

Investigation report

Report	
Report title Report on the investigation of a fire in the local equipment room (LER) on <i>Gina Krog</i>	Activity number 001029032
Classification	
<input checked="" type="checkbox"/> Unclassified	<input type="checkbox"/> Exempt from publication
Parties involved	
Team A-1	Approved by / date Kjell M. Auflem / 28 January 2025
Investigation team participants [REDACTED]	Investigation leader [REDACTED]

Contents

1	Summary	3
2	Abbreviations	3
3	The Norwegian Ocean Industry Authority's investigation	3
	3.1 Composition of the investigation group	3
	3.2 Mandate of the investigation group	4
4	Background information	4
	4.1 Description of facility and organisation	4
	4.2 Situation before the incident	6
	4.3 Description of CCR/LER design	6
	4.4 Cooling unit (DX unit)	8
5	Sequence of events	8
6	Emergency preparedness	12
7	Technical investigations	13
	7.1 Summary from report prepared by SINTEF Energy AS	14
8	Potential of the incident	15
	8.1 Actual consequences	15
	8.2 Potential consequences	16
9	Direct and underlying causes	16
10	Observations	16
	10.1 Non-conformities	17
	10.1.1 Lack of firewall	17
	10.1.2 Lack of knowledge about barriers	17
	10.1.3 Deficiencies in handling of hazard and accident situations	17
	10.1.4 Training and drilling of the emergency response organisation on board	18
11	Barriers that did function	18
12	Uncertainties	19
13	Annexes	19

1 Summary

On 21 June 2023, a fire broke out in a cooling unit (DX unit) on board the *Gina Krog*. The unit was located in a local equipment room (LER) in the living quarters and smoke from the fire spread out of the equipment room into the adjacent corridor, central control room (CCR) and emergency preparedness room. The CCR is adjacent to the LER where the DX unit was situated, and there was no smoke and gas tight fire division between the rooms. At the other end of the CCR, and directly adjacent to it, is the emergency preparedness room.

Relevant personnel on board were unaware that the CCR and the LER were not separated by a smoke and gas tight fire division, and that smoke and combustion gases from the fire in the LER could therefore spread into the CCR. When handling the fire, it was necessary to evacuate the CCR and the emergency preparedness room due to smoke intrusion from the fire into both these rooms.

2 Abbreviations

DX unit	Cooling unit (direct expansion unit)
Havtil	The Norwegian Ocean Industry Authority
LER	Local equipment room
CCR	Central control room

3 The Norwegian Ocean Industry Authority's investigation

Havtil (then PSA) was notified by Equinor about smoke development and a fire in the equipment room adjacent to the living quarters on *Gina Krog* on 21 June 2023 at 07:30. Havtil requested a Teams meeting to obtain more information about the incident, and this was held later that same day. Based on the information about the incident provided in this meeting, Havtil decided to investigate the incident.

The investigation group conducted inspections and interviews on board the *Gina Krog* over the period 22 to 26 June 2023. Interviews were also conducted on Teams on 26 June and 1 September 2023. Furthermore, a representative from Havtil's investigation group was present for the examination of the DX unit carried out by SINTEF in Trondheim from 10 to 11 August 2023.

The primary focus of the investigation has been to clarify the sequence of events, direct and background causes of the fire, the tackling of the fire after it was discovered and to assess barriers in the part of the facility where the incident occurred.

3.1 Composition of the investigation group

Havtil's investigation group consists of:



3.2 Mandate of the investigation group

The following mandate was approved for the investigation team:

- a. *Determine the scope and course of the incident (using a systematic review that typically describes timeline and events).*
- b. *Assess the actual and potential consequences of*
 1. *Harm sustained by people, property and the environment.*
 2. *The incident's potential for harm to people, property and the environment.*
- c. *Assess direct and underlying causes.*
- d. *Identify regulatory non-conformities and improvements relating to regulations (and internal requirements).*
- e. *Discuss and describe any uncertainties/unclear issues.*
- f. *Consider barriers that did function. (i.e. barriers that helped to prevent a hazard from developing into an accident, or barriers that mitigated the consequences of an accident.)*
- g. *Assess the company's own investigation report.*
- h. *Prepare a report and cover letter (potentially including suggestions for use of tools) according to the template.*
- i. *Recommend – and normally contribute to – further follow-up.*

4 Background information

4.1 Description of facility and organisation

Gina Krog is located in Utsira High just north of Sleipner Vest. The field was detected in 1978 and the PDO was approved in 2013. Equinor is the operator of the field. The *Gina Krog* facility is a fixed accommodation and processing facility that produces both oil and gas. Oil, condensate and gas are transported in pipelines via the Sleipner field. The PDO for alternative oil export solution was approved in 2022 and includes oil pipelines from *Gina Krog* to Sleipner A. Since September 2023, *Gina Krog* has been powered by energy from land via Johan Sverdrup.



Figure 1 Location of the Gina Krog field (Source: Norwegian Offshore Directorate)

Gina Krog is part of the business area Field Life eXtension (FLX) for late life facilities. The FLX organisation's "Maintenance and technical integrity" unit has overarching responsibility for maintenance and integrity of the *Gina Krog* facilities.

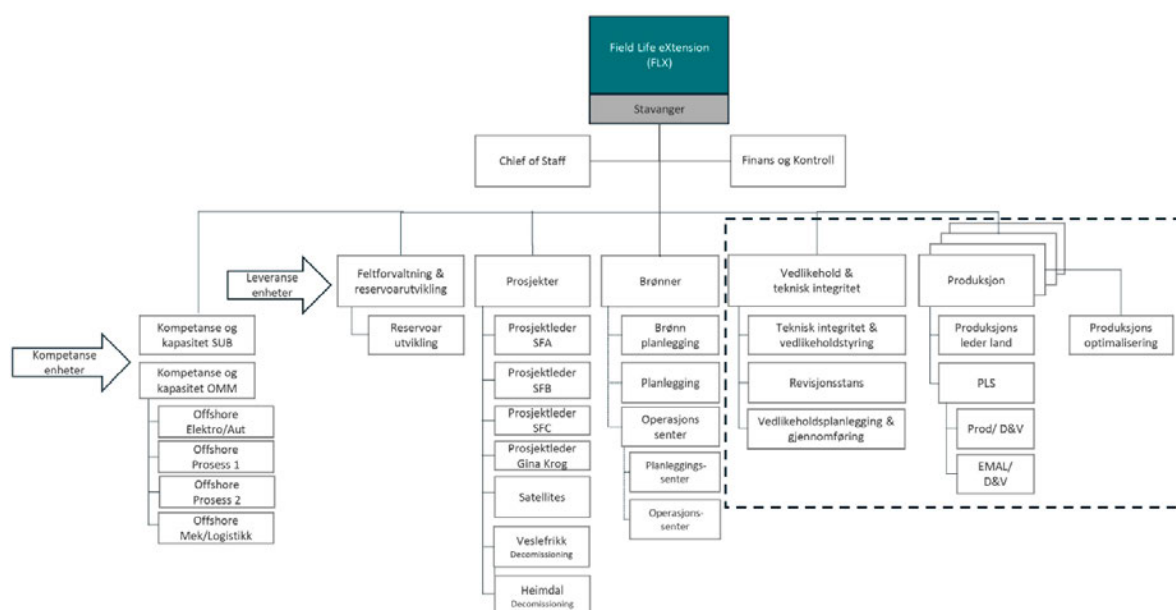


Figure 2 FLX organisation as of June 2023 (Source: Equinor)

4.2 Situation before the incident

At the time of the incident, 21 June 2023, operations on *Gina Krog* were running as normal. The incident occurred during the morning meeting, right after the 07:00 shift changeover.

There were 64 people on board the facility at the time of the incident. According to entries on the emergency panel, the outside temperature was 15 degrees Celsius and the wind speed was 17 knots.

4.3 Description of CCR/LER design

The central control room and LER are separated by a curved wall with large screens located on the CCR side. There is a door from the CCR to the LER, which consists of two separate door leaves that can be opened and closed with space between the door leaves. The emergency preparedness room is connected to the CCR, separated by a sliding glass door. The LER, CCR and the emergency preparedness room as well as the adjacent corridor are separated from their surroundings by an A-60 fire division. LER and SKR are separated from each other by a B-15 fire division.

The sketch below (Figure 3) shows the layout of the LER (above) and CCR (below). The double door between the CCR and LER is visible on the right at the end of the curved wall.

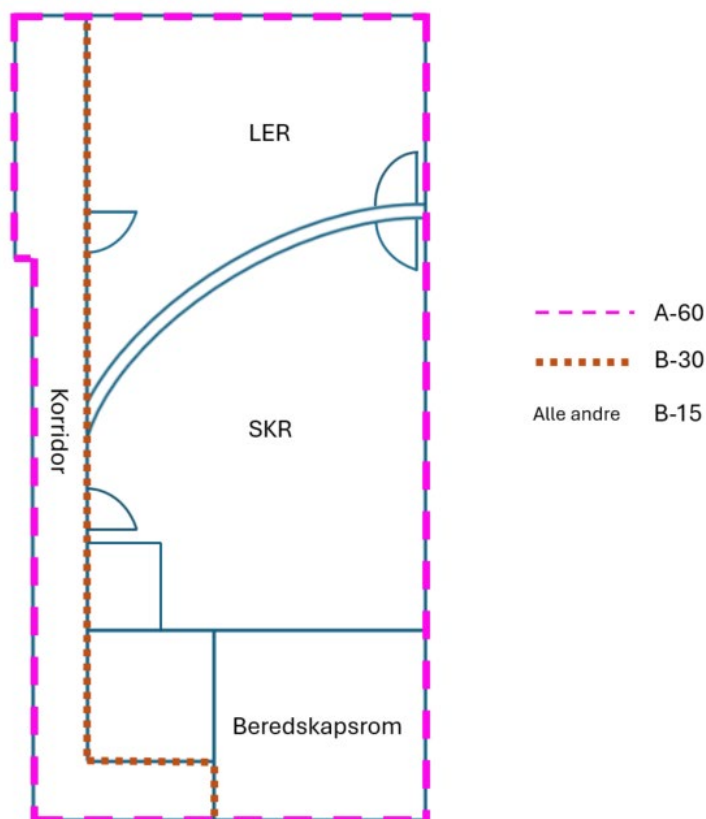
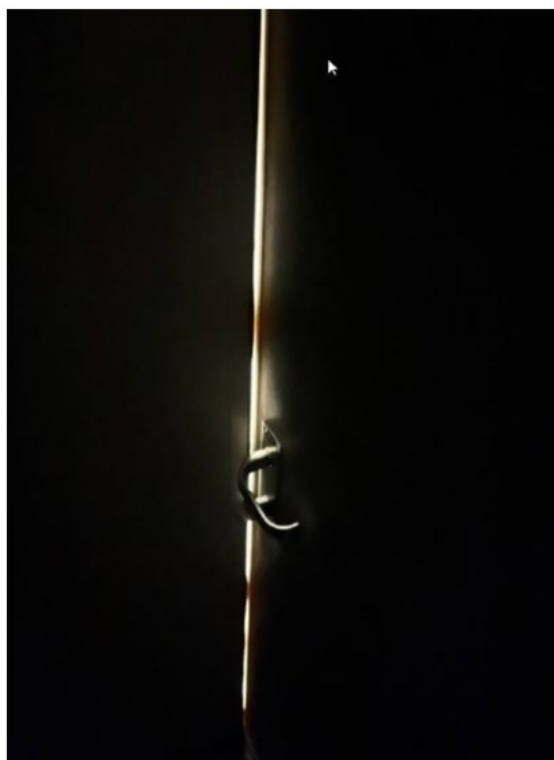
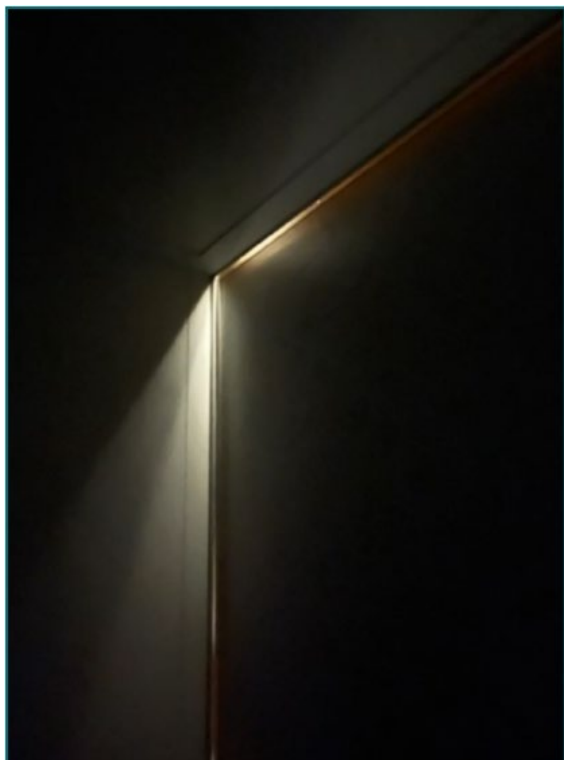


Figure 3 CCR and LER layout and fire divisions

There was a general perception among relevant personnel on board that the division between the CCR and LER was smoke and gas tight. In the aftermath of the incident of the 21 June, it was confirmed that the double door between the CCR and LER was B-15 fire-rated and thus not smoke and gas proof. The fact that smoke leaked in from the LER indicates that the CCR did not have overpressure compared to its surroundings. The image below shows leaky doors and the flow of air between them.



The CCR's ventilation is supplied via four ducts down along the curved wall with the LER. The exhaust is located in the ceiling at the opposite end of the room. The fact that the ventilation still runs in the events of confirmed smoke detection is a part of the HVAC design philosophy for the living quarters.

HVAC Design Philosophy LQ:

STID DOC | GKR | C132-KE-H-FD-0001 (equinor.com)

Due to the philosophy of active smoke control, a high degree of ventilation availability shall be applied. The ventilation systems shall be running as long as possible in case of fire, to reduce pressure build-up, reduce spread of smoke, and secure evacuation.

Displacement ventilation with low impulse supply at low level shall be used in CCR, cabins, corridors and smoking rooms in order to improve the air quality in the occupied zone. Mixing ventilation shall be provided for other areas.

4.4 Cooling unit (DX unit)

The DX unit where the fire broke out is located in the LER. This equipment is designed to cool down air from the room and send it below the raised floor. This creates an overpressure in the floor against the room above the raised floor. The air from the floor will rise into cabinets to cool components located there, and is ventilated out of the top of the cabinets towards the ceiling of the room.

5 Sequence of events

TIME	INCIDENT
07:00:19	Alarm: Early smoke LER L311
07:00:25	Alarm: Smoke raised floor L311
07:00:25	General alarm, automatic (200N detectors)
	PA message smoking room
	PA message shower
	PA message LER
	CCR operator opens the door to the LER for visual check and confirms presence of smoke in the LER
	General alarm, manual
07:00:27	Early smoke LER L311
07:00:51	Early smoke LER L311
07:02:01	Early smoke LER L311
07:02:35	Smoke raised floor L311
07:02:53	Smoke LER L311
Approx. 07:03	Emergency preparedness management mustered in the emergency preparedness room
07:03:29	Smoke LER L311

Approx. 07:08	Emergency preparedness management became aware that there was smoke in the control room
Approx. 07:10	POB control
07:11:08	Early smoke corridor L310
07:13:25	Smoke corridor south east L310
07:14:15	NAS 2.2 enabled from Critical Action Panel (CAP) in the control room
07:14:51	Early smoke CCR L312
07:15:00	Emergency preparedness management left the emergency preparedness room and set up in an alternative room
07:24:16	Smoke corridor L310
07:25:00	Moved to alternative control room
07:25:59	Early smoke corridor L310
07:27:32	Smoke raised floor CCR L312
07:28:22	Smoke ceiling emergency preparedness room L314
07:29:19	Smoke CCR L312
07:30:00	<i>Gina Krog</i> depressurisation completed
07:31:20	Smoke raised floor CCR L312
07:32:02	Early smoke emergency preparedness room L314

Table 1 Timeline of the incident

On 21 June 2023, at around 07:00, the CCR received an alarm for confirmed fire detection in the local equipment room (LER) in the living quarters on *Gina Krog*. This is a neighbouring room to the central control room (CCR) and contains many of the technical systems used in the control room. The general alarm was triggered and the emergency preparedness management and personnel acted in accordance with alarm instructions. One of the control room operators opened the door between the CCR and LER and confirmed that smoke was developing in the room.

The firefighting team entered the LER a few minutes after it was confirmed that there was smoke in the room. Upon entering the room, white smoke was observed coming from the top of the DX unit, and the team retreated from the room. The room was then re-entered to check the tag number of the DX unit, and it was observed that the smoke had thickened. The team then retreated from the room after identifying the tag number. Electrical personnel disconnected the power supply to the DX unit (outside of the LER), and the firefighting team entered the room once again with hoses after it was confirmed that the supply to the DX unit was shut off. At first, CO₂ was used, but after it was observed that the smoke development was still increasing, it was quickly decided to remove the top of the DX unit in order to place the hoses into the cabinet from the top and extinguish/cool it down with water. The fire team then left the room again. Finally, the room was entered for the last time to confirm that the fire had been extinguished.

Over the course of 32 minutes, alarms were set off by 18 different smoke detectors. These were located in the LER, CCR, the corridor outside of the LER/CCR and in the emergency preparedness room. The detectors were located in both the ceiling and the raised floor.

The table below (Table 2) provides an overview of the times the different detectors were set off.

Nr.	Starttid	Millisek	Tagnavn	Beskrivelse
1	21.06.2023 07:00:19	644	70SEL300B-005	Tidlig røyk LER L311
2	21.06.2023 07:00:25	151	70SOL300B-003	Røyk datagulv L311
3	21.06.2023 07:00:27	596	70SEL300B-004	Tidlig røyk LER L311
4	21.06.2023 07:00:51	395	70SEL300B-002	Tidlig røyk LER L311
5	21.06.2023 07:02:01	497	70SEL300B-003	Tidlig røyk LER L311
6	21.06.2023 07:02:35	103	70SOL300B-002	Røyk datagulv L311
7	21.06.2023 07:02:53	54	70SOL300B-001	Røyk LER L311
8	21.06.2023 07:03:29	355	70SOL300B-006	Røyk LER L311
9	21.06.2023 07:11:08	702	70SEL300B-006	Tidlig røyk korridor L310
10	21.06.2023 07:13:25	666	70SOL300B-012	Røyk korridor sørøst L310
11	21.06.2023 07:14:51	755	70SEL300B-007	Tidlig røyk CCR L312
12	21.06.2023 07:24:16	319	70SOL300B-005	Røyk korridor L310
13	21.06.2023 07:25:59	365	70SEL300B-001	Tidlig røyk korridor L310
14	21.06.2023 07:27:32	725	70SOL300B-013	Røyk datagulv CCR L312
15	21.06.2023 07:28:22	124	70SOL300B-020	Røyk himling Beredskapsrom L314
16	21.06.2023 07:29:19	576	70SOL300B-010	Røyk SKR L312
17	21.06.2023 07:31:20	824	70SOL300B-014	Røyk datagulv CCR L312
18	21.06.2023 07:32:02	814	70SEL300B-008	Tidlig røyk beredskapsrom L314

Table 2 Detector alarm by time overview

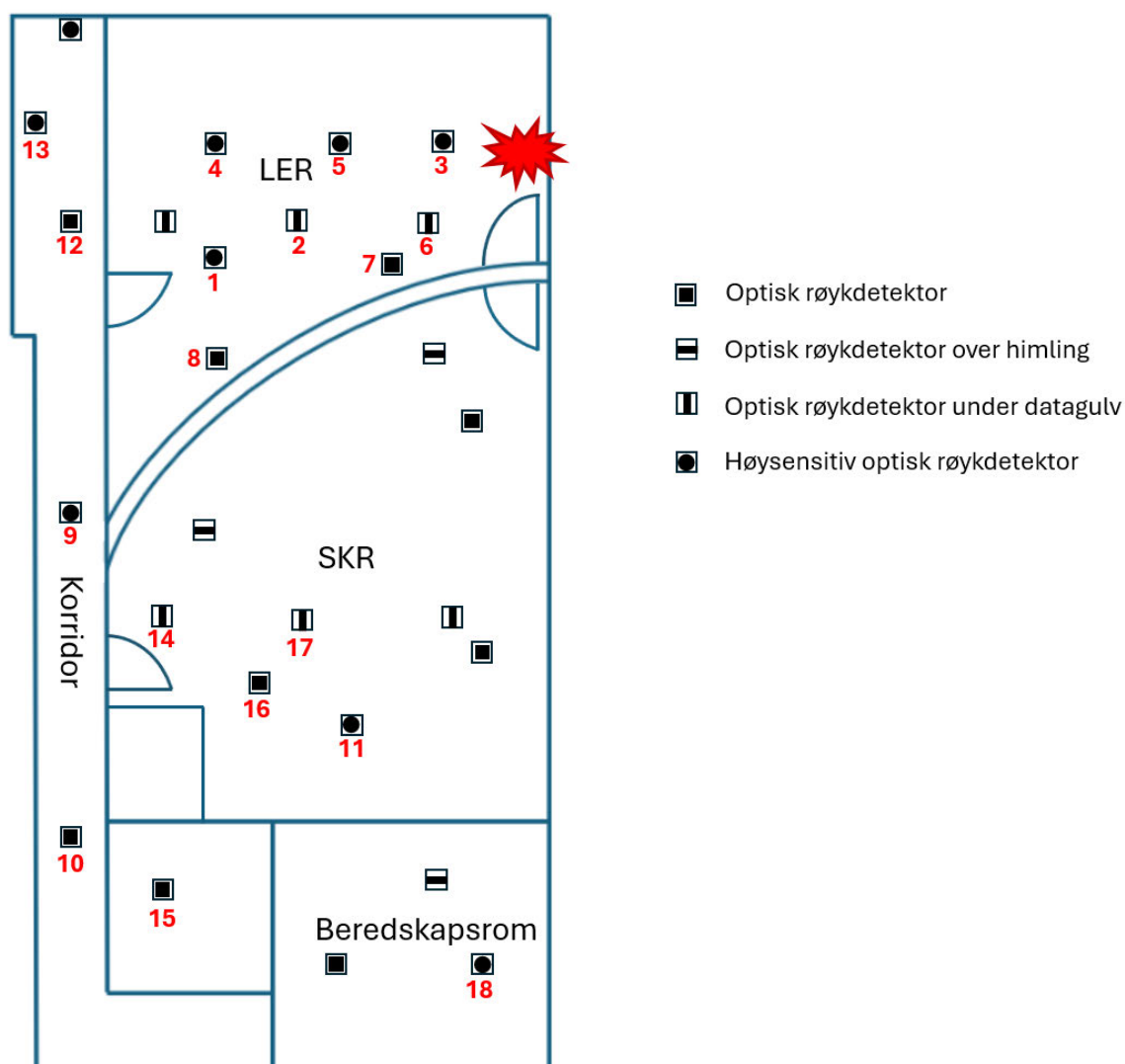


Figure 4 Detector alarm order

The first eight detectors to set off an alarm were located in the LER. The order in which they went off is shown in Figure 4. The red circle indicates the DX unit that was emitting smoke. Smoke detectors 1-4 went off in the space of 32 seconds. Three of the detectors were located in the ceiling and one in the raised floor. The two smoke detectors that confirmed detection were an early detector located in the ceiling of the LER and a detector located in the raised floor of the LER.

Based on the alarm list, it can be seen that the DX unit had changed its status to "not available" and "common error activated" after about six minutes. The alarm list also shows that a subdistribution board on panel 84EL401 set off an alarm at the same time.

The table below shows the alarms on the panel and DX unit.

21.06.2023 07:06:00	77GB402B-Q02	DX kjøler B L311 i drift	Event	Signal changed to 0
21.06.2023 07:06:00	77GB402B-Q02	DX kjøler B L311 i drift	Event	Signal changed to Alarm
21.06.2023 07:06:00	77GB402B-Q02	DX kjøler B L311 i drift	Event	Signal changed to 0
21.06.2023 07:06:01	84EL401-Q60A	UnderFordTavle fellesalarm	Event	Signal changed to Alarm
21.06.2023 07:06:01	84EL401-Q60A	UnderFordTavle fellesalarm	Event	Signal changed to 1
21.06.2023 07:06:01	84EL401-Q60A	UnderFordTavle fellesalarm	Event	Signal changed to 1
21.06.2023 07:06:01	84EL401-Q60A	UnderFordTavle fellesalarm	W	Alarm
21.06.2023 07:06:01	77GB402B-Q60	DX kjøler B L311 fellesalarm	Event	Signal changed to 1
21.06.2023 07:06:01	77GB402B-Q60	DX kjøler B L311 fellesalarm	W	Alarm
21.06.2023 07:06:01	77GB402B-Q60	DX kjøler B L311 fellesalarm	Event	Signal changed to Alarm
21.06.2023 07:06:01	77GB402B-Q60	DX kjøler B L311 fellesalarm	Event	Signal changed to 1
21.06.2023 07:06:02	71UY1245	Common Alarm Lamp (-H1) FWG A	Event	Signal changed to 0

Table 3 Alarms panel and DX unit

Around eight minutes after the first smoke detector went off, CCR personnel observed smoke inside of the CCR. The smoke was located near the wall dividing the control room from the LER. In a short space of time, the smoke thickened and spread further across the CCR, and it became increasingly difficult for the personnel to remain in the room. At around 07:15, it was decided to evacuate from the emergency preparedness room to an alternative one. Before the personnel evacuated to the alternative emergency preparedness room, the emergency shutdown (NAS 2.2) was activated from the critical alarm panel (CAP) in the CCR. At around 07:25, the CCR was also evacuated due to the accumulated smoke. Depressurisation for the installation was completed at around 07:30.

At almost the same time as the decision was taken to evacuate the CCR, the first smoke detector in the room went off. This detector was located at the end of the CCR furthest from the LER. The three other detectors in the CCR went off 10-15 minutes later. These were located near to the door between the CCR and the corridor.

POB control was achieved at 07:10.

6 Emergency preparedness

In accordance with the *Gina Krog* emergency preparedness plan, it is the task of the emergency preparedness manager (the platform manager or the deputy) to decide on mustering in an alternative emergency preparedness room as needed. In accordance with the emergency preparedness plan, the CCR duty manager acts as the emergency preparedness manager until the platform manager takes over. The facility must have a designated safe area for mustering all personnel, cf. the overarching emergency preparedness principles for the *Gina Krog* (Revision of the emergency preparedness analysis for the *Gina Krog* 2019).

The decision from the emergency preparedness management to muster in the emergency preparedness room after it was confirmed that there was fire and smoke development in the equipment room (LER311), and not in the alternative emergency preparedness room located in the D&W office in Q314, is questionable.

The emergency preparedness management also delayed the decision to evacuate the room after smoke was observed in the central control room (CCR) and the emergency preparedness room. This could have resulted in injuries to the personnel in the room and prevented or delayed the management of the hazard and accident situation.

The Log Keeper left the emergency preparedness room to assist the electrician on the Search and Rescue Team by disconnecting the electrical panel (without being relieved by a deputy). This was resolved by the Action Leader taking over the Panel Operator's duties. According to the emergency preparedness analysis and vulnerability analysis for the *Gina Krog*, electricians must have the necessary expertise for electrotechnical equipment.

As more smoke built up in the central control room, the CCR technician on duty faced challenges in handling the situation. Amongst other things, the CCR technician had to cover his face with his shirt as there was so much smoke in the room.

On the *Gina Krog*, it had not been ensured that sufficient training had been carried out for all emergency preparedness functions so that personnel were ready to handle hazard and accident situations in an effective manner at all times. In accordance with the emergency preparedness plan, the Process Specialist off duty was the Search and Rescue Leader. Furthermore, this function was also deputy for the Action Leader, Panel Operator and Accident Scene Leader. The Process Specialist was also on the height rescue team. Through interviews and documentation reviews on board, it was observed that the Process Specialist had not completed sufficient training and drilling in all these roles. In the event of a combination of multiple emergency roles, it must be ensured that training requirements are met (Revision of the emergency preparedness analysis for the *Gina Krog* 2019). There was also no training plan or documentation to ensure that the training was carried out.

7 Technical investigations

Equinor chose not carry out an interim investigation of the incident, but it was given a mandate for a technical investigation of the fire in the DX unit.

An internal group at Equinor was established in order to do the following:

- *Ensure that the unit (cabinet) where the fire occurred is investigated by a competent and independent party*
- *Identify the causes of the fire*
- *Make recommendations and propose measures relating to the incident*

SINTEF Energy AS was selected by Equinor to assist in the work on uncovering the cause of the fire, as well as for proposing measures to reduce the likelihood of similar events occurring in the future. The ruined DX unit was sent to the SINTEF Energy Lab

in Trondheim and was examined in August 2023 in the presence of representatives from Equinor and Havtil. The examination was limited to technical causes of the fire. The investigation group from Havtil have used this examination and its associated report as the basis of the investigation.

7.1 Summary from report prepared by SINTEF Energy AS

A short summary of the report that was produced by SINTEF after their technical examination of the DX unit (ref.XX) is provided below.

The fire unquestionably occurred in the section of cooling unit ("the DX unit") that contains the vast majority of the electrical components. It is also clear that ignition was caused by electrical energy, most likely supplied through the 230V power supply to the fan and compressor motors. Major damage means that the point of origin of the fire or a detailed chain of events has not been identified, but according to SINTEF's investigations there are two possible hypotheses:

- 1) The cables in two of the terminals (screw clamps) of the circuit breaker through which the entire electrical power is supplied to the DX unit proved to be completely loose. Overheating here – with subsequent ignition of nearby combustible material – may have started the fire.
- 2) Measurements by SINTEF showed that series resonance produces stationary voltages of more than 400V across the motor capacitor of the fan in the external heat exchanger. This reduces the life of the capacitor, and a capacitor failure resulting in a series fault and local heating may have ignited the capacitor itself or nearby components.

"Proposals for measures from the report produced by SINTEF Energy AS"

- It should be checked that the correct tightening torque is used in the cable terminals for the electrical components in the other DX units on the *Gina Krog*. If there are similar units from the same manufacturer installed at the same time on other platforms, these units should also be checked.
- The motor capacitors on DX units with a similar operating pattern should be replaced with capacitors that have a longer design life.
- An alternative to replacing the motor capacitors may be to rebuild the DX units so that the fan motor is run by a three-phase power supply (i.e., without a motor capacitor), or possibly to even replace entire DX units with three-phase-based units.



Figure 5 Cooling unit with cabinet door closed (left), open (middle), and after three internal panels/covers were removed (right). (Source: SINTEF Report 2023-01109 Fire in DX unit on the Gina Krog - Rev 1.0 (part 1))

8 Potential of the incident

8.1 Actual consequences

There was significant heat development, but the damage was limited to the DX unit itself which is built into a metal container (cabinet). Except from the significant amounts of soot, there was no clear damage outside of the DX unit.

Material damage and financial consequences:

1. Broken DX unit
2. Subsequent halt in production

Personnel in the CCR as well as emergency responders were exposed to smoke and fire gases, with consequent minor respiratory symptoms.

Fire smoke is a composite mixture of gasses, fumes and particles. The composition and distribution of various chemical components in the smoke is dependent on several factors, such as the materials that are burning and the nature of the fire. Inhalation of the gasses, fumes and particles created is normally associated with a major health risk as some of these can cause acute toxic effects and while others have the potential to increase the risk of developing a serious illness, such as cancer. Many

of the people involved in this incident inhaled smoke from the fire. This exposure can affect the risk of acute and permanent health issues.

8.2 Potential consequences

There is little combustible material in the area, and it is therefore unlikely that the fire would have spread beyond the room.

Had there been personnel present in the room at the time of the fire, it is unlikely that they would have been directly exposed beyond exposure to smoke in the seconds it would take to evacuate the room.

9 Direct and underlying causes

The investigation team has based the conclusions in the report following the investigations of the DX unit on probable causal relationships:

The fire occurred in the section of the DX unit that contains the vast majority of the electrical components. Ignition was caused by electrical energy, most likely supplied through the 230V power supply to the fan and compressor motors.

Major damage means that the point of origin of the fire or a detailed chain of events has not been identified, but based on SINTEF's investigations there are two possible hypotheses:

- The cables in two of the terminals (screw clamps) of the circuit breaker through which the entire electrical power is supplied to the DX unit proved to be completely loose. Overheating here – with subsequent ignition of nearby combustible material – may have started the fire.
- Measurements showed that series resonance produces stationary voltages of more than 400V across the motor capacitor of the fan in the external heat exchanger. This reduces the life of the capacitor, and a capacitor failure resulting in a series fault and local heating may have ignited the capacitor itself or nearby components.

10 Observations

Havtil's observations are generally divided into two categories:

Non-conformity: Observations where we *prove* the existence of a breach/non-compliance with respect to the regulations.

Improvement point: Observations where we *believe we have seen a* breach/non-compliance with respect to the regulations, but do not have sufficient information to be able to prove it.

10.1 Non-conformities

10.1.1 Lack of firewall

Non-conformities

Rooms that have important functions and equipment are not separated from their surroundings by class A fire divisions.

Rationale

The LER and CCR are not separated from their surroundings by class A fire divisions. The closest class A fire division, which is able prevent the spread of smoke, encircles the LER, CCR and emergency preparedness room as well as adjacent corridors (see Figure 3 in chapter 4.3). If smoke develops in the surroundings of the CCR, it is important to prevent the smoke spreading to the CCR itself, so that personnel do not need to evacuate before the incident has been resolved.

Due to the smoke development, it was not possible for the personnel to carry out the necessary safety functions in the central control room in a safe and effective manner before taking the decision to evacuate the CCR.

Requirements

The Facilities Regulations on fire division, Section 30, second paragraph

10.1.2 Lack of knowledge about barriers

Non-conformities

There was not sufficient knowledge of which barriers were established.

Rationale

It was not known that the wall between the LER and CRR was not a smoke and gas tight (Class A) fire division.

Requirements

The Management Regulations, Section 5 concerning barriers, fourth paragraph

10.1.3 Deficiencies in handling of hazard and accident situations

Non-conformities

Equinor had not ensured that necessary measures had been put in place as fast as possible in the event of a fire in the LER so that the hazard situation would not develop into an accident situation for the CCR and emergency personnel, and so that personnel on the *Gina Krog* could be evacuated quickly and efficiently at any time.

Rationale

After the emergency preparedness management had confirmed that there was fire and smoke development in the equipment room (LER311), it was decided to muster in the emergency preparedness room next to the CCR and not in the alternative one. The emergency preparedness management also decided not to evacuate the emergency preparedness room after it was observed that smoke was entering the central control room (CCR) and then the emergency preparedness room as well. This could have resulted in injuries to the personnel and prevented or delayed the management of the hazard and accident situation. It was not possible for the personnel in the CCR to handle the emergency situation and carry out the necessary safety functions in a safe and effective manner.

Requirements

The Activities Regulations, Section 77 on the handling of hazard and accident situations, letter b, cf. letter d

10.1.4 Training and drilling of the emergency response organisation on board

Non-conformities

Equinor had not ensured that the necessary training and drilling was carried out so that personnel with multiple emergency roles were ready to handle hazard and accident situations in an effective manner at any time.

Rationale

In accordance with the emergency preparedness plan, the Process Specialist off duty was the Search and Rescue Leader. Furthermore, this function was deputy for the Action Leader, Panel Operator and Accident Scene Leader. The Process Specialist was also on the height rescue team. Through interviews and documentation reviews on board, it was observed that the Process Specialist had not done training and drilling in all these roles. There was also no training plan or documentation to ensure that the training was carried out.

Requirements

The Activities Regulations, Section 23 on training and drills, first paragraph

11 Barriers that did function

- Fire detection with associated alarms and automatic actions
- Manual actions carried out by CCR personnel (NAS 2.2)
- Active firefighting

12 Uncertainties

It is unclear how the smoke spread from the LER to the CCR. Based on witness observations, the concentration was highest closest to the wall between the LER and CCR. This may indicate that smoke had spread through walls or doors between the LER and CCR. It has been verified that the double door between the CCR and LER is not sealed (see chapter 4.3).

However, the first detector that went off was located inside the CCR on the wall furthest from the LER. The next detector that went off was the smoke detector near to the door between the corridor and the CCR. It is therefore a possibility that smoke entered the control room via the corridor when the door was opened. The detectors in the CCR near the wall and door between the LER and CCR did not go off. Based on observations of where the smoke came from and how it spread in the room, it is uncertain how other detectors in the room did not go off earlier.

The time which the cooling unit had been in operation after the confirmed fire detection may potentially have impacted the air flow/spread of smoke.

13 Annexes

A: Documents used in the investigation.

B: Overview of Equinor personnel who were interviewed or attended meetings in connection with the investigation

Annex A – Documents used in the investigation

1. Presentation after meeting with *Gina Krog* on 21 June 2023
2. C132-KE-H5300-XT-0017-00 Wiring and termination diagram electro – DX system 77GB402B, 77HE402, rev. 05
3. Event log from the CCR from just before the event until depressurisation completed
4. FPDS - LER, CCR AND ECC AREA L300 - L300B, rev. 06
5. C132-KE-S-XE-0300-01 Fire Division Layout LQ Level 3, Rev. 03
6. Log emergency response boards 1st Line
7. Weather data 21 June 2023
8. FV program 77GB402B
9. FV program 93AD474
10. C132-KE-S-XF-0300-01 Fire & Gas Plot Plan Level 3 West EL.+517,550, rev. 05
11. TR1055 App. B – Safety Strategy – *Gina Krog*, Final Ver. 5
12. C132-ST-S-RA-0002 Revision of the Emergency Preparedness Analysis for the *Gina Krog*, Rev. 03
13. C132-KE-H-XE-0300-02 HVAC GA Duct Layout LQ Level 3 East, rev. 04
14. C132-KE-H-XE-0300-01 HVAC GA Duct Layout LQ Level 3 West, rev. 03
15. Organization Chart – FLX Production and Maintenance Land and Offshore
16. Cooling Unit B Fault Signal Trend / Alarm List
17. C132-KA-S-RF-0001 Total Risk Analysis *Gina Krog* Rev. 09
18. Vulnerability assessment of the emergency response organisation on *Gina Krog*
19. GL0282 Risk and Emergency Preparedness Analysis, Final. Ver. 3
20. 2014-1269 *Gina Krog* Detailed Design Emergency Preparedness Analysis, Rev. 1
21. DISP 147109
22. Emergency response report *Gina Krog* 20 June 2023 and 22 June 2023
23. Synergy 2568448 Fire in DX unit (room cooler) in LER room LQ3 floor
24. C132-KE-H-XC-0300-01 HVAC Area D&ID LQ Level 3 West, rev. 07
25. C132-KE-H5300-XB-7702-01 P&ID DX system air cooled condenser 77HE402/77GB402B, rev. 05
26. Smoke Detection – Alarm List and Layout
27. C132-KA-J-FD-0002 Fire & Gas (F&G) System Design Philosophy, rev. 07
28. C132-KE-C5522-XF-0003-01 Signpost Plot Plan Safety, Escape and Firefighting Equipment Signs Level 3, Rev. 04
29. Report after smoke test *Gina Krog* 2017
30. Sintef Energy AS, 2023-10-11, Report no. 2023:01109, Fire in DX unit on *Gina Krog* 21 June 2023, investigation of causes
31. 2nd line log – Fire on *Gina Krog* 21 June 2023