place for rescuing personnel who, for example, are hanging from a scaffolding or other high point which complicates rescue from the ground, or on who should perform such a rescue.

Grounds

The emergency response plan has not described nor defined rescue at height as a response measure or how or whom will be responsible in the event for such rescue. See Equinor's WR-1920.

Requirements

Section 66 of the TOF on emergency preparedness plans, see section 67 of the TOF on handling hazard and emergency situations

Section 6 of the management regulations on management of health, safety and the environment (clarification of responsibility)

9.2 Improvement points – Equinor**9.2.0 Inadequate manning in the H&S service****Improvement point**

Equinor Mongstad's H&S service has not identified and publicised which personnel can carry out fall rescue or rescue from height.

Grounds

Under slightly different circumstances, this incident could have left the IP hanging high above ground level and a need for rescue at height would then have arisen. The H&S service is not adequately staffed for such rescues. See Equinor's WR-1920.

Requirement

Section 67 of the TOF on handling hazard and emergency situations, see section 65 of the TOF on the emergency preparedness organisation.

9.2.1 Inadequate emergency drills and training involving ISS trades/BBS

Improvement point

No systematic emergency response drills or training are conducted in the form of, for example, co-training with ISS contractor BBS. That may also apply to other contractors who are present at Mongstad over long periods.

Grounds

Interviews and document reviews revealed that no plans or agreements exist on systematic co-training of the preparedness organisations or personnel maintained by Equinor and ISS contractor BBS at Mongstad.

Requirements

Section 65 of the TOF on the emergency preparedness organisation, see section 67 of the TOF on handling hazard and emergency situations

Section 50 of the TOF on competence

9.3 Nonconformities – Beerenberg Services

9.3.0 Risk assessment and organisation of the work

Nonconformity

Failure to organise the work in such a way that the probability of errors which can lead to hazards or accidents is reduced.

Grounds

The responsible party must choose technical, operational and organisational solutions which, through early planning and organisation, reduce the probability of harm, errors, hazards and accidents arising. Work at height is regarded as risky, which imposes more stringent requirements for risk assessments. That applies not only to execution of work at height (from scaffolding) but also for personnel assembling/dismantling scaffolding.

The responsible party has not carried out an overall risk assessment for safe execution of the work as specified in the norms for scaffolding assembly/dismantling referenced by both BBS and Equinor.

Installation guides have not been prepared or provision made for fall-arrest equipment and rescue related to the work which scaffolders are assigned to execute.

BBS cannot document that the risk involved in executing scaffolding activities and using PPE have been assessed other than through generic risk assessments provided by the A standard and WP forms.

As far as possible, provision must be made for collective fall prevention rather than personal protection measures. This is also emphasised by training measure from industry associations and the European working environment agency.

Interviews with senior personnel and a review of governing documents show that no emphasis is given to collective prevention measures when building scaffolding from a safe platform/scaffold floor, since this involves additional work.

It emerges from interviews that a number of workers have questioned the method used at Mongstad where scaffolders are assigned to assemble/dismantle scaffolding with fall-arrest alone by standing on a ledger with a pipe diameter of about three centimetres and attached to scaffolding materials by a fall-arrest harness using 1.5 metres of Y-shaped lanyard with shock absorber and hooks. Interviews reveal that BBS claims this to be legal in Norway. On that basis, the scaffolders execute the work of assembling and dismantling scaffolding with no emphasis given to fall-prevention measures.

The risks associated with mixing materials from various manufacturers and components belonging to different generations of scaffolding material from the same manufacturer have not been assessed beyond confirmation from the manufacturers that the material matches the connection components. Statements from manufacturers shown to the PSA team by BBS confirm that the materials can be used together, but emphasise that product responsibility ceases to apply with such mixing.

In interviews and through document reviews, BBS was unable to present analyses for risk or for emergency preparedness in relation to work at height.

Analyses are meant to be appropriate in that they provide decision support for this or that process, operation or phase involved in planning scaffolding work. According to BBS's procedures, a risk analysis must be reviewed by a new work team, at shift changes, at the start of a new job and when possible changes are made to a team.

Requirements

Section 46 of the TOF on organisation of work, see section 17-1 of the FUA on risk assessment of work at height

Section 4 of the management regulations on risk reduction

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

9.3.1 Organisation and execution of maintenance

Nonconformity

BBS had failed to ensure adequate maintenance and checks of scaffolding materials.

Grounds

According to installation guides from scaffolding manufacturers, ledger safety latches must be checked and tightened if they are loose. The documentation states that scaffolding material must be checked during dismantling and before assembly. In addition, interviewees confirmed that this was how checks were conducted. It also emerged from interviews that time is not available to maintain scaffolding materials during intermediate storage before they are reused. During inspection of the area where the investigation occurred, the PSA team observed that damaged materials had been taken out and transported to the site for completing installation of the scaffolding. Several ledgers with loose safety latches were also observed.

Requirement

Section 58 of the TOF on maintenance

9.3.2 Expertise

Nonconformity

BBS had not ensured that personnel have the necessary theoretical and practical expertise required to install scaffolding.

Grounds

Interviews with BBS personnel who follow up expertise revealed that the company has not quality-assured or implemented a system to quality-assure the training bodies which train their own scaffolders and temporary hires. BBS accepts documentation submitted and feedback from scaffolding foremen.

The training which is given does not accord with the training norm in guideline 105 from Offshore Norge, which is 54 hours of theory and 108 of documented practical exercises within the same modules. According to interviews, training for assembling and dismantling scaffolding was given over two days.

Documentation on the use of fall-arrest equipment, where the requirement is 3.5 hours of theory and four of practical exercises, was given as brief virtual training without necessary practical exercises.

None of the scaffolders had training in self-rescue and first aid.

None of the scaffolders assigned to install scaffolding had trade certification as skilled scaffolders. Equinor's frame agreement with BBS requires compliance with Offshore Norge's 105 Recommended guidelines on competence requirements for scaffolders. Expertise requirements for a scaffolding team are provided in section 2.4, which specifies at least one skilled scaffolder per team. Other team members must have received training as scaffolders.

Requirement

Section 50 of the TOF on competence, see paragraphs two and three of the guidelines

9.3.3 Communication of information**Nonconformity**

Important information for the ability to plan and execute activities was not adequately communicated to the relevant users.

Grounds

Procedures, installation guides and user manuals are to be considered necessary for planning and executing activities in a safe manner. This information must be communicated to the relevant users, and must then be made available in a language which the relevant workers understand.

BBS's governing documents for risk and safety are available only in Norwegian and English. Governing documentation from Equinor, such as OM 205.04 Work at height, which BBS works in accordance with and which forms the basis for safe work at height, are also available only in Norwegian and English.

None of the relevant people interviewed by the investigation team came across as having problems understanding questions put to them in English.

Requirement

Section 15 of the management regulations on information, see section 3-2, third paragraph of the Working Environment Act

9.3.4 Self-rescue, fall rescue and rescue at height are not planned and prepared for, or described in the emergency response plan**Nonconformity**

BBS has not made sufficient plans for drilling personnel working at height in self-rescue, nor are any measures for this evident in the emergency response plan. GOV-AP17-00175, the BBS emergency preparedness plan, provides no specific information on which planned measures are in place to ensuring that the company's own personnel can provide life-saving first aid/CPR should the need arise – as, for example, during this incident.

Nor had any written or formal agreement been entered into with Equinor on how responsibility for fall rescue/rescue at height will be handled for the ISS contractor/BBS at Mongstad.

No adequate training was provided in self-rescue or use of a fall-arrest block.

Grounds

Interviews and document reviews revealed that no specific and written agreements exist on how and by whom fall rescue/rescue at height will be conducted in the event, for example, of a fall from scaffolding where a person might be left hanging 10-20 metres above ground.

Nor, apart from the actual notification routines, are fall rescue or other emergency measures described in a dedicated emergency response plan.

It is also not possible to document that resources for conducting fall rescue/rescue at height are available at Mongstad at all times when work is under way on either assembling or dismantling scaffolding or other ISS work on scaffolding, whether this is being pursued by either BBS or Equinor at Mongstad.

Interviews, internal requirements and document reviews revealed that a scaffolding team is expected to carry out self-rescue in the event of an accidental fall. Various explanations were provided of how training on self-rescue is taken care of, and a number of people reported that they had not received such training and were thereby unable to use a rescue block, for example.

It also emerged from interviews that a number of people could not use a rescue block since they had not received sufficient training in its safe utilisation and thereby knew little or nothing about this equipment.

Rescue from height for the relevant work being done when the incident occurred was not assessed before executing the job. Several members of the relevant scaffolding team had received no training in self-rescue or in using the rescue equipment available at Mongstad.

GOV-AP17-00175, the BBS emergency preparedness plan dated 23 January 2023, contains no specific measures for rescuing personnel at height or plans for providing first aid/CPR to its own injured personnel.

During this incident, several BBS personnel were the first to come to the aid of the IP, but none are required to have first-aid capabilities or could document these.

Nor is there any general requirement for BBS personnel at Mongstad to have first-aid competence. In corresponding work offshore, the general rule is that all personnel must have a basis safety course with subsequent refresher courses, where first aid and CPS are included as one of the main modules.

Requirements

Section 66 of the TOF on emergency preparedness plans, see section 67 of the TOF on handling hazard and accident situations
Section 50 of the TOF on competence

9.3.5 Emergency drills and training are not carried out systematically for BBS personnel

Nonconformity

No systematic emergency response drills or training of own personnel are conducted at Mongstad, as required by section 3.1 of GOV-AP17-00175, the BBS emergency preparedness plan.

Grounds

Interviews and document reviews revealed that no systematic emergency response drills or training are conducted by BBS's emergency preparedness organisation or personnel at Mongstad

Requirement

Section 65 of the TOF on emergency preparedness organisation, see section 67 of the TOF on handling hazard and accident situations and section 52 of the TOF on practice and exercises

9.3.6 Management of the psychosocial working environment

Nonconformity

BBS had not ensured a good psychosocial and organisational working environment by taking account of conditions which could affect worker health, safety and welfare at Mongstad.

Grounds

Document reviews and interviews revealed that BBS and Equinor Mongstad were aware of conditions which were significant for the psychosocial and organisational working environment and which could have consequences for the health and safety of BBS personnel at the plant (see section 6.5 above).

Information on conditions which were significant for the psychosocial working environment also emerged from Equinor's human rights assessment of BBS personnel at Mongstad in July 2022. The results revealed discriminatory treatment of foreign personnel and temporary hires compared with Norwegian employees, management pressure to work faster, and incidents of harassment. The investigation team was told that some of the findings in this assessment were still relevant for BBS personnel at Mongstad.

Inadequate organisation of psychosocial and organisational conditions in the work meant that a high level of exposure – through high levels of work, for example, pressure of time, bullying and lack of management support – had continued over several years. However, BBS was unable to show how the company systematically used this information to ensure a good psychosocial and organisational working environment in relation to conditions which might affect the health, safety and welfare of the workforce.

Requirements

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

Section 47 of the TOF on psychosocial conditions

10 Barriers

Ahead of the actual incident, the investigation team has been unable to find barriers which functioned adequately and could thereby have contributed to preventing a serious outcome, such as functioning fall-arrest equipment, for example. This applies to human, organisational and operational barriers.

It can be said that, to a certain extent, PPE such as a hard hat and other clothing probably helped to reduce personal injury.

After the IP fell to the ground, Mongstad's emergency response organisation was notified and activated speedily and without wasting time. The H&S service's personnel arrived quickly at the incident site and initiated life-saving first aid before readying the IP for transport to hospital in Mongstad's ambulance.

11 Discussion of uncertainties

The investigation builds on interviews with personnel involved, inspections, reconstructions at ground level and document reviews. An interview was conducted on 19 June 2023 with the IP. It had not been possible to speak with them before then because of their condition after the incident. The rest of the work team was interviewed on 14 February 2023. Witnesses remember more accurately and completely soon after an incident. The more time passes, the more memories of the incident may be influenced by other people and their perception of the event. However, the investigation team has decided that this has not been significant for its conclusions.

Uncertainty has prevailed about who acted as leader of the scaffolding team. The PSA team was told that the IP was name leader of the scaffolding team that day, and that the person doing the building usually becomes team leader. That does not accord

with the form on “risk assessment – carrying out scaffolding activity”, where the ganger was named as team leader. The completed A standard form said the same.

12 Assessment of the player’s investigation report

Equinor’s investigation report provides a thorough presentation of the facts relating to the incident. Much work has been devoted to assessing the scaffolding materials and the mixing of materials from different manufacturers. The Equinor investigators have held meetings with both manufacturers of scaffolding materials and experts on assembling and dismantling these. During its investigation, Equinor has used several approaches – such as human factors analysis tools (HFAT) – to understand how the incident occurred.

The conclusion reached by Equinor’s investigation team appears rather vague. Much attention is paid here to the scaffolders and what those installing the scaffolding knew about the direct cause. Little consideration is given to the responsibility of the employer and the principal enterprise for necessary training, risk assessments and organisation.

What manufacturers think of scaffolding manufacturers mixing components from several sources is made clear in their user instructions and in section 17-8 of the FUA. When the employer fails to follow the installation guides from the manufacturer, a qualified person must prepare an assembly plan and inform the scaffolding team about risks presented by the work. The installation guides from manufacturers explain how they recommend attaching fall-arrest hooks to the scaffolding.

The importance of ensuring that ledger latches are placed in the locked position is well known to both Equinor and BBS as well as other scaffolding contractors. Attention is paid to this in their own instructions and in PSA audits when following up work at height. For years, the PSA has been highlighting this weakness with latches and the importance of ensuring that they are in the locked position. It has also called the attention of both Equinor and contractors through several audits to the need to make provision for maintaining and checking scaffolding materials. The installation guides from some manufacturers include tightening ledger latches in the measures to be carried out during maintenance.

Equinor notes that no requirements exist for dimensioning loads, testing or design in order to use scaffolding materials as the attachment point for fall-arrest equipment. On this point, BBS’s scaffolding manual states that the attachment point must be able to cope with a minimum load of 10 kN.

Section 6.11.2 in NS 9700-1 specifies that the attachment point for fall-arrest must cope with at least nine kN. This standard is referenced by both Equinor and BBS. Information from NS 9700-1 is also repeated in section 9.2.2 of NS 9610.

The relationship between the use of collective protective measures rather than PPE is highlighted both in section 4 of the PSA's management regulations on risk reduction and section 17-6 of the FUA. Use of collective protection measures is the focus of attention in the textbook from the SEF and has been on the agenda at the scaffolding seminars held annually by the SEF.

Expertise requirements for training scaffolders are well established, and are also referenced by both Equinor and BBS. A new training standard was developed in 2016 through Standards Norway with contributions from the industry, the government and the industry association. The latter has also produced training materials for scaffolders, so that good provision is available for obtaining the necessary theoretical teaching followed by practical training in the company.

The employer is responsible for ensuring that personnel who execute work have the expertise necessary at all times for executing activities they are assigned to carry out. When the employer opts to use foreign workers to execute work, they must also ensure that the personnel assigned to do the work have the necessary understanding and training pursuant to the requirements which apply in Norway.

In the PSA team's view, most of the requirements for safe working are in place. The industry association has done a great deal of work to make provision for adequate training through the SEF and the Federation of Norwegian Coating, Insulation and Scaffolding Contractors (KIS). Principals and employers must ensure compliance with the measures adopted by the government and the industry association for safe working. Both the PSA and the Labour Inspection Authority refer in their regulations to the norms which are to be applied to ensure adequate practical and theoretical training. The PSA also describes conditions relating to the use of recognised standards in section 24 of the framework regulations.

The PSA is otherwise positive to continuing its collaboration with both the industry as a whole and the individual players to strengthen safety in the industry even further.

13 Appendices

A: The following documents have been drawn on in the investigation.

- Organisasjonskart-Equinor-Mongstad januar 2023
- OM205.04 - Utfør arbeid i høyden - Mid & downstream
- OM205.04.01 - Montere, demontere og tildekke stillas - Mid & downstream
- 20A02 Info from operation

- 26.01 Gjeldende Notification plan for unwanted incident 3871 Mongstad - 17.04.2022 TL
- 26.01 Helseovervåkning Mongstad 2021-2022
- 27.01 Fagbrevsandel
- AT 1310 0001549245
- AT 1310 0001560770
- AT fra 8_9 des jobbpakke 20A02
- AT for dagen
- Criterias and measures to resume work at height at Equinor Mongstad 27.01.2023
- Equinor - BBS_Human Rights Assessment report_Issue 2_final
- ERT First Meeting
- ERT Log
- Granskingsmandat Equinor
- MAT-2023021 Undersøkelse av stillasmateriell fra fallulykke_Mongstad_sign
- HMS arbeidsmøte på tvers 26
- IMT Status meeting
- Incident Brief
- Jobbpakke 20A02
- Risiko jobbpakke 20A01, 20A02 og 20A06 Onpager V.1.0
- Risikoanalyse 20A01 20A02 og 20A06
- Synergi 2330684_forslag til arbeidsomfang pr 22012023
- 14.02 Ytterligere dokumentasjon Ptil - testrapport og risikovurdering_13.02
- 15.02 Ptil - Spørsmål om fallsikringsutstyret_15.02
- 28.02 SV_ Risikovurderingen jobbpakke_27.02
- 20180911_HAKI uttalelse om blanding av utstyr
- Aluhak Systemstillas+i+aluminium+klasse+1-6 monteringsanvisning
- Manual_HAKI Hengende stillas_NO
- Monteringsanvisning_Aluscaff_2022-02_Norsk_230124_190737
- Skriv fra Delta
- 24.02 Ptil - RUHer som er meldt inn på utfordringer med fallsikringsutstyr. 21.02
- Prosess Demontere stillas
- Prosessbeskrivelse utføre arbeid i høyde
- Registrerte data Fallsele og y-line Mongstad
- Risikovurdering 3871 Mongstad 2023_21.02
- Ti på topp januar 23_21.02
- GOV-AP17-00174-Beredskapslogg 18.01.2023 Mongstad R
- GOV-AP17-00175 TL (1) Beredskapsplan Beerenberg
- GOV-MA31-00418 BBS Stillashåndbok
- GOV-AP31-00549 Beste praksis Stillasarbeid
- GOV-P36-00070 Fallsikring
- GOV-WI17-00215 Arbeid i høyde
- K-15342 Kontroll og vedlikehold av stillaskomponenter

- Brukermanual fallsele Singing Rock Unit
- Brukerveiledning Singing Rock utstyr (1)
- Falldemper SR Reactor 140
- Fallsele kontroll Mongstad
- Fangline Singing Rock Octopus_2014_01
- Samsvarserklæringer fallsele Singing Rock Unit og fangline Singing Rock Octopus
- Y-line kontroll Mongstad
- 17.02 Ptil - RUHer som er meldt inn på utfordringer med fallsikringsutstyr. _15.02
- Forbedre arbeid
- Glendene Notification plan for unwanted incident 3871 Mongstad - 17.04.2022
- A 2023-02 MMP L2 rapport
- Mongstad Personlig HMS-håndbok for Equinors landanlegg Lokal versjon 9.0
- Equinor WR-9007 Beredskapsplan MMP OPL Mongstad
- Equinor WR-1920 Beredskap i MMP OPL (Ytelseskrav)

Other accessible documents drawn on in the investigation

- Rapport etter Petroleumstilsynets granskning av dødsulykke på Oseberg B 07052009
- Mekanisk prøving av stillas ifm. granskning av fallulykke på Oseberg B 07052009
- Granskingsrapport - Intern ulykkesgranskning - Fall ifm. stillasarbeid på Oseberg B 07052009 - Hendelse personskade dødsulykke
- Rapport etter tilsyn med Equinor Mongstad, del 2 - selskapets oppfølging av arbeidsmiljø for ISO-fagene.
- Rapport etter tilsyn med Equinor Mongstad, del 2 – selskapets oppfølging av arbeidsmiljø for ISO-fagene 001902046
- Offshore Norge 105 – Recommended guidelines on competence requirements for scaffolders
- NS 9700-1 Scaffolds and encapsulation constructions - Part 1: Technical requirements and requirements for training, assembly and use
- Safetec-endrede-rammebetingelser-og-konsekvenser-for-arbeidsmiljo-og-sikkerhet-i-petroleumsvirksom
- Arbeidstilsynets kompass rapport

B: Overview of personnel interviewed (not publicly available pursuant to section 13, paragraph one of the Norwegian Freedom of Information Act)