REPUBLIC OF THE MARSHALL ISLANDS

Maritime Administrator

VALARIS DS-4 CASUALTY INVESTIGATION REPORT

Loss of Moorings

Hunterston, Scotland | 2 February 2021

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AUTHORITY

An investigation, under the authority of the Republic of the Marshall Islands laws and regulations, including all international instruments to which the Republic of the Marshall Islands is a Party, was conducted to determine the cause of the casualty.

Maritime Administrator

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LIST OF ABBREVIATIONS AND ACRONYMS

1 A/E	First Assistant Engineer
3 A/E	Third Assistant Engineer
3/O	Third Officer
AIS	Automatic Identification System
ANSI	American National Standards Institute
ANSI/API RP 2MET	ANSI/API Recommended Practice Derivation of Metocean Design and Operating Conditions
API	American Petroleum Institute
API RP 2SK	API Recommended Practice Design and Analysis of Stationkeeping Systems for Floating Structures
ASD	Able Seafarer Deck
ASE	Able Seafarer Engineer
C/E	Chief Engineer
C/O	Chief Officer
COVID-19	Coronavirus Disease 2019
DNV GL	Det Norske Veritas Germanischer Lloyd
DNV GL-RP-C205	DNV GL Recommended Practice Environmental Conditions and Environmental Loads
DNV GL-ST-NOO1	DNV GL Standard Marine Operations and Marine Warranty
DOC	Document of Compliance
DP	Dynamic Positioning
DPA	Designated Person Ashore
ERA5	European Centre for Medium-Range Weather Forecasts
ETO	Electro-Technical Officer
HMPE	High Modulus Polyethylene
ICLL	International Convention on Load Lines, 1966
ILO	International Labour Organization
IMO	International Maritime Organization
ISM	International Safety Management
ISM Code	International Management Code for the Safe Operation of Ships and for Pollution Prevention
kg/m^3	Kilograms per Cubic Meter

kn	Knots
kW	Kilowatt
m	Meters
m/s	Meters Per Second
m^2	Square Meters
MARPOL	International Convention for the Prevention of Pollution from Ships
MBL	Minimum Breaking Load
MLC, 2006	Maritime Labour Convention, 2006
MODU	Mobile Offshore Drilling Unit
MSMC	Minimum Safe Manning Certificate
MSMS	Marine Safety Management System
N	Newtons
NM	Nautical Miles
OICEW	Officer in Charge of an Engineering Watch
OICNW	Officer in Charge of a Navigational Watch
OS	Ordinary Seafarer
P&I Club	Protection and Indemnity Club
PA system	Public Address System
PMSC	Port Marine Safety Code
SMS	Safety Management System
SOLAS	International Convention for the Safety of Life at Sea, 1974
SOP	Standard Operating Procedure
STCW Code	Seafarers' Training, Certification and Watchkeeping Code
STCW	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers
SWL	Safe Working Load
T	True
t	Ton
UHMWPE	Ultra High Molecular Weight Polyethylene
URL	Uniform Resource Locator
V	Volt
VHF	Very High Frequency

PART 1: EXECUTIVE SUMMARY

On 2 February 2021, the Republic of the Marshall Islands-registered drill ships VALARIS DS-4 and ENSCO DS-8, managed by Noah Ship Management DMCCO (Noah), were moored at the Hunterston Jetty, which is located at the southern end of the Clyde Estuary, on the Largs Channel, between Great Cumbrae Island and the Scottish mainland. Both drill ships held a Provisional Certificate of Registry with the endorsement "This Certificate is Only Valid while the Vessel Remains in Laid-up Status and is Not Valid for Navigation."[1]

Offshore winds from the northeast had increased throughout the day and by 1800[2] were between 50-55 kn. At about 1915, VALARIS DS-4's moorings failed during storm force winds. The drill ship was blown off the jetty and drifted to the southwest until about 1923, when the anchor, which had previously been deployed as part of the VALARIS DS-4's mooring arrangements, held. This likely prevented the drill ship from going aground on Great Cumbrae Island, which was about 400 m to the west.

VALARIS DS-4's crew were able to start all but one of the drill ship's diesel generators but did have difficulties bringing the bow and stern thrusters online. VALARIS DS-4 was re-moored at Hunterston Jetty on 8 February 2021 after the crewmembers were able to start all but one of the azimuth thrusters.

ENSCO DS-8 remained moored alongside the jetty with tug assistance and the use of its thrusters.

1 A vessel holding a Provisional Certificate of Registry with the endorsement "This Certificate is Only Valid while the Vessel Remains in Laid-up Status and is Not Valid for Navigation" is out of service and is not required to comply with the international and national requirements that would otherwise be applicable to the vessel when it is in service.

2 Unless otherwise stated, all times are the drill ships' local time (UTC +0).

The marine safety investigation conducted by the Republic of the Marshall Islands Maritime Administrator (the "Administrator")[3] identified the following:

1. Causal factors that contributed to this marine incident include:

   (a) the inability of VALARIS DS-4's crewmembers to bring the thrusters online in time to prevent the mooring lines from being overloaded by the storm force winds from the northeast; and

   (b) the Master of VALARIS DS-4 did not request tug assistance when the weather forecast for storm force north easterly winds was received on the afternoon of 2 February 2021.

2. Additional causal factors that may have contributed to this marine incident include:

   (a) inadequate coordination between Joulon Asset Management (Joulon) and Clydeport Operations Limited (COL) throughout the planning process for the lay-up of VALARIS DS-4 and ENSCO DS-8 at Hunterston Jetty;

   (b) inadequate identification and consideration of local conditions, including the higher than forecast northeasterly and easterly winds, winter temperatures, and the time required for tugs to arrive after being requested, as part of Joulon's risk assessment for berthing the drill ships alongside at Hunterston Jetty;

   (c) inadequate identification of the drill ships' power requirements during Joulon's and Noah's planning for the lay-up of VALARIS DS-4 and ENSCO DS-8 to ensure that a sufficient number of diesel generators and thrusters would be available if needed during a period of high winds or an emergency situation;

   (d) the apparent deviation from the drill ships' mooring plans when VALARIS DS-4 and ENSCO DS-8 were moored after being shifted along the jetty in late January 2021;

   (e) the lack of third-party verification that VALARIS DS-4 and ENSCO DS-8 were moored in accordance with the drill ships' mooring plans;

   (f) with the exception of the drill ships' mooring plans, the lack of third-party assurance of Joulon's and Noah's planning and execution of the lay-up of VALARIS DS-4 and ENSCO DS-8 at Hunterston Jetty;

   (g) the lack of comprehensive flag State regulations intended to ensure the safety and security of laid-up vessels;

   (h) the lack of flag State requirements for Republic of the Marshall Islands-registered vessels that are in lay-up to undergo inspections or other forms of oversight to verify they do not pose a safety or security hazard; and

   (i) the absence of port State regulations intended to ensure the safety and security of ships laid-up in ports and harbors in the United Kingdom.

3. Actions or events that reduced the adverse consequences of this marine incident include:

   (a) that VALARIS DS-4's and ENSCO DS-8's anchors had been pre-deployed when the drill ships were berthed at Hunterston Jetty and that VALARIS DS-4's anchor was reset and held the drill ship in mid-channel after being blown off the jetty following the loss of moorings; and

   (b) the arrival of tugs to hold ENSCO DS-8 alongside the berth.

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3 The United Kingdom of Great Britain and Northern Ireland (hereinafter "United Kingdom") was a substantially interested State for this marine safety investigation. The United Kingdom Marine Accident Investigations Branch (MAIB) supported the Administrator throughout the investigation.

PART 2: FINDINGS OF FACT

The following Findings of Fact are based on the information obtained during the Administrator's marine safety investigation.

1. Ship particulars: *see* charts to right.

2. VALARIS DS-4 and ENSCO DS-8 are both dynamically positioned deep water drill ships *(see Figure 1)*.

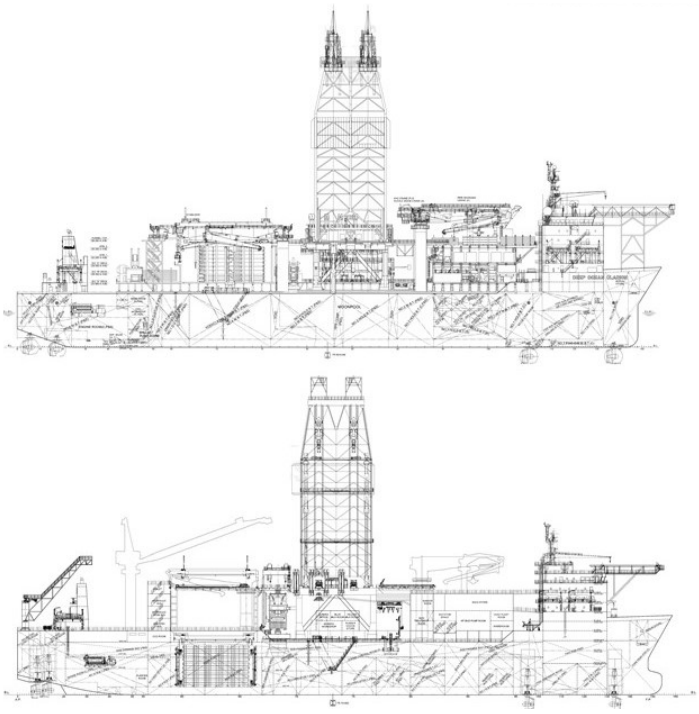

Figure 1: General Arrangement Drawing of VALARIS DS-4 (top) and ENSCO DS-8 (bottom).

3. Both drill ships are equipped with three forward and three aft electrically driven azimuth thrusters that are used for propulsion and steering. Electrical power is provided by six diesel generators. Relevant details of the drill ships' propulsion systems are in the following table:

COMPONET	VALARIS DS-4	ENSCO DS-8
Diesel Generators (six each)	MAN B&W 8,000 kW	Wartsila 7,290 kW
Azimuth Thrusters (six each)	Rolls Royce 5,500 kW	Rolls Royce 5,500 kW

SHIP PARTICULARS

Ship Name
VALARIS DS-4

Registered Owner
Ensco Ocean 1 Company

ISM Ship Management
Noah Ship Management DMCCO

Flag State
Republic of the Marshall Islands

IMO No.	Official No.	Call Sign
9459943	3636	V7SE8

Year of Build	Gross Tonnage
2010	60,162

Net Tonnage	Deadweight Tonnage
18,048	96,273

Length x Breadth x Depth
211.3 x 42 x 19 m

Ship Type
Drill Ship

Document of Compliance Recognized Organization
Bureau Veritas

Safety Management Certificate Recognized Organization
Bureau Veritas

Classification Society
American Bureau of Shipping

Persons on Board
Crewmembers: 7
Technical Support: 2

Lay-up at Las Palmas de Gran Canaria

4. Following their arrival at Las Palmas de Gran Canaria (hereinafter "Las Palmas"), Kingdom of Spain (hereinafter "Spain") in May 2020, VALARIS DS-4 and ENSCO DS-8 were Laid-up Warm Stacked in accordance with American Bureau of Shipping's (ABS's) Guide for Lay-up and Reactivation of Mobile Offshore Drilling Units.[4] At the time, both drill ships were managed by Ensco International Inc. (Ensco).[5]

5. The Administrator issued a Provisional Certificate of Registry with the endorsement "This Certificate is Only Valid while the Vessel Remains in Laid-up Status and is Not Valid for Navigation"[6] to ENSCO DS-8 on 16 June 2020 and to VALARIS DS-4 on 1 July 2020.

6. ABS changed the lay-up status of VALARIS DS-4 in August 2020 and ENSCO DS-8 in October 2020 to laid-up without additional notation when annual lay-up surveys were not completed.

7. The drill ships' owners decided to move VALARIS DS-4 and ENSCO DS-8 to another lay-up location while they were at Las Palmas.

Change of Lay-up Location

8. By late September 2020, the drill ships' owners had contracted Joulon to plan for the their continued lay-up at either another Spanish port or in Hunterston, Scotland. This included conducting risk assessments and the development of contingency plans, coordination with port authorities, and establishing preventive maintenance requirements.

9. Joulon did not hold a DOC. Joulon subcontracted Noah, who holds a DOC, as marine managers for both drill ships. This included assisting with conducting risk assessments and developing contingency plans. It also included daily

SHIP PARTICULARS

Ship Name
ENSCO DS-8

Registered Owner
Ensco Intercontinental GMBH

ISM Ship Management
Noah Ship Management DMCCO

Flag State
Republic of the Marshall Islands

IMO No.	Official No.	Call Sign
9659531	5307	V7CQ5

Year of Build	Gross Tonnage
2015	57,335

Net Tonnage	Deadweight Tonnage
17,200	77,000

Length x Breadth x Depth
213.6 x 38 x 18.5 m

Ship Type
Drill Ship

Document of Compliance Recognized Organization
Bureau Veritas

Safety Management Certificate Recognized Organization
Bureau Veritas

Classification Society
American Bureau of Shipping

Persons on Board
Crewmembers: 6
Technical Support: 4

4 The ABS guidelines are addressed in greater detail later in this report.

5 Ensco held a DOC issued in accordance with the ISM Code and was named on the SMCs held by VALARIS DS-4 and ENSCO DS-8 as the company responsible for the operation of both drill ships per SOLAS chapter IX.

6 A vessel holding a Provisional Certificate of Registry with the endorsement "This Certificate is Only Valid while the Vessel Remains in Laid-Up Status and is Not Valid for Navigation" is out of service and is not required to comply with the international and national requirements that would otherwise be applicable to the vessel when it is in service.

management of both drill ships, hiring of marine crews, ensuring required preventive maintenance tasks were conducted, and coordination with the drill ships' flag State.

10. It was planned that Joulon and Noah would assume responsibility for managing the drill ships after their arrival at another lay-up location.

11. On 24 November 2020, ABS surveyors attended VALARIS DS-4 and ENSCO DS-8 to complete reactivation surveys. Both drill ships were issued short term international statutory certificates[7] that were valid through 23 December 2020 and class certificates for VALARIS DS-4 to complete a single voyage to Almería, Spain and for ENSCO DS-8 to complete a single voyage to Motril, Spain.

12. Sometime after the reactivation surveys were completed, the drill ships' owners, in coordination with Joulon and Noah, decided to move both drill ships from Las Palmas to Hunterston rather than Almería and Motril for continued lay-up.

Hunterston Jetty

13. Hunterston Jetty is located at the southern end of the River Clyde between Great Cumbrae Island and the Scottish mainland *(see Figure 2)*. The jetty was built in 1979 to accommodate ships up to 380 m in length on its outer face[8] delivering iron ore to the Ravenscraig steelworks. The jetty has been largely vacant since the steelworks closed in 2016.[9]

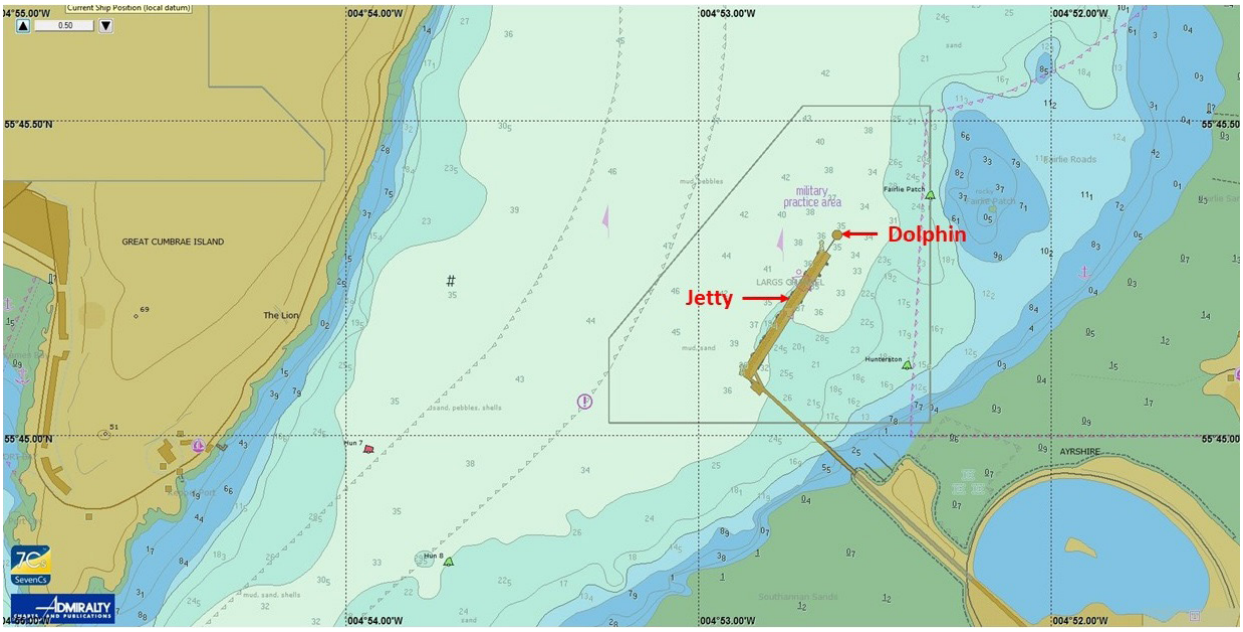

Figure 2: Hunterston Jetty.

7 The following short term international certificates were issued to both drill ships: International Load Line Certificate, International Oil Pollution Prevention Certificate, International Air Pollution Prevention Certificate, Mobile Offshore Drilling Unit Safety Certificate (1989), and an International Sewage Pollution Prevention Certificate. The Safety Management Certificates held by both drill ships had remained valid since no intermediate audits had been required while the drill ships were in lay-up at Las Palmas.

8 Vessels up to 280 m in length could be moored on the inside face of the jetty.

9 The cranes and cargo handling equipment were removed from the jetty when the steelworks were closed.

14. The jetty is 443 m long and is oriented along the 033° T/213° T axis *(see Figure 2)*. It is fitted with 100 t bollards approximately every 20 m. There is also a 150 t bollard on a dolphin at its north end *(see Figure 2)*. The jetty is equipped with seven Yokohama fenders. The maximum tidal range alongside is 3.9 m.

15. The jetty was owned and operated by COL, which was the statutory harbor authority for the Clyde Estuary.

16. COL oversaw the safe operation of the port and jetty based on Peel Ports Group's (Peel Port's) MSMS and the supporting SOPs.[10]

17. In 2014, COL created a generic risk assessment[11] for the lay-up of ships within the area for which it was the statutory harbor authority. The following mitigation measures were identified that:

    (a) the ship's mooring plan met Classification Society requirements;

    (b) the ship's operating procedures and COL emergency procedures were aligned;

    (c) the ship's crewmembers were aware of local sensitivities and the Harbour Master's requirements;

    (d) a joint planning meeting be conducted to discuss the availability of tug assistance and to ensure that the moorings were in good condition;

    (e) the local police force and fire and rescue service were aware of the laid-up ship; and

    (f) the proposed lay-up plan met the port's emergency preparedness procedures as described in the port's MSMS.

Planning for Lay-up at Hunterston Jetty

Drill Ship Risk Assessment

18. On 24 November 2020, Joulon completed a risk assessment for berthing drill ships alongside at Hunterston, Scotland. Identified hazards, potential consequences, and current and additional controls include:[12]

HAZARD	POTENTIAL CONSEQUENCES	BARRIERS / CONTROLS	
Vessel mooring component failure	Losing vessel position at quay	Current Controls • Mooring analysis and line arrangement • Regular inspections of lines by crew • Third-party verification • Port competence – tug availability • Equipment maintenance and certification • Following procedures as per contingency plan • Power thruster availability	Additional Controls • Equipment verification • Additional mooring ropes available • Line adjustment for tidal variations • Deploying ship's anchors

10 The MSMS was based on the United Kingdom's PMSC and Guide to Good Practice on Port Marine Operations. Both documents are discussed later in the report.

11 Risk assessment 156 – lay-up vessels: covering vessels laid-up at Loch Striven, Great Harbour or elsewhere within COL's jurisdiction.

12 The other identified hazards were tidal variations and collisions with another vessel.

HAZARD	POTENTIAL CONSEQUENCES	BARRIERS / CONTROLS	
Mooring rope failure	Strain on the mooring rope Losing vessel position at quay	Current Controls • Constant monitoring of the mooring ropes • Monitoring environmental conditions on daily basis • Crew are trained in the event of a mooring failure and other associated emergencies by way of regular drills (per contingency plan) • Daily operations preparedness meeting	Additional Controls • Additional mooring ropes available • Sufficient manning levels for adjusting lines • Additional resources to be made available at quayside during adverse weather conditions • Deploying anchors as required
Quayside mooring component failure	Losing vessel position at quay	Current Controls • Mooring analysis and line arrangement • Third-party verification • Port competence – tug availability • Quayside bollards maintenance and load test • Following procedures as per contingency plan • Power thruster availability	Additional Controls • Cross lining to adjacent bollard • Additional mooring ropes available • Equipment verification • Line adjustment for tidal variations • Deploying ship's anchors • Additional resources available on quayside
Adverse weather	Strain on the mooring rope Vessel structure colliding with quayside	Current Controls • Mooring analysis and line arrangement • Monitoring environmental conditions on daily basis • Weather forecast data from two independent parties • Daily operations preparedness meeting • Coordination with Port Authorities on regular basis • Contingency plan and emergency response in place	Additional Controls • Power thrusters available • Tug availability • Additional resources available on quayside • Deploying ship's anchors • Deploying anchors as required

19. It was determined that the level of residual risk for each of the identified hazards was broadly acceptable with the identified current and additional controls in place.

Mooring Plan

20. On 25 November 2020, Joulon contracted InterMoor[13] to develop a plan for mooring ENSCO DS-8 at Hunterston Jetty. The plan was based on the drill ship's anchor being deployed.[14] Joulon also provided InterMoor with the results of an extreme wind study with a 10-year return period that had been prepared for the drill ship's owners

13 InterMoor is an engineering firm that specializes in design, installation, inspection, and maintenance of offshore mooring arrangements.

14 ENSCO DS-8's ground tackle consists of one 14 t high holding power anchor and 14 shackles of anchor chain.

based on the ERA5 dataset for 1979-2019.[15] The 10-year average maximum 1-minute wind speeds[16] at an elevation of 10 m identified by this study were:

1-MINUTE MEAN WIND SPEED	WIND DIRECTION (T)							
	337.5° - 022.5°	022.5° - 067.5°	067.5° - 112.5°	112.5° - 157.5°	157.5° - 202.5°	202.5° - 247.5°	247.5° - 292.5°	292.5° - 337.5°
m/s	18.5	20.5	21.4	26.3	30.6	34.2	34.7	28.3
kn	36.1	39.8	41.5	51.1	59.5	66.5	67.4	55.0

21. On 30 November 2020, InterMoor provided an initial mooring plan (Rev. 00) for ENSCO DS-8 to Joulon for their review.

22. On 1 December 2020, Joulon contracted InterMoor to produce a plan for mooring VALARIS DS-4 at Hunterston Jetty. This plan was supposed to be based on the weather data that had been used for ENSCO DS-8's mooring plan. The initial plan (Rev. 00) was provided to Joulon on 4 December 2020. This plan was based on the use of two anchors rather than one.[17]

23. On 18 December 2020, in response to comments received from Joulon following their review of the initial mooring plans for VALARIS DS-4 and ENSCO DS-8, InterMoor recommended that the revisions to these plans be based on weather data for a 100-year return per DNV GL-ST-N001.[18] The 100-year mean wind speeds at an elevation of 10 m were calculated based on the ERA5 dataset of 1-hour mean wind speeds for 1979-2019. The wind speeds were:[19]

REPORTING PERIOD	WIND DIRECTION (T)											
	000°	030°	060°	090°	120°	150°	180°	210°	240°	270°	300°	330°
1-hour mean (m/s)	17	18	20	20	19	23	25	25	27	27	25	22
10-minute mean (m/s)	18	20	22	22	21	25	27	28	30	30	27	24
1-minute mean (m/s)	20	22	24	24	23	27	30	31	33	33	30	26
3-second gust (m/s)	22	24	26	27	25	31	33	35	38	38	34	29
1-hour mean (kn)	33.0	35.0	38.9	38.9	36.9	44.7	48.6	48.6	52.5	52.5	48.6	42.8
10-minute mean (kn)	35.0	38.9	42.8	42.8	40.8	48.6	52.5	54.4	58.3	58.3	52.5	46.7
1-minute mean (kn)	38.9	42.8	46.7	46.7	44.7	52.5	58.3	60.3	64.1	64.1	58.3	50.5
3-second gust (kn)	42.8	46.7	50.5	52.5	48.6	60.3	64.1	68.0	73.9	73.9	66.1	56.4

15 This data is distributed by the Copernicus Climate Change Service (https://climate.copernicus.eu/).

16 The ERA5 dataset does not report 1-minute maximum winds speeds. These were determined by converting maximum 3-second wind gusts using a wind-averaging formula in ANSI/API RP 2MET.

17 VALARIS DS-4's ground tackle consists of one 15 t high holding power anchor and 14 shackles of anchor chain.

18 Based on DNV GL-ST-N001, quayside / inshore moorings that are intended to be in place for more than one year should be based on a 100-year return, those that are intended to be in place for one month to a year should be based on a 50-year return, and those that will be in place for seven days to one month should be based on a 10-year return. A lower return period could be used if the vessel could leave its berth on receipt of a forecast for poor weather.

19 The calculations to determine the 10-minute mean, 1-minute mean, and 3-second guest wind speeds were based on DNV GL-RP-C205.

24. On 23 December 2020, InterMoor provided the results of the mooring analysis completed using the data for the 100-year return to Joulon and the drill ships' owners. In response, Joulon directed InterMoor to base the mooring plans on the data for the 10-year return as provided for by API RP 2SK.[20] Joulon also informed InterMoor that VALARIS DS-4 had one anchor.

25. InterMoor provided the revised mooring plan for VALARIS DS-4 to Joulon on 24 December 2020. Based on this plan, the drill ship was to be moored with 15 UHMWPE lines and the anchor. The lines consisted of 30, 36, and 40 mm diameter lines. Except for a 36 mm line leading forward from a connection point on the starboard side forward of amidships, a 36 mm line leading aft from the starboard quarter, and two 40 mm stern lines, the remainder of the lines were all 30 mm.

26. The revised mooring plan for ENSCO DS-8 was provided on 28 December 2020. The drill ship was to be moored using 14 40 mm diameter UHMWPE lines and the anchor.

27. In addition to specifying the number of lines that were to be used and the points on the ships and on the jetty where each line was to be connected, they also specified the type, diameter, length of line that should be paid out from the fairlead, and pre-tension force for each line. Both plans also specified how much anchor chain should be paid out when the anchors were set.

28. Neither of the two mooring plans included a requirement for the drill ships' thrusters to be started or that they should leave the jetty when the forecast or actual wind speed exceeded a given speed.

29. InterMoor reported that the length of each line was established to maximize how much load it could absorb[21] and to account for tidal changes. This was done so the drill ships' crewmembers would not need to adjust the lines when the tide changed.

30. The mooring plan was developed using the OrcaFlex model, which assumes that wind speed is constant or steady.

31. The mooring plans were not reviewed by the Administrator nor were they required to be reviewed by the Administrator.[22]

Drill Ships' Emergency Response Plans

32. On 24 December 2020, Joulon finalized the emergency response plans for both VALARIS DS-4 and ENSCO DS-8. Both plans included emergency contact numbers for Joulon, Noah, Hunterston Terminal, tugs, and emergency services. They also both included emergency response procedures for adverse weather.[23]

33. The procedures for adverse weather consisted of a decision-making flow chart that included a list of actions that should be taken following the receipt of a forecast for adverse weather. Adverse weather was not defined by these procedures. The flow chart included decision points for each Master to decide if tugs or a berthing team would be required.

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20 API RP 2SK recommends that weather data for a 100-year return period be used for permanent moorings. It also indicates that a shorter return period, determined by a risk analysis that takes the consequences of a mooring failure into account, may be justified if the design life of the mooring is less than 20 years. Further, API RP 2SK does not differentiate between quayside / inshore moorings and offshore moorings.

21 This is based on the MBL and axial stiffness of the line, which are functions of the line type and diameter. In general, short lines are able to absorb less load than longer lines of the same type and diameter.

22 The Administrator's requirements for vessels in lay-up are discussed later in the report.

23 They also included response procedures for vessel collision, fire, man overboard, loss of containment, and medical emergency.

34. The procedures did not include guidance addressing when to request the support of tugs or a berthing team or starting the drill ships' thrusters nor did they reference the weather contingency plans that had been developed for both drill ships.

Drill Ships' Weather Contingency Plans

35. The weather contingency plans were developed taking into account the risk assessment that Joulon completed for berthing VALARIS DS-4 and ENSCO DS-8 alongside at Hunterston Jetty.[24] The plans included the actions that should be taken in different scenarios, including winds that exceeded the upper limits of the drill ships' mooring plan.[25]

36. The actions required by the weather contingency plans, if the forecast or actual wind speeds exceeded those that the mooring plans were based on, or if there was an indication that the drill ships' moorings might fail, were divided into three phases based on forecast and actual wind speeds. The actions that were supposed to be taken during each of these phases were:

INITIAL PHASE **Wind Speed Forecast to Exceed Mooring Plan Limits (> 50 kn)**	**SECOND PHASE** **Wind Speed Increasedto 60 kn**	**THIRD PHASE** **Wind Speed is MoreThan 70 kn**
• Inform crew to prepare for second phase • Escalate port authority to standby • Ensure the quayside is clear or free from any obstruction • Keep extra mooring lines and equipment ready • Put engines and thrusters on standby	• Inform crew of escalation • Mobilize port authority contingency response team • Follow emergency thruster control procedure • Start engines and keep thrusters ready per the emergency thruster control procedure • Monitor mooring lines	• Call Peel Ports and request help from contingency response team, including tugs and mooring line handling team • Initiate onshore contingency response organization • Monitor engines and thrusters • Monitor mooring lines

37. The weather contingency plan indicated that up to four thrusters were available for use when required. It also stated that the thrusters should be limited to 30-50% of their rated capacity in extreme weather conditions. The plan also indicated that tugs at Greenock could arrive on scene within 2–3 hours and that tugs engaged in ship assist work might be available sooner.

Port Planning

38. In September 2020, a structural assessment conducted on behalf of Peel Ports determined the jetty could accommodate five drill ships, two of which were VALARIS DS-4 and ENSCO DS-8.

39. This assessment was based on three of the drill ships being moored side-by-side on the outside face of the jetty and the other two being moored side-by-side on the inside face. It was assumed that each drill ship had a transverse windage area of 8,000 m^2. It was also assumed that the second and third drill ships would receive 30% and 15% of the force of the wind and current acting on the outermost drill ship.

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24 This risk assessment is addressed earlier in this report.

25 The other scenarios were collision, an emergency departure from the quay, and extreme tidal variations.

40. It was reported that the mooring loads were calculated using different wind and current directions. Neither the source nor the details of the weather data that was used for this assessment were reported.

41. Also in September 2020, COL commissioned a third-party analysis of wind speeds and directions at the Hunterston Jetty. The analysis was based on wind speeds recorded at 5-minute intervals from 2009-2020[26] that were averaged to hourly mean values and adjusted to represent the speed at 10 m above the ground. This analysis indicated that the 10-year hourly extreme winds at the jetty were:

REPORTING PERIOD	WIND DIRECTION (T)											
	000°	**030°**	**060°**	**090°**	**120°**	**150°**	**180°**	**210°**	**240°**	**270°**	**300°**	**330°**
1-hour mean (kn)	16.9	15.7	22.7	19	10.4	11.1	19.7	22.1	24.1	26.2	18.6	14.6
1-hour mean (kn)	32.8	30.5	44.1	36.9	20.2	21.6	38.3	43	46.8	50.9	36.2	28.4

The third-party's report did state that it was not possible for a hindcast model to "resolve highly modified local features."

42. In December 2020, Joulon provided copies of the initial mooring plans (Rev. 00) for both VALARIS DS-4 and ENSCO DS-8 to COL for their review. It was reported that COL initially had some reservations about the mooring plans and considered engaging a third-party to review them and to propose any changes deemed necessary. COL subsequently determined that the drill ships' mooring plans were adequate given their understanding that they had been developed by InterMoor based on the conditions at the Hunterston Jetty and that they had been approved by the drill ships' flag State and insurers.

43. After reviewing the mooring plans, COL advised Joulon there was a 3-hour lead time for tug support at the jetty. It was not reported when COL provided this information to Joulon or if this information was also provided to the Masters of VALARIS DS-4 and ENSCO DS-8.

44. Neither the risk assessment, the emergency response plans, nor the weather contingency plans were revised based on the information provided by COL regarding the lead times for tugs.

45. On 8 December 2020, COL had the mooring bollards on the jetty re-tested and certified by an independent consultant to confirm their SWL.

46. On 24 December 2020, a contractual agreement between COL and Thanh Ngoc DMCC (Thanh Ngoc)[27] for VALARIS DS-4 and ENSCO DS-8 to be laid-up at Hunterston Jetty was signed. The agreement was for 24 months.

47. The agreement included the following clauses addressing the drill ships' manning:

    (a) that details regarding the drill ships' lay-up crew were to be provided to COL "before the commencement of the Vessel lay-up;"

    (b) that Thanh Ngoc would always keep marine operations crew available at the jetty; and

26 The source of this data was not reported.

27 Thanh Ngoc is a subsidiary company of Joulon. *See* http://thanh-ngoc.com.

(c) that COL and Thanh Ngoc agreed the drill ship manning would be "to levels approved by [the] Harbour Master and in accordance with Applicable Laws."[28]

48. The agreement also included a schedule containing copies of the original revisions of the mooring plans for both VALARIS DS-4 and ENSCO DS-8, a schedule stipulating conditions for mooring, and an annex with a list of documents that were to be provided for each of the laid-up drill ships.

49. The stated conditions for mooring VALARIS DS-4 and ENSCO DS-8 at Hunterston Jetty included, among other things, that:[29]

(a) two anchors be used by each of the two drill ships;

(b) the drill ships be provided with adequate moorings; and

(c) that "a sufficient number of persons" are available to maintain an effective mooring watch and fire patrol.

50. The documents that were required to be provided included:

(a) mooring plans that had been approved by the drill ships' P&I Club(s);

(b) risk assessments for the moorings;

(c) layout plans for the ships' anchors;

(d) action plans for emergency situations, including fire, oil spill, and loss of onboard systems (e.g., power or communications);

(e) ships' particulars;

(f) minimum manning in accordance with flag State policy and proof that the ships' flag State is content with reduced manning during laid-up period; and

(g) arrangements for immobilization of propulsion systems.

51. Based on the information available to the Administrator, it is not possible to establish if Joulon or Noah provided COL with drawings of the drill ships and details of their mooring arrangements, which showed that both VALARIS DS-4 and ENSCO DS-8 were equipped with only one anchor each, prior to providing COL copies of the drill ships' mooring plans. It is also not possible to establish when COL may have received copies of the drill ships' contingency plans.

Lay-up at Hunterston Jetty

52. On 14 December 2020, ABS surveyors attended VALARIS DS-4 and ENSCO DS-8 to conduct reactivation surveys. Both drill ships were issued short term international statutory certificates[30] that were valid through 13 January 2021 and class certificates for a single voyage from Las Palmas to Hunterston.

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28 The agreement defined Applicable Laws as "the laws of England and Wales and any other laws, bye laws or regulations (including health and safety regulations), internationally binding conventions, regulatory policies, directives, guidelines or industry codes (including the Vessel Regulations) which apply to the operation of the Vessels and Terminal and personnel there."

29 The stated conditions also addressed issues related to compliance with orders that might be issued by the Harbour Master, compliance with pollution prevention requirements, ballasting, maintenance of safe access to the drill ships, and communications.

30 The following short term international certificates were issued to both drill ships: International Load Line Certificate, International Oil Pollution Prevention Certificate, International Air Pollution Prevention Certificate, Mobile Offshore Drilling Unit Safety Certificate (1989), and an International Sewage Pollution Prevention Certificate. As previously noted, the Safety Management Certificates held by both drill ships had remained valid since no intermediate audits had been required while the drill ships were in lay-up at Las Palmas.

53. The Administrator issued a Provisional Certificate of Registry with an endorsement for a single voyage in ballast from Las Palmas to Hunterston to ENSCO DS-8 on 15 December 2020 and to VALARIS DS-4 on 17 December 2020.

54. On 23 December 2020, a pre-arrival meeting involving COL, Joulon, and the Masters of VALARIS DS-4 and ENSCO DS-8 was conducted. It was reported that during the meeting the drill ships' Masters asked for some additional survey information for the locations where each drill ships' anchor was planned to be dropped when they arrived at Hunterston Jetty. COL provided the requested information after the meeting was completed.

55. VALARIS DS-4 arrived at Hunterston Jetty on 27 December 2020. Prior to berthing, the drill ship's anchor was dropped to the northeast of the jetty so that it would be about 35° off its starboard bow once the drill ship was moored alongside. The drill ship then laid out 10 shackles of anchor chain while maneuvering alongside the jetty.

56. ENSCO DS-8 arrived at Hunterston Jetty on 28 December 2020. The drill ship's anchor was dropped to the southeast of the jetty so it would be 45° off the port bow and then 12 shackles of anchor chain were laid out as it maneuvered alongside the jetty.

57. It was reported that both VALARIS DS-4 and ENSCO DS-8 were then moored using additional lines and that some lines were made up to different connection points than those specified by the mooring plans developed by InterMoor. Compliance with the mooring plan was not verified by the drill ships' Masters, InterMoor, COL, or any other third-party. There is no available documentation recording the length of each of the mooring lines.

58. VALARIS DS-4 was moored starboard side to at the northeast end of the jetty with the bow extending past the dolphin. ENSCO DS-8 was moored port side to at the southwest end of the jetty.

59. It was reported that the Masters of VALARIS DS-4 and ENSCO DS-8, during the transit from Las Palmas to Hunterston, had expressed some concerns regarding the drill ships' mooring plans to the pilot who was on board when they were moored at the Hunterston Jetty. The concerns that the pilot reported to COL were related to the high windage of the drill ships and included that the Masters would:

    (a) normally plan on using the thrusters to supplement the moorings when the winds were from some relative directions[31] more than 18 kn; and

    (b) typically depart the berth when the winds were above 25-30 kn and shift to safe water until the wind speeds were lower.

    It is not known if the Masters of the laid-up drill ships, who had also been on board during the transit from Las Palmas, had similar concerns, or if they discussed this with Joulon or Noah.

60. It was also reported that the pilot advised the Masters of the laid-up drill ships regarding the need to ensure their moorings were well maintained, particularly when easterly winds were forecast. The pilot was reported to have told the Masters that the actual velocity of winds from the east is typically higher than what was forecast. Lastly, the pilot advised that there were no tugs in the immediate vicinity and a 6-hour notice was required for normal assistance. It is not known if Joulon or Noah were made aware of this information.

31 It was not reported what these relative directions were.

61. On 28 December 2020, United Kingdom Maritime and Coastguard Agency (MCA) inspectors attended VALARIS DS-4 and ENSCO DS-8 to conduct a port State control inspection on both drill ships. It was reported that both drill ships had a full marine crew[32] on board when the inspections were conducted. The available documentation for these inspections provides no indication that VALARIS DS-4 and ENSCO DS-8 were going to be placed in lay-up at Hunterston Jetty. Both inspection reports included an observation noting that they had been in lay-up at Las Palmas to explain why they held short term certificates.[33] A deficiency was issued to ENSCO DS-8 requiring that surveys for full-term certificates be conducted prior to departure.[34] A similar deficiency was not issued to VALARIS DS-4.[35]

62. On 28 December 2020, management of VALARIS DS-4 was transferred from Ensco to Joulon and Noah and the drill ship was placed into lay-up.

63. Concurrent with the change of management, there was a handover from the crewmembers who had been on board for the transit from Las Palmas to the lay-up crew hired by Noah. The VALARIS DS-4 lay-up crew consisted of a Master, C/E, ETO, two ASDs, and two Oilers/Motormen. A Project Manager and Project Technician hired by Joulon were also on board.

64. On 29 December 2020, ENSCO DS-8 was also placed in lay-up after management was transferred from Ensco to Joulon and Noah along with a handover from the transit crew to the lay-up crew. The lay-up crew consisted of a Master, C/E, ETO, two ASDs, and Motorman hired by Noah Ship Management, as well as an Operations Engineer, two Project Engineers, and a Technical Assistant hired by Joulon.

65. Based on the drill ships' logs, the daily routine on board both VALARIS DS-4 and ENSCO DS-8, from the time that they entered lay-up, included checking and adjusting the mooring lines at least once a day. It could not be verified if the lines were adjusted to maintain the lengths specified in the InterMoor mooring plans or if this was to prevent them from going slack per customary practice.

66. Following the VALARIS DS-4's and ENSCO DS-8's arrival at Hunterston Jetty, one main diesel generator and two thrusters on each drill ship were to be kept ready for use. Their other five main diesel generators and four thrusters were placed into cold iron.

67. Both drill ships were fitted with a 220 V deck generator that provided power to the Accommodations and essential services, such as the mooring winches and fire pumps. If the thrusters needed to be placed in standby or online, it was necessary to switch over to one of the drill ships' permanently installed 440 V diesel generators. The changeover was not automatic and required the drill ship be blacked out until a 440 V generator assumed the load.

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32 Based on the MSMC issued by the Administrator, the minimum marine crew for both drill ships included a Master, C/O, two 3/Os, three ASDs, two OSs, C/E, 1 A/E, two 3 A/Es, and three Oilers/Motormen or ASE.

33 The following short term international certificates had been issued to both drill ships before they departed Las Palmas: International Load Line Certificate, International Oil Pollution Prevention Certificate, International Air Pollution Prevention Certificate, Mobile Offshore Drilling Unit Safety Certificate (1989), and an International Sewage Pollution Prevention Certificate. The certificates issued to both drill ships were valid through 13 January 2021. ENSCO DS-8 had also been issued interim Safety Management Certificate by Bureau Veritas since the drill ship's full-term certificate expired on 14 December 2020 and a renewal audit had not been conducted while it was in lay-up. The Safety Management Certificate held by VALARIS DS-4 had been issued on 23 March 2020 and was valid through 17 July 2023.

34 ENSCO DS-8 was also issued a deficiency for an inoperable rescue boat that was required to be rectified prior to departure.

35 VALARIS DS-4 was issued three deficiencies for the emergency lighting for the Engine Room escape not working, the line throwing apparatus being expired, and the rescue boat not being operational. All three were required to be rectified prior to departure.

68. On 4 January 2021, Joulon updated the weather contingency plans for both drill ships based on comments from the Master of VALARIS DS-4 regarding the potential impact of winds from the northeast. The plans were revised to require that:

    (a) when winds of 40 kn or more from the northeast to east were forecast, the crew should be on standby, the drill ship's diesel generator started, and the thrusters placed on standby; and

    (b) when the winds were 50 kn or more from the northeast to east that two thrusters be engaged.

69. On 4 January 2021, based on the owner's notification that VALARIS DS-4 and ENSCO DS-8 were safely moored at Hunterston Jetty, ABS changed the status of both drill ships to laid-up, without additional qualification.[36] The effective date of the change of status was 28 December 2020 for VALARIS DS-4 and 29 December 2020 for ENSCO DS-8.

70. On 14 January 2021, the drill ships' owners informed the Administrator that VALARIS DS-4 and ENSCO DS-8 were in lay-up at Hunterston Jetty and requested that a Provisional Certificate of Registry in Laid-up Status be issued to each of the drill ships. These certificates were issued that same day.[37]

Weather Information

71. The Masters of VALARIS DS-4 and ENSCO DS-8 had access to the Meteorological (Met) Office's inshore and shipping forecasts[38] and its local weather forecasts for Hunterston and the surrounding area. The inshore forecast included the Firth of Clyde.[39]

72. Both drill ships also had functioning anemometers mounted on the port and starboard sides of the mainmast, which is above the Bridge.

VALARIS DS-4 Partial Loss of Moorings on 13 January 2021

73. On the evening of 13 January 2021, the winds were from the northeast at 20-25 kn with gusts of 30 kn.[40]

74. Between about 2115–2230, VALARIS DS-4 was reported to be yawing on the jetty with the forward third of the drill ship moving as far as 12-15 m away from the jetty. This caused the gangway to pull off the jetty and hang over the drill ship's side.

75. It was reported that line No. 8[41] had parted. Although the remaining mooring lines remained intact, they were all reported to have slipped as much as 4-5 m on the bollards.

76. The initial efforts to start the drill ship's diesel generators so the thrusters could be brought online were not successful and at 0028 on 14 January 2021, the Master contacted the port and requested tug assistance. He was informed that tugs would not be on scene until 0600.

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36 The notification was provided in an email to ABS that was sent on 30 December 2021.

37 The certificate for ENSCO DS-8 was dated 13 January 2021. This was because the Provisional Certificate of Registry that had been issued for the voyage from Las Palmas to Hunterston expired on that date.

38 The inshore forecast was for coastal waters extending up to 12 NM from shore whereas the shipping forecast included offshore waters.

39 The Firth of Clyde is the mouth of the River Clyde. Hunterston is located in this area.

40 Based on the drill ships' deck logs, there had previously been winds of 20 knots from the northeast on 4 January 2020.

41 Line No. 8 was a 30 mm UHMWPE forward spring line.

77. Sometime after VALARIS DS-4 had stopped yawing, the engineers were able to start a diesel generator and bring the thrusters online. The Master then brought VALARIS DS-4 back alongside the jetty. Once alongside, the drill ship's crewmembers adjusted the mooring lines.

78. At 0139, the port was informed that the drill ship's thrusters had been started and that tug assistance was no longer required.

79. Later in the day, COL conducted an inspection of VALARIS DS-4's moorings. During this inspection they observed that some of the lines appeared to have been damaged because of drill ship's movement during the recent easterly winds, that some of the lines appeared to not have been properly made fast on the drill ship's bits, and that several of the mooring lines were slack.

80. On 15 January 2021, COL held a remote meeting with Joulon and Noah. It was reported that this included a discussion of the observations made during COL's inspection of the moorings. COL also questioned whether the drill ship's mooring lines were the proper size. Following the meeting, COL produced a written inspection report with recommendations that was shared with Joulon and the Master of VALARIS DS-4.

Shift of VALARIS DS-4 and ENSCO DS-8

81. After meeting with COL, Joulon, and Noah decided to shift VALARIS DS-4 and ENSCO DS-8 to the southwest along the berth. Joulon also contracted InterMoor to conduct an analysis to determine the likely cause for VALARIS DS-4's mooring line No. 8 parting and to develop a revised mooring plan. They also decided to replace all of VALARIS DS-4's mooring lines with 42 mm and 48 mm diameter UHMWPE lines.

82. InterMoor determined that the likely cause of VALARIS DS-4's Line No. 8 parting was that less line had been paid out from the fairlead than was specified by the mooring plan.

83. Ahead of the planned move, a planning meeting involving the drill ships' Masters, pilots, Joulon, and COL was held to discuss the sequence for how the move would be conducted and related safety issues.

84. Between 24-25 January 2021, VALARIS DS-4 was shifted 27 m and ENSCO DS-8 was shifted 10 m to the southwest along the jetty and re-moored. After being re-moored, VALARIS DS-4's bow did not extend past the dolphin at the northeast end of the jetty.

85. The revised mooring plan InterMoor developed for VALARIS DS-4 specified that the drill ship be moored with 12 42 mm and four 48 mm UHMWPE lines plus the anchor. Two of the 48 mm lines led aft from bits located amidships and starboard quarter. The other two 48 mm lines were used as stern lines.

86. It was reported that when VALARIS DS-4 was re-moored, some of the lines included in the revised mooring plan were made up to different connection points than specified by the plan. It was also reported that one additional line was installed at the drill ship's bow and that two additional lines were installed at the stern. There is no available documentation recording the actual length of the mooring lines when VALARIS DS-4 was re-moored.

87. The revised mooring plan InterMoor developed for ENSCO DS-8 specified that the drill ship be re-moored with 13 40 mm and four 42 mm diameter UHMWPE lines plus the anchor.

88. It was reported that when ENSCO DS-8 was re-moored, some of the lines were made up to different connection points than identified in the mooring plan developed by InterMoor. It was also reported that an additional 42 mm diameter line was installed as a forward breast line. There is no available documentation recording the actual length of the mooring lines when ENSCO DS-8 was re-moored.

89. Compliance of the mooring arrangements with the mooring plans was not verified by any third-party on behalf of the drill ships' managers or the port.

90. Based on the drill ships' logs, the crewmembers continued to monitor and adjust the mooring lines each day. It could not be verified if the lines were adjusted to maintain the lengths specified in the mooring plans developed by InterMoor or if this was to prevent them from going slack.

91. Neither the owner, Joulon, nor Noah informed the Administrator of VALARIS DS-4's partial loss of moorings as required by the Republic of the Marshall Islands Maritime Regulations (MI-108) (the "Maritime Regulations"), section 6.36.[42]

Availability of Diesel Generators and Thrusters

92. By mid-January 2021, the engineers on VALARIS DS-4 and ENSCO DS-8 were reported to have difficulty starting the diesel generators and thrusters on both drill ships due to inadequate preheating of the lube oil and jacket water for both the diesel generators and thrusters. There was also inadequate heating for the fuel oil purifiers. It was additionally reported that there were water leaks on the thrusters.

93. It was determined that these problems were related to the temperatures during this period, which generally were between -1 and 2°C, and that the 220 V deck generators on both drill ships could not provide sufficient power for the preheaters. In addition, it was also not possible to provide power to the feeder panel for thrusters Nos. 1-3 on both drill ships without switching over to the diesel generators.

94. Throughout January 2021, the engineers and Joulon technicians on VALARIS DS-4 and ENSCO DS-8 worked to identify a solution so that the diesel generators and thrusters could be placed online if needed.

95. On 30 January 2021, the Master of ENSCO DS-8 sent an email to Noah reporting that in an emergency they would need to request tug assistance since the drill ship's thrusters were not available for use. He also reported that they required weather forecasts that were more accurate. Noah responded by stating that the issue with the diesel generators and thrusters needed to be resolved as soon as possible. Based on the records and information available to the Administrator, the Master of VALARIS DS-4 did not make any similar reports to Noah.

96. On 1 February 2021, the C/E on board ENSCO DS-8 sent an email to Joulon reporting that the cold weather (0°C) was making it difficult to preheat the jacket water and lube oil for diesel generator No. 4 using only one heating element.[43] The C/E stated that they planned to turn off the preheater for the deck crane so that a second heating element could be turned on to better preheat the jacket water and lube oil for diesel generator No. 4.[44]

42 The Administrator was first made aware of this marine incident by the United Kingdom MCA on 12 February 2021.

43 It was planned to start this diesel generator to operate a deck crane.

44 The preheating system was designed to use five heating elements.

97. By the morning of 2 February 2021, the jacket water temperature had reached 60°C, which was the minimum temperature for starting the diesel generator. By contrast, the lube oil temperature was between 21-33°C. It was supposed to be not less than 40°C. The C/E advised Joulon that preheating the lube oil more efficiently would require running the pre-lube oil pump continuously, but that they did not have sufficient electrical power to do this.

Weather 29 January 2021 to 1 February 2021

98. Between 29 January 2021 to 1 February 2021, both drill ships were reporting winds from the northeast between 20-30 kn with some higher gusts. In the email that ENSCO DS-8's Master sent Noah on 30 January 2021, it was reported that gusts up to 55 kn had been observed. It also stated that based on the Met Office forecast that had been provided by Peel Ports, the winds had been expected to be from the northeast at 15 kn with gusts of 20-25 kn. Based on the URL the Master included in the email, the reference was to the Met Office local forecast for Hunterston and the surrounding area.

99. The Met Office inshore forecasts for the period predicted that the winds would generally be from the northeast to southeast between Beaufort Force 4-5 (11-21 kn) with occasional periods of Beaufort Force 6-8 (22-40 kn).

100. Local pilots and tug operators subsequently reported that easterly winds at the Hunterston Jetty can exceed the forecast by up to 10 kn and that gusts can be as much as 15 kn higher than was forecast.

Loss of Moorings on 2 February 2021

101. Based on the Met Office inshore weather forecast issued at 0001 UTC on 2 February 2021, the forecast for the next 24 hours was for winds from the east to southeast between Beaufort Force 5-7 (17-33 kn) with periods of Beaufort Force 8 (34-40 kn). Forecasts issued later in the day were for easterly winds of similar force.

102. Based on VALARIS DS-4's Noon Report for 2 February 2021, the observed winds were from the northeast at 25 kn with gusts between 45-53 kn. It was reported that the mooring lines and gangway were being checked due to the high gusts and that the drill ship was being prepared for the upcoming days of forecast high winds coming off the shore.[45]

103. ENSCO DS-8's Noon Report indicated that winds from the east at 30-35 kn with gusts of 40-50 kn had been recorded. It was also reported that the mooring lines were being adjusted as necessary and that diesel generators Nos. 3 and 4 were being preheated.

104. Based on the drill ships' logs, the wind speed increased throughout the day. At 1600, VALARIS DS-4 reported northeast winds of 50 kn. The storm force winds continued, and at 1830, it was reported that the winds were 55 kn.[46]

105. By 1720, ENSCO DS-8's diesel generator No. 3 had been started and the drill ship's power had been swapped from the portable deck generator.

106. At 1845, VALARIS DS-4's Master, C/E, and ASD on duty reported hearing a noise that they thought sounded like the anchor chain. It was reported that the wind speed was about 70 kn.[47] When the Master and ASD went on

45 It was not reported if these actions included trying to make any of the diesel generators and thrusters ready to start.

46 Winds of 48-55 knots are Beaufort Force 10.

47 It was not reported if this was a gust or sustained speed.

deck to investigate, they observed that several of the forward mooring lines had parted, and that the drill ship was moving away from the jetty.

107. VALARIS DS-4's C/E went to the Engine Room to start a diesel generator and to prepare thruster No. 5.

108. Based on AIS information, by about 1915, all of the drill ship's forward mooring lines had parted. Within the next 2-3 minutes, the remaining mooring lines had parted. The drill ship was blown off the jetty and started drifting to the southwest at about 2 kn.

109. About when VALARIS DS-4 started drifting away from the jetty, the Master made an announcement on the drill ship's PA system directing all crewmembers to muster on the Bridge. The C/E left the Engine Room and went to the Bridge.

110. It was reported that the diesel generator the C/E had started stopped running a short time after he left the Engine Room.

111. At 1915, the Master of VALARIS DS-4 broadcast a MAYDAY by VHF.

112. Based on AIS information, at about 1923, the anchor held. By this time, VALARIS DS-4 had drifted approximately halfway across the channel between the jetty and Great Cumbrae Island, which was about 400 m to the west.

113. At about 1920, the Master of ENSCO DS-8 called the Harbor Master to request tug assistance. He also notified Noah, Joulon, Peel Ports, and the MCA.

114. Following VALARIS DS-4's loss of moorings and reported inability to start the diesel generators and thrusters, the MCA mobilized equipment for a Tier 3 oil spill response in case the drill ship went aground.

115. At 2040, the first tug arrived with a pilot on board. After determining that VALARIS DS-4 was not dragging anchor, the pilot directed the tug to go alongside ENSCO DS-8 and help hold the drill ship alongside the jetty. A second tug arrived on scene at 2040 and also started pushing ENSCO DS-8.

116. At 2204, ENSCO DS-8's gangway was pulled off the jetty when the drill ship was struck by a gust of 60-70 kn.

117. A third tug arrived at 2310 and started pushing on ENSCO DS-8.

118. At 0530 on 3 February 2021, a fourth tug arrived and also was used to help hold ENSCO DS-8 alongside the jetty.

119. Throughout the day, both drill ships were reporting the winds to be from the east northeast. VALARIS DS-4, which remained at anchor halfway across the channel between the jetty and Great Cumbrae Island, reported winds of 30 kn with gusts of 45-50 kn. ENSCO DS-8 reported winds of 40-45 kn with gusts of 50-60 kn. The forecast was for winds from the east 30-35 kn with gusts of 45-55 kn.

120. By noon on 3 February 2021, VALARIS DS-4's diesel generator No. 3 and thruster No. 2 had been started and were online. Efforts to start thruster No. 5 were not successful.[48] ENSCO DS-8's diesel generators Nos. 3 and 4 were online and thrusters Nos. 3, 5, and 6 were being preheated. These thrusters were started by noon on 4 February 2021 and were being used to help hold the drill ship alongside the jetty.

48 Thrusters Nos. 2 and 5 were the two thrusters that had been designated to be started. It was reported that both had been successfully tested before the temperatures dropped to between -1 and 2°C in mid-January 2021.

121. From 4-5 February 2021, the crewmembers on board VALARIS DS-4, with remote assistance from service technicians from the manufacturers of the thrusters and the thruster control system, continued their efforts to determine why thruster No. 5 could not be started. During this period, tugs were pushing on the drill ship's stern to relieve pressure on the anchor chain. The number of tugs that were pushing at any one time varied between one and two.

122. The weather began to improve over the course of the next several days. The winds continued to be from the northeast but at 15-30 kn with gusts of 45-50 kn. By 6 February 2021, the winds had shifted to the east at 20 kn.

123. On 6 February 2021, service technicians from the manufacturers of the thrusters and the thruster control system embarked VALARIS DS-4 to assist the crewmembers as they continued their efforts to troubleshoot the thrusters. It was reported that the issues that prevented the thrusters from being started included electrical faults and low cooling water pressure due to leaking hoses.

124. During the day on 7 February 2021, most of the issues with the VALARIS DS-4's thrusters were resolved and thrusters Nos. 1-4 and No. 6 were operational. Thruster No. 5 remained non-operational due to the failure of some diodes in the thruster's control system.

125. At 1500, the Master of ENSCO DS-8 released the tugs on 30-minute notice after receiving permission from the MCA. By this time, the winds were from the north at 10 kn with gusts up to 15 kn.

126. On the morning of 8 February 2021, the MCA granted permission for VALARIS DS-4 to return to the jetty. By 1700, the drill ship was moored alongside the jetty.

Crew on Board VALARIS DS-4 and ENSCO DS-8

127. On 17 November 2020, while planning for the continued lay-up of VALARIS DS-4 and ENSCO DS-8 at another Spanish port or at Hunterston, Noah informed the Administrator that they intended to maintain the drill ships' current manning, which consisted of a navigating officer, an engineering officer, an ETO, and three ratings. The Administrator replied by stating that per Marine Guideline No. 1-11-1, Lay-Up of Vessels (MG 1-11-1),[49] the manning level while the drill ships were in lay-up should be developed in coordination with the port or coastal State authorities and the drill ships' P&I Club.[50]

128. On 20 November 2020, Ensco, who was then the drill ships' manager, requested that the Administrator issue a letter accepting their proposed manning for VALARIS DS-4, ENSCO DS-8, and five other drill ships while they were in lay-up. It was proposed that each drill ship would have a five-person marine crew who held the required STCW endorsements for their position on board and a two-person maintenance crew. The marine crew would consist of a Master, one OICNW, two ASDs/OSs, and one C/E or 2/E. The request did not state where the drill ships would be laid-up.[51]

129. The Administrator issued letters on 23 November 2020 stating there was no objection to the manning proposed by Ensco for VALARIS DS-4, ENSCO DS-8, and the five other drill ships while they were in lay-up at Las

49 MG 1-11-1 is discussed later in the report.

50 The MSMCs that had previously been issued by the Administrator to VALARIS DS-4 and ENSCO DS-8 in accordance with SOLAS regulation V/14 were not applicable since the drill ships were out of service. Per SOLAS regulations V/14.2 and I/1(a), the MSMCs would be applicable when the drill ships departed Hunterston after coming out of lay-up.

51 Ensco had not submitted a similar request to the Administrator before VALARIS DS-4 and ENSCO DS-8 entered lay-up in May 2020.

Palmas. Each of the letters also stated that "the manning level, however, must be in compliance with all local regulations and Administrator guidelines, and must be adequate to ensure the safety and security of the vessel and crew, and the protection of the marine environment."

130. COL reported they had not been made aware of the specific number of crewmembers on board VALARIS DS-4 and ENSCO DS-8 while they were in lay-up before the drill ships arrived at Hunterston Jetty. COL also stated they first became aware of the Administrator's requirement that the drill ships' manning be approved by the port authorities at the lay-up location sometime after 9 February 2021.

131. When the loss of moorings occurred on 2 February 2021, VALARIS DS-4 had a marine crew of six, along with a project manager and technician on board. Each member of the marine crew held either a certificate of competence or proficiency issued by their national administration. The Master held valid seafarer documentation issued by the Republic of the Marshall Islands for his position on board.[52]

132. The experience of the marine crew on board VALARIS DS-4 prior to 2 February 2021:

Rank	Time On Board VALARIS DS-4	Time in Rank	Time with Company
Master	2 months	11 years	2 years
C/E	2 months	20 years	1 month
ETO	2 months	7 years, 1 month	2 months
ASD1	4 days	2 years, 15 days	4 days
ASD2	4 days	2 years, 15 days	4 days
Oiler	21 days	1 year, 2 months	21 days

133. On 2 February 2021, there was a marine crew of six, an operations engineer, two project engineers, and a technical assistant on board ENSCO DS-8. Each member of the marine crew held either a certificate of competence or proficiency issued by their national administration. The Oiler held valid seafarer documentation issued by the Republic of the Marshall Islands appropriate for his position on board.[53]

134. The experience of the marine crew on board ENSCO DS-8 prior to 2 February 2021:

Rank	Time on Board ENSCO DS-8	Time in Rank	Time with Company
Master	2 months	1 year, 10 months	2 months
C/E	2 months	9 years	2 months
ETO	2 months	3 years, 4 months	2 months
ASD1	23 days	12 years, 6 months	23 days
ASD2	8 days	11 months	8 days
Oiler	4 days	1 year, 8 months	4 days

52 Because VALARIS DS-4 was out of service while holding a Provisional Certificate of Registry with the endorsement "This Certificate is Only Valid while the Vessel Remains in Laid-up Status and is Not Valid for Navigation," the vessel was not in service as defined in STCW and therefore the crew were not required to hold Republic of the Marshall Islands' seafarer documentation.

53 As noted previously, because ENSCO DS-8 held a Provisional Certificate of Registry with the endorsement "This Certificate is Only Valid while the Vessel Remains in Laid-Up Status and is Not Valid for Navigation," the drill ship was not in service as defined in STCW and therefore the crew were not required to hold Republic of the Marshall Islands' seafarer documentation.

135. VALARIS DS-4's and ENSCO DS-8's Master, C/E, and ETO had all signed on board the drill ships at Las Palmas in early December 2020. They remained on board for familiarization during the drill ships' voyages to Hunterston.

136. The tonnage endorsements on the national certificates of competency held by the Masters were appropriate to work as Master on board VALARIS DS-4 and ENSCO DS-8. Both held the qualifications required to serve as a DP operator on all three classes of DP vessels. [54]

137. The C/E on board VALARIS DS-4 held a certificate of competency authorizing him to work as a C/E on vessels with up to 3,000 kW propulsion power.[55] The certificate of competency held by the C/E on board ENSCO DS-8 authorized him to work as a C/E on board vessels with 3,000 kW or more propulsive power.[56]

138. The ETOs had extensive documented service on board DP equipped vessels before they signed on VALARIS DS-4 and ENSCO DS-8.

MCA Inspections

139. On 9 February 2021, MCA inspectors attended ENSCO DS-8 and issued improvement notices addressing:

    (a) the drill ship's moorings;

    (b) that routine maintenance and inspection of fire fighting equipment and lifesaving appliances were not being conducted;

    (c) that instructions and procedures related to the drill ship's laid-up status were not available to the crewmembers; and

    (d) the quality of the food on board.

    A requirement to provide confirmation that the installation of the portable deck generator met the applicable requirements was also issued.

    They also issued a deficiency addressing the drill ship's manning, based on the equipment that was being operated at the time of the inspection[57] and a prohibition notice to prevent the drill ship from proceeding to sea until it held valid applicable international certificates.[58]

140. On 10 February 2021, MCA inspectors conducted an inspection on board VALARIS DS-4. The deficiencies documented by the attending inspectors were similar to those that were issued to ENSCO DS-8. The improvement notices that were issued also addressed the same issues that were addressed in the notices that were issued to ENSCO DS-8. An additional improvement notice was issued that addressed that the deck crane used for taking on stores and equipment while the drill ship was moored to the jetty did not have valid certification. A prohibition notice to prevent VALARIS DS-4 from proceeding to sea without valid applicable certificates was also issued.[59]

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54 *See* IMO Circular MSC.1/Circ.1580, Guidelines for Vessels and Units with Dynamic Positioning (DP) Systems.

55 Based on the MSMC issued by the Administrator, VALARIS DS-4 had a total propulsive power of 48,000 kW. As previously noted, the requirements of this certificate were not applicable since the drill ship held a Provisional Certificate of Registry with the endorsement "The Certificate is Only Valid while the Vessels Remains in Laid-Up Status and is Not Valid for Navigation."

56 Based on the International Air Pollution Prevention Supplement issued by ABS, ENSCO DS-8 had a total propulsive power of 43,740 kW.

57 No action was taken by the MCA since there was not any legislation addressing manning of drill ships in lay-up.

58 As previously discussed, ENSCO DS-8's international certificates expired on 13 January 2021, after the drill ship entered lay-up. Additional deficiencies related to the marine crew's seafarer employment agreements and catering were also issued.

59 The international certificates held by VALARIS DS-4 had also expired on 13 January 2021.

ABS Guidance for Lay-up of MODUs[60]

141. The ABS Guide for Lay-up and Reactivation of Mobile Offshore Drilling Units (2017) (the "ABS Lay-up Guide") provides guidelines for owners that address issues related to the preservation and protection of a laid-up vessel. It includes three basic conditions:[61]

    (a) **Laid-up:** The vessel is out of service for an undetermined length of time and ABS has not reviewed lay-up procedures that may have been prepared by the vessel's owner or operator. All class surveys are held in abeyance and statutory surveys are completed only if required by the vessel's flag State. An initial lay-up survey and annual surveys are not required. A reactivation survey, including all due and overdue class and statutory surveys, is required before the vessel returns to operation.

    (b) **Laid-up Warm Stacked:** The vessel is not in operation and is positioned in a sheltered location with a crew on board to carry out maintenance and preservation activities per the lay-up procedures reviewed by ABS.[62] If requested, ABS will also conduct an engineering review of the mooring plan and will also conduct a mooring survey. All class surveys are held in abeyance and statutory surveys are completed only if required by the vessel's flag State. An initial lay-up survey and annual surveys are required to be completed. A reactivation survey, including all due and overdue class and statutory surveys, is required before the vessel returns to operation.

    (c) **Laid-up Cold Stacked:** The only difference between this condition and Laid-up Warm Stacked is that the vessel is not manned. The requirements for ABS to review the lay-up plan and the survey requirements are the same as Laid-up Warm Stacked.

142. In addition to the three basic conditions, the ABS guidance includes two enhanced conditions that are intended to assist with managing the asset by minimizing risk exposure while also reducing the time and cost of reactivation. These two conditions are:

    (a) Enhanced Laid-up Warm Stacked; and

    (b) Enhanced Laid-up Cold Stacked.

    The difference between these two conditions is that a cold stacked vessel is not manned. In addition to the requirements for a vessel that is Laid-up Warm Stacked or Cold Stacked, ABS will review the proposed lay-up location, the planned mooring arrangements, the location specific risk assessment, and emergency response capabilities in the area when a vessel is placed in either of these conditions.[63] ABS will also conduct a mooring survey once the vessel is on location.

143. A vessel owner or operator is required to inform ABS when placing a vessel into lay-up to keep it in class. It is for the owner or operator to decide the lay-up condition for the vessel.

60 A MODU is a vessel capable of engaging in drilling operations for the exploration for or exploitation of resources beneath the seabed such as liquid or gaseous hydrocarbons, sulphur, or salt. *See* the 1989 MODU Code, paragraph 1.3.1. These include drill ships such as VALARIS DS-4 and ENSCO DS-8.

61 *See* ABS Lay-up Guide, Section 1. It is noted that other Classification Societies also have guidelines for placing vessels in lay-up.

62 Guidance regarding the scope and content of the lay-up procedures is provided in the ABS Lay-up Guide, Section 2.

63 Guidance addressing these issues is provided in the ABS Lay-up Guide, Section 3.

Flag State Requirements

144. The Republic of the Marshall Islands Maritime Act 1990 (MI-107) (the "Maritime Act"), section 214 establishes requirements for issuing a Provisional Certificate of Registry to a vessel. These include requirements for the owner to provide evidence that the vessel is in a seaworthy condition and the owner holds third-party liability insurance providing, at a minimum, coverage for pollution liability and shipwreck removal.

145. The Republic of the Marshall Islands Vessel Registration and Mortgage Recording Procedures (MI-100), chapter III, section 4,[64] issued by the Administrator addresses the registration of vessels that have been taken out of service and are moored for a prolonged period. Provisional Certificates of Registry issued to laid-up vessels can be issued for up to one year and are required to have the following endorsement: "This Certificate is Only Valid while the Vessel Remains in Laid-up Status and is Not Valid for Navigation."

146. A vessel holding a Provisional Certificate of Registry with the endorsement "This Certificate is Only Valid while the Vessels Remains in Laid-up Status and is Not Valid for Navigation" is not "in service" as defined in STCW and is therefore not required to comply with the international and national seafarer's documentation requirements that would otherwise be applicable to the vessel when in service.

147. An owner wanting to register a vessel in a laid-up status must provide a statement from the vessel's Classification Society indicating that if it were surveyed when entering lay-up, it would meet the requirements for a classification and tonnage measurement certificates. The owner is also required to, among other things, provide proof of liability insurance and a notarized statement that the vessel will not be moved or navigated while out of class.[65]

148. The Maritime Regulations, section 5.34.2, require that vessels undergo an initial safety inspection before returning to service "at the end of an official lay-up period." Section 5.34.3 of these regulations exempt vessels that are in an official lay-up period from annual safety inspections while laid up.

149. The Administrator's guidance in MG-1-11-1 identifies issues a vessel owner or operator should consider along with recommended procedures for vessels entering, in, and coming out of lay-up.[66]

150. This guideline recommends that when planning to place a vessel in lay-up that the vessel owner develop lay-up procedures that at a minimum address:

    (a) vessel manning;

    (b) firefighting, lifesaving, stability and watertight integrity;

    (c) pre-lay-up preservation measures;

    (d) maintenance while in lay-up;

    (e) whether Classification Society and statutory certificates will be maintained; and

    (f) contingency measures in case of emergencies while the vessel is laid-up.

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64 The reference is to the June 2018 revision of the Vessel Registration and Mortgage Recording Procedures, which was the revision in effect on 2 February 2021. The Administrator revised and reissued this document under the title Vessel Registration and Instrument Recording in April of 2022.

65 The other required documents pertain to the vessel's ownership and registration (if not currently registered in the Republic of the Marshall Islands).

66 It is noted that this document does not have the force of regulation.

Vessel owners are advised to seek assistance from the vessel's Classification Society when preparing the lay-up procedures.

151. Vessel owners are also advised to contact the local port and coastal State authorities to determine if there are any specific requirements or regulations that may be applicable while the vessel is moored or anchored at the planned lay-up location and that should be addressed in the lay-up procedures.

152. The Administrator's guidelines include additional recommendations addressing vessel manning, maintenance, safety and security, and pollution.

(a) **Manning** – Vessel owners are assigned responsibility for ensuring that the vessel's manning is sufficient to ensure:

(i) the safety and security of the vessel;

(ii) that the vessel is maintained; and

(iii) that it does not become a pollution risk.

It is recommended that the manning be developed in coordination with the port or coastal State authorities and the vessel's P&I Club. It is also recommended that if the vessel will not be manned, that all parties are informed and that the lay-up procedures reflect this.

(b) **Maintenance** – Vessel owners are responsible for ensuring that the vessel's basic structural and watertight integrity, stability, and essential machinery and systems are properly maintained while in lay-up so that it does not pose a safety or pollution risk.

(c) **Safety and security** – Vessel owners are advised to keep in place portions of the vessel's Ship Security Plan along with any local requirements to ensure the safety of the vessel.[67] They are also advised that systems required for crew comfort and safety are adequate for the number of persons who will be on board and are both operational and ready for use in normal and emergency situations.

(d) **Pollution** – Vessel owners are assigned the responsibility of ensuring that the vessel does not present any pollution hazards while in lay-up. They are also advised that the vessel is subject to any MARPOL requirements that would apply if it were in active service, along with any port or coastal State requirements.

153. The Administrator's guidance also addresses the owner's responsibilities when a vessel leaves lay-up. These responsibilities include ensuring that all Classification Society and statutory certificates are reactivated, that the SMS is fully functional, and that the vessel is manned per the MSMC issued by the Administrator.

154. As required by the Maritime Act, sections 805 and 825 and the Maritime Regulations, section 7.47, the officers and crew are required to hold Republic of the Marshall Islands' seafarer documentation when the vessel proceeds to sea after leaving lay-up.

Port State Requirements

155. The PMSC sets out guidance for a national standard for all aspects of safety in port facilities and is intended to enhance safety for those who use or work in ports, vessels within the port area, passengers, and the marine

67 Examples that are provided are accommodation systems, firefighting equipment, and lifesaving appliances.

environment. This PMSC provides general guidance addressing several areas related to the safe management of the port, including the use of risk assessments and principles of an effective MSMS.[68]

156. Guidance for implementing the PMSC is provided in the associated Guide to Good Practice. This Guide to Good Practice does not include guidance addressing issues that should be considered for the lay-up of vessels within a port or harbor.

157. The MCA does not have any requirements or guidance applicable to the lay-up of non-United Kingdom-registered vessels.[69]

PART 3: ANALYSIS

The following Analysis is based on the above Findings of Fact.

Loss of Moorings

VALARIS DS-4 lost its moorings and was blown off the jetty when the logged wind was from the northeast at 55 kn. There are some indications that the speed may have actually been higher when the mooring lines started to part. All the drill ship's mooring lines had parted within 30 minutes after the Master and other crewmembers reported hearing what they thought was the anchor chain at 1845 on 2 February 2021. The vessel drifted halfway across the channel between the jetty and Great Cumbrae Island before the anchor reset. The fact the anchor held likely prevented the drill ship from going aground on Great Cumbrae Island.

The C/E on board VALARIS DS-4 had started a diesel generator sometime after the noise, thought to be the anchor chain, was heard. He had not been able to shift power from the portable generator to the diesel generator and then place one or more of the drill ship's thrusters online before the drill ship was blown off the jetty or while it was drifting across the channel.

ENSCO DS-8's moorings held the drill ship to the jetty without any lines parting or assistance from the time that VALARIS DS-4 mooring line started parting until a tug arrived and started pushing the drill ship against the jetty at 2040 on 2 February 2021. One of the drill ship's diesel generators had been started and the drill ship's power shifted from the portable deck generator by 1720 on 3 February 2021, and by noon on 4 February 2021, three of the drill ship's thrusters were running.

It cannot be determined whether VALARIS DS-4 would have remained alongside the jetty if the crewmembers could have placed two thrusters online or if tugs had been pushing the drill ship alongside before 1845 on 2 February 2021.

It also cannot be determined whether ENSCO DS-8's mooring lines would have kept the drill ship alongside the jetty without the use of thrusters or the assistance of the tugs pushing on the drill ship until the period of high winds from the northeast to east had abated by 6 February 2021.

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68 Other areas that are addressed include the duties of key personnel, the duties and powers of harbor authorities, and compliance with directions from the General Lighthouse Authority.

69 The MCA does have guidance for their surveyors for conducting audits of SMSs on board ships holding Safety Management Certificates issued by the MCA. *See* MCA, Instructions for the Guidance of Surveyors on International Safety Management Code for the Safe Operation of Ships and for Pollution Prevention (MSIS02, Rev 06-2020), chapter 8, section 8.1.

On 7 February 2021, ENSCO DS-8 released the tugs that had been helping hold the drill ship alongside the jetty. On 8 February 2021, VALARIS DS-4 weighed anchor and, under its own power, was re-moored alongside the jetty.

Availability of Diesel Generators and Thrusters

After the drill ships arrived at Hunterston Jetty, it was planned to keep one diesel generator and two thrusters available for use.

By mid-January 2021, Joulon and Noah were aware that the engineers on board VALARIS DS-4 and ENSCO DS-8 were having difficulty starting the diesel generators and thrusters due to inadequate preheating of the lube oil and jacket water and inadequate heating of the fuel oil purifiers. This was due to a combination of the temperatures in mid- to late-January 2021 and the 220 V deck generators on both drill ships having sufficient power to only energize a limited number of heating elements. In addition, preheating of thrusters Nos. 1-3 on both drill ships required that the 440 V feeder panel for these thrusters be energized.

The engineers and Joulon technicians on board VALARIS DS-4 and ENSCO DS-8 worked throughout the latter half of January to identify a solution so that the thrusters could be made available if needed. They had not identified a solution to these problems by 2 February 2021.

The problems encountered on board both VALARIS DS-4 and ENSCO DS-8 with keeping a diesel generator and thrusters ready for use after the drill ships arrived at Hunterston Jetty, is an indication that Joulon and Noah did not give adequate attention to the winter temperatures in the area while planning for the drill ships' lay-up. It is noted that the average temperature during January in North Ayrshire is 3.5°C, which is only slightly warmer than the -1.5 to 2°C temperatures that were observed during January 2021.

Based on the information available to the Administrator, the inability to start thruster No. 5 on board VALARIS DS-4, after the loss of moorings, was due to a failure of a component and was not reasonably foreseeable.

Planning for Lay-up at Hunterston Jetty

Planning for the lay-up of VALARIS DS-4 and ENSCO DS-8 at Hunterston Jetty had been started in September 2020 while the two drill ships were laid-up at Las Palmas. Based on the records available to the Administrator, Joulon appeared to have primary responsibility for conducting and coordinating vessel-focused planning activities.

It appears most of the detailed planning did not start until sometime after mid-November 2020 following the decision to not move the drill ships to the ports of Almería and Motril. By this time, Joulon had subcontracted Noah as the marine manager for both drill ships. It was also during this time that it was decided that each drill ship would have a crew of five or six seafarers, which was similar to the size of the crews that were on board the drill ships while they were in Las Palmas.

The detailed planning included:

(a) conducting a risk assessment for berthing at Hunterston Jetty;

(b) contracting to have mooring plans developed;

(c) developing multi-hazard emergency response plans; and

(d) developing weather contingency plans.

Risk Assessment

The risk assessment for berthing VALARIS DS-4 and ENSCO DS-8 at Hunterston Jetty identified multiple hazards related to a loss of moorings. These included a failure of a mooring fitting either on the drill ship or on the jetty, failure of a mooring line, and adverse weather. Several controls were identified for addressing these hazards.

The controls that were identified included the availability of the drill ships' thrusters.[70] Neither the risk assessment nor other information that is available to the Administrator provides any indication whether Joulon or Noah assessed how many thrusters might reasonably be required nor what was required to ensure that thrusters would be available considering the average winter temperatures in North Ayrshire. There is also no indication that the technical requirements for ensuring the availability of the thrusters were considered when they identified the number and qualifications of the drill ships' engineers during lay-up.

Coordination with the port authority was one of the identified controls for managing a loss of moorings when the risk assessment was conducted. The information available to the Administrator does not provide any indication that Joulon sought input from COL to ensure that local conditions were considered when the risk assessment was completed in November 2020.

The risk assessment was not updated after COL informed Joulon that there was a 3-hour lead time for tug support at the jetty in December 2020. The risk assessment was also not updated to take into account the information that the pilot provided the Masters of the laid-up drill ships when VALARIS DS-4 and ENSCO DS-8 arrived at Hunterston Jetty that the actual velocity of winds from the east is typically higher than forecast, that there were no tugs in the immediate vicinity, and that a 6-hour notice was required for normal assistance.

Mooring Plan

Joulon contracted InterMoor to conduct a mooring analysis and develop a site-specific mooring plan for both VALARIS DS-4 and ENSCO DS-8 as part of their detailed planning for laying the drill ships up at Hunterston Jetty.

In response to instructions provided by Joulon, InterMoor based the mooring plans on the average maximum 1-minute wind speeds at an elevation of 10 m for a 10-year return period. It is noted that InterMoor had proposed basing the plans on the average maximum 1-minute wind speeds at an elevation of 10 m for a 100-year return period.

Whereas the 10-year average maximum 1-minute winds from the northeast to east were between 39.8-41.5 kn, the 100-year 1-minute winds were between 42.8-46.7 kn. Because wind speed is squared when calculating the force of the wind acting on a surface,[71] using the 100-year winds would have increased the force of the wind on both drill ships by about 1.8-2.9%.

As discussed, the magnitude of the speed of winds from the northeast and east were higher at Hunterston Jetty than the forecast speeds. It is not known if the weather data, which was based on the ERA5 dataset for 1979-2019, used for the mooring plan reflected this.

The mooring plans for both drill ships specified the number, type, sizes of the lines to be used, and where each line was supposed to be connected on the drill ships and the jetty. They also specified the length of line that should be paid out

70 It is noted that the risk assessment did not include any indication of how many thrusters would be available.

71 The force of wind acting on a surface is calculated using the formula $Fw = 1/2\ \rho\ v2A$, where Fw is wind force (N), ρ is the density of air (kg/m^3), and A is the surface area (m^2).

from the fairlead and the pretension force for each line. Neither of the mooring plans included a requirement for thrusters to be used to relieve the tension on the lines when the wind speed exceeded any given speed.

The length of line that should be paid out from the fairlead was intended to maximize how much load an individual line could absorb and to ensure the drill ships' crewmembers would not need to adjust the lines each time the tide changed.

When VALARIS DS-4 and ENSCO DS-8 arrived at Hunterston Jetty and when they were shifted to the southwest in late January 2021, both drill ships were reportedly moored using more lines and that some lines were made up to different connection points than that specified by the mooring plans developed by InterMoor *(see Figures 3 and 4)*. Based on the information available to the Administrator, it is not clear why the lines were not arranged as specified in the mooring plans. It is possible that it was not clear that the drill ships' Masters and Joulon program managers who were on board the drill ships were aware that compliance with the arrangements specified in the mooring plans was necessary to ensure that the drill ships' moorings functioned as intended.

It could not be verified whether the line lengths when the drill ships were first moored at Hunterston Jetty or when they were shifted along the jetty were as specified in the mooring plans.

Based on the drill ships' logs, the daily routine on both VALARIS DS-4 and ENSCO DS-8 included checking and adjusting the mooring lines at least once a day. It was not possible to establish whether the lines were adjusted to maintain the lengths specified in the mooring plans, or if this was to prevent them from going slack per customary practice. If the lines were being adjusted based on customary practice, this could provide an explanation as to why the mooring plan was not followed.

Lastly, third-party verification was identified as a control during the risk assessment conducted by Joulon. However, it is noted that there was no third-party verification that the drill ships were moored in accordance with the mooring plans either when they first arrived at Hunterston Jetty or after they were shifted along the jetty in late January 2021.

Joulon provided a copy of the original mooring plans for VALARIS DS-4 and ENSCO DS-8 to COL. There is no indication that copies of the revised mooring plans, that were completed shortly before the drill ships' arrival at Hunterston Jetty, were provided to COL. There is also no indication that COL verified if the drill ships' mooring arrangements were per the mooring plans following their arrival at Hunterston Jetty or after they were shifted along the jetty in late January 2021.

Drill Ships' Emergency Response Plans

The emergency response plans prepared by Joulon for VALARIS DS-4 and ENSCO DS-8 included procedures for adverse weather. These procedures consisted of a decision-making flow chart with a list of actions that should be taken following the receipt of a forecast of adverse weather. It also included decision points for the Master to decide if tugs or a berthing team were required.

These procedures consisted of what is considered good practice. The potential effectiveness of the procedures was reduced by the fact that they did not provide objective guidance regarding either Joulon's or Noah's expectations regarding what might be considered adverse weather or how much lead time was required for tugs to arrive at Hunterston Jetty. It is also noted that the drill ships' emergency response plans did not reference their weather contingency plans.

Based on the information that is available, it is not possible to establish to what extent the adverse weather procedures in the drill ships' emergency response plans may have been implemented. What is known is that neither the Master of VALARIS DS-4 or the Master of ENSCO DS-8 called for tug assistance until after VALARIS DS-4 experienced the full loss of moorings. It is also known that ENSCO DS-8 remained alongside the jetty with tug assistance until the period of heavy winds from the northeast to east abated. This is an indication that timely implementation of the adverse weather procedures could have potentially prevented a loss of moorings.

Drill Ships' Weather Contingency Plans

The drill ships' weather contingency plans included actions that were supposed to be taken based on the forecast greater than 50 kn and actual wind speeds greater than 60 and 70 kn regardless of direction. After the drill ships arrived at Hunterston Jetty, the plans were amended based on comments provided by the Master of VALARIS DS-4 when winds of 40 kn or more from the northeast to east were forecast or when the actual wind speeds were 50 kn or more from the northeast to east.

Based on these plans, a diesel generator should have been started and the thrusters placed on standby when winds from the northeast to east of 40 kn or more were forecast and two thrusters should have been engaged when winds from the northeast to east of 50 kn or more were being experienced. As previously discussed, thrusters on board both VALARIS DS-4 and ENSCO DS-8 could not be made available for use on 2 February 2021.

On 30 January 2021, the Master of ENSCO DS-8 informed Noah that tug assistance would be needed in an emergency since the thrusters were not available for use. However, he did not make such a request until after VALARIS DS-4 was blown off the jetty on the evening of 2 February 2021. It was not reported why the Masters did not request tug assistance when northerly winds greater than 40-50 kn were observed during the day.

The drill ships' weather contingency plans both indicated that there were four thrusters available for use on both VALARIS DS-4 and ENSCO DS-8. In contrast, following the drill ships' arrival at Hunterston Jetty it was planned to keep two thrusters available for use and to put the other thrusters in cold iron.

Port Planning

COL undertook a structural assessment of the jetty that determined as many as five drill ships similar to VALARIS DS-4 and ENSCO DS-8 could be accommodated. They also had the mooring bollards tested to confirm their SWL as part of their preparations for VALARIS DS-4 and ENSCO DS-8 being placed in lay-up at Hunterston Jetty.

COL additionally conducted an assessment of the initial mooring plans for VALARIS DS-4 and ENSCO DS-8. They reportedly had some initial concerns with the plans and had engaged a third-party to review the plans and propose changes. However, COL did not have the third-party review completed and determined the mooring plans were adequate based on their impression that they were based on weather conditions at Hunterston Jetty. It was also based on their understanding that the mooring plans had been approved by the drill ships' flag State and insurers. The basis for COL's understanding is that the plans had been approved by the flag State and insurers could not be confirmed. As previously stated, the Administrator had not reviewed these plans.

As part of their agreement for VALARIS DS-4 and ENSCO DS-8 to be laid-up at Hunterston Jetty, COL established requirements regarding the drill ships' crew. These included requirements that the drill ships would be manned with

enough persons to maintain an effective mooring watch and fire patrol, that evidence the manning was acceptable to the flag State, and that the manning would be approved by the Harbour Master. COL also reported that they had not discussed the size of the drill ships' crews with Joulon or Noah before either VALARIS DS-4 or ENSCO DS-8 arrived at Hunterston Jetty. They also stated that they first became aware of the Administrator's requirement that the drill ships' manning be approved by the port authorities sometime after 9 February 2021.

COL also required, as part of the agreement for the drill ships to be laid-up at Hunterston Jetty, that they be provided a copy of the drill ships' contingency plans. It is not clear when copies of the plans were provided.

Coordination Between Drill Ship Managers and Port

Although there were ongoing discussions, including a pre-arrival meeting on 23 December 2020, between COL and Joulon during the planning for the lay-up of VALARIS DS-4 and ENSCO DS-8, COL also reported that they were unaware of details regarding the drill ships' crews until after VALARIS DS-4 and ENSCO DS-8 arrived at Hunterston Jetty. It is also not clear if COL had been provided copies of the revised mooring plans following the drill ships' arrival.[72] Lastly, it is not clear whether Joulon had advised COL of their intention to have one diesel generator and two thrusters available for use on both drill ships. These are indications of possible ineffective coordination and communication between Joulon, Noah, and COL.

Classification Society Guidance

ABS' lay-up guidance for MODUs provides guidelines for owners addressing issues related to the preservation and protection of a laid-up vessel. This guidance identifies three basic lay-up conditions: Laid-up, Laid-up Warm Stacked, and Laid-up Cold Stacked. It also includes two enhanced conditions.[73] It is for the owner of a vessel being placed in lay-up to decide which of these conditions the vessel will be placed in.

One of the basic conditions is laid-up, which indicates the vessel is out of service for an undetermined length of time and that ABS has not reviewed any lay-up procedures that the vessel's owner or operator might have prepared. When a vessel is placed in this lay-up condition, Classification Society surveys are held in abeyance and statutory surveys are completed only if required by the vessel's flag State. Based on ABS records, both VALARIS DS-4 and ENSCO DS-8 were placed in this status when they entered lay-up after arriving at Hunterston Jetty.[74]

Placing VALARIS DS-4 and ENSCO DS-8 in one of the other two basic lay-up conditions would have provided for third-party review of Joulon's lay-up plan. The support services that would have been provided by ABS would also have included the completion of an initial and annual lay-up surveys to verify compliance with the lay-up plan. On request, ABS would also have conducted an engineering review of the mooring plan and survey of the installed mooring arrangements.

Placing VALARIS DS-4 and ENSCO DS-8 in either of the two enhanced lay-up conditions would have further increased the level of support provided by ABS to include a review of the proposed lay-up location, the planned mooring arrangements, the location specific risk assessment, and the emergency response capabilities in the area when a vessel

72 These were the revisions that InterMoor completed on 24 and 28 December 2020.

73 As previously discussed, these are "Enhanced Laid-up Warm Stacked" and "Enhanced Laid-up Cold Stacked."

74 It is noted that VALARIS DS-4 and ENSCO DS-8 had been in Laid-up Warm Stacked when they first went into lay-up in Las Palmas in June 2020. The status of both drill ships was later changed to laid-up after the drill ships' managers at the time did not arrange to have annual lay-up surveys conducted.

is placed in the either of these conditions. It would also have included the completion of a mooring survey after the drill ships arrived at Hunterston Jetty.

The Administrator is not aware whether the owners of VALARIS DS-4 and ENSCO DS-8, Joulon or Noah Ship Management gave consideration to placing the drill ships into Laid-up Warm Stacked, Laid-up Cold Stacked, or either of the two enhanced lay-up conditions following their arrival at Hunterston Jetty.

Some level of support from ABS may have contributed to ensuring the effectiveness of the controls identified during the risk assessment for berthing drill ships alongside at Hunterston Jetty that Joulon had conducted in November 2020.

Flag State Requirements

The Administrator requires the owner of a Republic of the Marshall Islands-registered vessel being placed in lay-up to provide a statement from the relevant Classification Society indicating it would meet the requirements for classification if it was surveyed when it entered lay-up as a condition for issuing a Provisional Certificate of Registry with the endorsement "This Certificate is Only Valid while the Vessel Remains in Laid-up Status and is Not Valid for Navigation." Vessels are exempt from annual safety inspections while in an official lay-up period but are required to undergo an initial safety inspection before returning to service. These requirements provide a means for the Administrator to verify that the vessel is seaworthy when it enters lay-up and when it returns to service.

The Administrator's MG-1-11-1 places the responsibility for ensuring the safety and security of a Republic of the Marshall Islands-registered vessel while in lay-up on the vessel's owner. This guidance includes provisions addressing the manning, vessel maintenance and preservation, vessel safety, and contingency measures in place for emergencies during lay-up. This guidance does not have the force of regulation and cannot be enforced by the Administrator.

The Administrator's guidance advises owners to seek assistance from the vessel's Classification Society when preparing lay-up procedures. Such assistance is consistent with the support ABS would have provided if VALARIS DS-4 and ENSCO DS-8 had been placed in either Laid-up Warm Stacked, Laid-up Cold Stacked, or in one of the two enhanced lay-up conditions discussed previously.

The Administrator's guidance also advises owners to contact the local port and coastal State authorities where the vessel is going to be laid-up to determine if there are specific requirements or regulations that might be applicable to the laid-up vessel. It also is recommended that the vessel owner develop the vessel manning in coordination with the port or coastal State authorities.[75]

In November 2020, the Administrator informed Noah that the drill ships' manning while in lay-up should be developed in coordination with the port or coastal State authorities and that it should comply with local regulations. Based on the information available, it appears that COL was not aware of the number of crewmembers who would be on board VALARIS DS-4 and ENSCO DS-8 until after their arrival at Hunterston Jetty. It also appears that neither Noah or Joulon had discussed the drill ships planned manning with the MCA before VALARIS DS-4's loss of moorings on 2 February 2021.

75 As discussed previously, the Administrator informed Noah in November 2020 that the drill ships' manning while in lay-up should be developed in coordination with the port or coastal State authorities and that it should be in compliance with local regulations.

Port State Requirements

The MCA had not issued guidance for port authorities regarding issues that should be addressed when a vessel will be laid-up within a port or harbor. Similarly, the MCA has not issued regulations or guidance addressing the lay-up of non-United Kingdom-registered vessels.

PART 4: CONCLUSIONS

The following Conclusions are based on the above Findings of Fact and Analysis and shall in no way create a presumption of blame or apportion liability.

1. Causal factors that contributed to this marine incident include:
   (a) the inability of VALARIS DS-4's crewmembers to bring the thrusters online in time to prevent the mooring lines from being overloaded by the storm force winds from the northeast; and
   (b) the Master of VALARIS DS-4 did not request tug assistance when the weather forecast for storm force north easterly winds was received on the afternoon of 2 February 2021.

2. Additional causal factors that may have contributed to this marine incident include:
   (a) inadequate coordination between Joulon and COL throughout the planning process for the lay-up of VALARIS DS-4 and ENSCO DS-8 at Hunterston Jetty;
   (b) inadequate identification and consideration of local conditions, including the higher than forecast northeasterly and easterly winds, winter temperatures, and the time required for tugs to arrive after being requested, as part of Joulon's risk assessment for berthing the drill ships alongside at Hunterston Jetty;
   (c) inadequate identification of the drill ships' power requirements during Joulon's and Noah's planning for the lay-up of VALARIS DS-4 and ENSCO DS-8 to ensure that a sufficient number of diesel generators and thrusters would be available if needed during a period of high winds or an emergency situation;
   (d) the apparent deviation from the drill ships' mooring plans when VALARIS DS-4 and ENSCO DS-8 were moored after being shifted along the jetty in late January 2021;
   (e) the lack of third-party verification that VALARIS DS-4 and ENSCO DS-8 were moored in accordance with the drill ships' mooring plans;
   (f) with the exception of the drill ships' mooring plans, the lack of third-party assurance of Joulon's and Noah's planning and execution of the lay-up of VALARIS DS-4 and ENSCO DS-8 at Hunterston Jetty;
   (g) the lack of comprehensive flag State regulations intended to ensure the safety and security of laid-up vessels;
   (h) the lack of flag State requirements for Republic of the Marshall Islands-registered vessels that are in lay-up to undergo inspections or other forms of oversight to verify they do not pose a safety or security hazard; and
   (i) the absence of port State regulations intended to ensure the safety and security of ships laid-up in ports and harbors in the United Kingdom.

3. Actions or events that reduced the adverse consequences of this marine incident include:

   (a) that VALARIS DS-4's and ENSCO DS-8's anchors had been pre-deployed when the drill ships were berthed at Hunterston Jetty and that VALARIS DS-4's anchor was reset and held the drill ship in mid-channel after being blown off the jetty following the loss of moorings; and

   (b) the arrival of tugs to hold ENSCO DS-8 alongside the berth.

PART 5: PREVENTIVE ACTIONS

In response to this marine incident, Joulon and Noah have taken the following the Preventive Actions:

1. Changes were made to the preheating systems so that all six thrusters could potentially be started simultaneously if necessary.

2. The number of diesel generators and thrusters that were supposed to be ready for use on board each drill ship was changed from one generator and two thrusters to all six diesel generators and thrusters.

3. Established a requirement that a power swap from the deck generators to the drill ships' diesel generators be conducted once a week and at each change of a senior officer.

4. Joulon contracted InterMoor to develop new mooring plans for both drill ships. After determining that the 1-minute maximum average wind speeds for a 10-year return and 100-year return were comparable, it was decided to use the weather data for the 10-year return. The mooring plan for VALARIS DS-4 is a based on 25 mooring lines[76] plus the anchor. The mooring plan for ENSCO DS-8 is based on 18 mooring lines[77] plus the anchor. Both drill ships' new mooring plans also included requirements for when thrusters should be engaged based on minimum wind speeds from different directions.

5. The drill ships' weather contingency plans were revised to base the criteria for when each of three phases should be implemented on forecast and actual wind speeds from different quadrants. These changes, which are based on the new mooring plans, reduce the threshold for implementing the initial phase when the winds were from the northeast to east to 30 kn, for implementing the second phase to 35 kn, and for implementing the third phase to 45 kn. The revised plans now require that at least one engine and two thrusters be online during the second phase and that a minimum of four thrusters be engaged during the third phase.

6. The drill ships' emergency response plans were amended to refer to the weather contingency plans for determining when preparations should be made to start one or more diesel generators, conduct a power swap, and bring thrusters online. The revised plans also include additional guidance for requesting tug assistance.

7. Procedures were established for the planned departure of the drill ships from alongside the jetty if warranted based on the weather forecast or in an emergency situation. The plans included provisions for using tugs to move the drill ships off the jetty if it was not possible to swap power from the deck generator, the thrusters could not be started, or there was a loss of electrical power on board.

76 This consists of three 36 mm, 16 42 mm, two 44 mm, and four 48 mm UHMWPE lines.

77 This consists of 13 40 mm and five 42 mm UHMWPE lines.

8. The manning for both drill ships was revised so that the marine crew would consist of a Master, a navigation officer, two engineering officers, an ETO, and four ratings between October and April. The number of ratings would be reduced to three from May to September. The revised manning was agreed to by COL.

Peel Ports has taken the following Preventive Actions:

1. The COL risk assessment for the lay-up of drill ships was reviewed and additional mitigation measures were added.

2. A risk assessment addressing emergency response for a fire on board a vessel and lines parting in severe weather was conducted.

3. The existing COL procedures for the lay-up of vessels were reviewed and revised to include more detailed guidance and establish clear expectations for vessel owners wanting to lay a vessel up at one of its facilities on the Clyde Estuary. The revised procedures require that vessel owners provide information regarding the vessel's planned lay-up status, the mooring plan, the status of machinery and safety systems while in lay-up, the maintenance and inspection of mooring lines, and emergency procedures. They also require that the vessel's proposed manning while in lay-up be approved by the flag State before it will be reviewed by the statutory harbor authority. The revised procedures are being adopted by each of the statutory harbor authorities within Peel Ports.

4. COL, in coordination with Joulon, conducted a review of VALARIS DS-4's and ENSCO DS-8's equipment status (e.g., diesel generators, thrusters, and related systems) and criteria for activating the drill ships' weather contingency plan.

5. COL reviewed and agreed to Joulon's revised manning for both VALARIS DS-4 and ENSCO DS-8.

6. COL conducted a review of the jetty infrastructure taking into consideration winter conditions.

7. COL contracted to have an independent third-party review of the drill ship's new mooring plans completed.

8. Contingency response plans for responding to emergencies involving a laid-up vessel were developed for each statutory harbor area within Peel Ports.

9. A weather monitoring station was installed at the Hunterston Jetty. The information from this station is available to both VALARIS DS-4 and ENSCO DS-8 and relevant parties. It is also being compared to the wind speeds observed on the drill ships' anemometers.

The Administrator has taken the following Preventive Actions:

1. In coordination with MAIB, issued Marine Safety Advisory No. 14-21, Loss of Moorings During Lay-Up on 5 October 2021.

2. Revised its requirements for issuing a Provisional Certificate of Registry in Laid-up status to include a reference to the MG 1-11-1.[78]

78 *See* the April 2022 revision of the Republic of the Marshall Islands Vessel Registration and Instrument Recording (MI-100), section 10.3.

PART 6: RECOMMENDATIONS

The following Recommendations are based on the above Conclusions and in consideration of the Preventive Actions taken.

1. It is recommended that Joulon and Noah:

   (a) review and revise their procedures for planning for vessel lay-ups taking the lessons learned from this marine incident into account.

2. It is recommended that Peel Ports:

   (a) propose guidance on planning and conducting of vessel lay-up in ports in the United Kingdom to the MCA's PMSC Steering Group, for inclusion in the PMSC's Guide to Good Practice.

3. It is recommended that the Administrator:

   (a) develop additional regulatory requirements that take different lay-up conditions into account to ensure the safety of Republic of the Marshall Islands-registered vessels that are placed in lay-up and crews on board such vessels; and

   (b) review, and revise where required, internal procedures related to oversight of compliance with established requirements for vessels in lay-up.

4. It is recommended that the MCA, in coordination with the PMSC Steering Group:

   (a) consider publishing guidance on the planning and conducting of vessel lay-ups in ports in the United Kingdom, for inclusion in the PMSC's Guide to Good Practice.

The Administrator's marine safety investigation is closed. It will be reopened if additional information is received that would warrant further review.