**Bundesstelle für Seeunfalluntersuchung**
Federal Bureau of Maritime Casualty Investigation

Serious Marine Casualty

# Allision with an offshore wind turbine in the Gode Wind 1 wind farm by the PETRA L on 24 April 2023

Investigation Report 192/23

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# Amendments

| Page | Amendment | Date |
|---|---|---|
| | | |

# Contents

# Figures

# Abbreviations

| | |
|---|---|
| A&B | Antigua and Barbuda |
| AB | Able seafarer deck |
| AIS | Automatic Identification System |
| BMDV | Federal Ministry for Digital and Transport |
| BMVI | Federal Ministry of Transport and Digital Infrastructure |
| BNWAS | Bridge navigational watch alarm system |
| BSH | Federal Maritime and Hydrographic Agency |
| CCTV | Closed circuit television |
| COG | Course over ground |
| COLREGs | Convention on the International Regulations for Preventing Collisions at Sea |
| CTV | Crew transfer vessel |
| EEZ | Exclusive Economic Zone |
| ETA | Estimated time of arrival |
| GAA | Labour inspectorate |
| GB/GBT | German Bight/German Bight Traffic |
| GDWS | Federal Waterways and Shipping Agency |
| GOW | Gode Wind (name of wind farm) |
| GOW R04 | Name of affected wind turbine |
| GOW01 | Gode Wind 1 (name of wind farm) |
| GT | Gross tonnage |
| KPD | Key planning decision |
| LSMC | Less serious marine casualty |
| LT | Local time |
| MHCC | Marine and Helicopter Coordination Centre |
| MTC | Maritime traffic control |
| MV | Motor vessel |
| NA | Nautical assistant |
| NOK | Kiel Canal |
| NOM | Norden Offshore Management |
| NvD | Nautical supervisor |
| OWF | Offshore wind farm |
| OWT | Offshore wind turbine |
| Radar | Radio detection and ranging |
| SAR | Search and rescue |
| SeeAnlV | *Seeanlagenverordnung* [German Offshore Installations Ordinance] |

| | |
|---|---|
| SeeAufgG | *Seeaufgabengesetz* [German Federal Maritime Responsibilities Act] |
| SEG | SafeSeaNet Ecosystem Graphical User Interface (GUI) |
| SFC | Security framework concept |
| sG | Shipping police permit |
| SOG | Speed over ground |
| SOLAS | International Convention for the Safety of Life at Sea, 1974, as amended by the 1988 Protocol |
| SOMS | Systematic Offshore Management System |
| ssG | River and shipping police permit |
| STCW Code | Seafarer's Training, Certification and Watchkeeping Code |
| STCW Convention | International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 |
| TSS | Traffic separation scheme |
| ULS | Unattended lightship |
| UNCLOS | United Nations Convention on the Law of the Sea |
| UPS | Uninterruptible power supply |
| UTC | Universal time coordinated |
| VDR | Voyage data recorder |
| VHF | Very high frequency |
| VTS | Vessel traffic service |
| VOKVR | *Verordnung zu den Internationalen Regeln von 1972 zur Verhütung von Zusammenstößen auf See* [Ordinance to Implement the International Regulations for Preventing Collisions at Sea, 1972] |
| VV | Administrative regulation |
| WindSeeG | *Windenergie-auf-See-Gesetz* [German Offshore Wind Energy Act] |
| WSA(s) | Waterways and Shipping Office(s) |
| WSV | Federal Waterways and Shipping Administration |

# 1 SUMMARY

The multipurpose vessel PETRA L, flying the flag of Antigua and Barbuda, was sailing from Szczecin in Poland to Merksem in Belgium via the Kiel Canal on 24 April 2023. After leaving the locks at Brunsbüttel, she headed for the Terschelling-German Bight traffic separation scheme (TSS).

At about 2004, the PETRA L struck an offshore wind turbine (OWT) in the Gode Wind 1 wind farm north of the Terschelling-German Bight TSS, damaging it in the process. She was sailing at a speed of some 9 kts. The ship was heavily damaged. The bow was torn open and pushed in on the starboard side – including below the waterline, which inevitably led to water ingress. There were no casualties.

Since the ship had remained buoyant and the engine was still running, the master decided, despite the enormous damage, to sail 70 nm from his current position to Emden and initially sailed back to the TSS.

The PETRA L was made fast in the port of Emden at 0840 on 25 April 2023[1].

It was not until daylight began to break that the damage on the starboard side of the bow could be fully ascertained. The BSU was informed about the incident at midday. Two investigators surveyed the ship on the following day and spoke with the parties involved.

In addition to the minimum manning of seagoing ships, this investigation also focuses on the monitoring of maritime traffic by Vessel Traffic Service (VTS) Wilhelmshaven and the wind farm operator's control centre.

[1] Unless otherwise stated, all times are Central European Summer Time (CEST) = UTC +2 hours (local time at the scene of the accident).

# 2 FACTUAL INFORMATION

## 2.1 Photograph of the ship


Figure 1: Photograph of the undamaged PETRA L[2]

## 2.2 Ship particulars

| | |
|---|---|
| Name of ship: | PETRA L |
| Type of ship: | Dry/multipurpose cargo carrier |
| Flag: | Antigua and Barbuda |
| Port of registry: | Saint John's |
| IMO number: | 8205187 |
| Call sign: | V2OK3 |
| Owner (at time of accident): | MP Shipping GmbH & Co. KG |
| Shipping company: | MP Shipping GmbH & Co. KG |
| Year built: | 1984 |
| Shipyard: | BARKMEIJER STROOBOS |
| Classification society: | BUREAU VERITAS |
| Length overall: | 73.66 m |
| Breadth overall: | 11.5 m |
| Draught (max.): | 4.2 m |
| Gross tonnage: | 1,162 |
| Deadweight: | 1,685 t |
| Engine rating: | 750 kW |
| Main engine: | Caterpillar USA 1 x 3512TA |
| (Service) Speed: | 10.5 kts |
| Hull material: | Steel |

[2] Source: Hasenpusch Photo-Productions.

| | |
|---|---|
| Hull design: | Single hull |
| Minimum safe manning: | 5 |

## 2.3 Voyage particulars

| | |
|---|---|
| Port of departure: | Szczecin, Poland |
| Port of destination: | Merksem, Belgium |
| Type of voyage: | Merchant shipping<br>International |
| Cargo information: | 1,170 t of wheat in bulk |
| Draught at time of accident: | $D_f$ = 3.30 m, $D_a$ = 3.30 m |
| Crew: | 7 |
| Pilot on board: | No |
| Number of passengers: | 0 |

## 2.4 Marine casualty information

| | |
|---|---|
| Type of marine casualty: | Serious marine casualty: Allision with an offshore wind turbine |
| Date, time: | 24 April 2023, 2004 |
| Location: | North Sea, Gode Wind 1 wind farm |
| Latitude/Longitude: | φ = 53°59.1'N, λ = 006°58.7'E |
| Ship operation and voyage segment: | German EEZ (North Sea) |
| Place on board: | Starboard bow |
| Consequences: | Large breach, heavy damage to the starboard side of the bow, water ingress. Damage to the wind turbine, which was initially shut down as a precaution. |

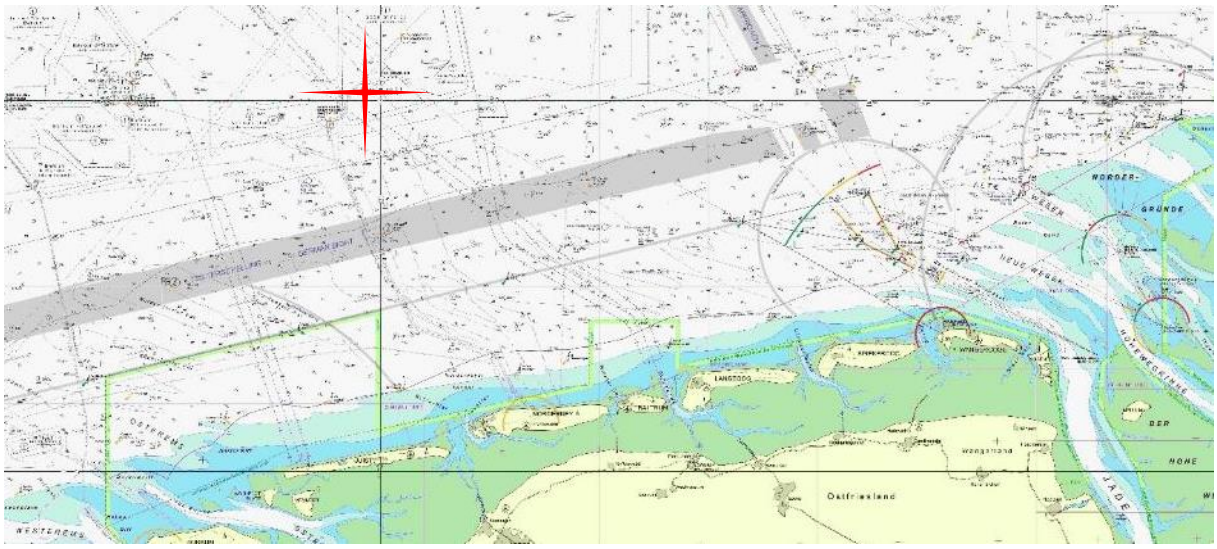


Figure 2: Scene of the accident; extract from Navigational Chart INT 1413[3]

[3] Source: Federal Maritime and Hydrographic Agency (BSH), Edition 2 of 15/04/2021.

## 2.5 Shore authority involvement and emergency response

| | |
|---|---|
| Agencies involved: | None |
| Resources used: | None |
| Actions taken: | PETRA L notified VTS Emden and used Emden as the port of refuge. |

# 3 COURSE OF THE ACCIDENT AND INVESTIGATION

## 3.1 Course of the accident

The multipurpose vessel PETRA L, flying the flag of Antigua and Barbuda, was sailing from Szczecin in Poland to Merksem in Belgium via the Kiel Canal on 24 April 2023. After leaving the locks at Brunsbüttel, she headed for the Terschelling-German Bight traffic separation scheme (TSS).

The following accounts are chiefly based on AIS and VHF recordings of Vessel Traffic Service Wilhelmshaven and a statement of the master, which the BSU was unable to verify for lack of a VDR or other witnesses.

The ship navigated the TSS in a westerly direction on a course of 253° COG. A course alteration of 20 degrees starboard was executed at 1841 and completed at 1842. The ship stayed on this new course of 280° COG, exited the TSS at 1917, and then sailed toward the Gode Wind 1 wind farm.

The general cargo vessel sailed into the wind turbine (GOW R04) in the Gode Wind 1 wind farm at a speed over ground of about 9 kts at 2004. While the OWT sustained only relatively minor damage, the PETRA L was severely damaged. The bow was torn open and pushed in on the starboard side – including below the waterline, which inevitably led to water ingress. There were no casualties.

After the allision, the master reportedly put the helm to astern immediately to move away from the OWT. He then altered course to port and headed for the TSS.

Since the ship had remained buoyant and the engine was still running, the master decided, despite the enormous damage, to sail 70 nm from his current position to Emden and followed the westbound one-way route of the TSS.

He reportedly attempted to contact VTS Wilhelmshaven on VHF channels 79 and 80 immediately and continued trying repeatedly. He reportedly only managed to contact the VTS 1.5 hours after the allision and reported the incident. GBT did not respond to the report, but instead instructed him to follow the TSS as far as the Borkumriff buoy and only then to alter course south in the direction of Emden. He acknowledged and complied with the instruction.

It was only when the ship entered the lock at Emden on the morning of 25 April 2023 that the damage on the starboard side of the bow was noticed by the skipper of a buoy tender, the GUSTAV MEYER, and reported to VTS Emden.

The PETRA L was made fast in the port of Emden at 0840. All damage to the ship was comprehensively recorded there.

Ørsted, the wind farm operator, stated that initial internal notifications were reportedly received on the night of 25/26 April 2023, which were immediately investigated in the morning. Ørsted reportedly arranged for the OWT to be visually inspected by helicopter on the morning of 26 April 2023. Damage was found on OWT GOW R04, which confirmed the suspected allision between the PETRA L and an OWT belonging to Ørsted.

## 3.2 Investigation

### 3.2.1 Investigation at the scene

The BSU was informed about the incident at midday on 25 April 2023. Two investigators surveyed the ship on the following day and spoke with the parties involved. Due to the size of the ship, a VDR was not installed on board. No other technical recordings could have been used to investigate the accident, either.

#### 3.2.1.1 Damage to the ship

The below photographs clearly show the damage to the bow of the PETRA L. The deck at the forecastle is damaged over an area of some 5 m. The V-shaped breach extends below the ship's waterline.

Figure 3: Damage to the bow[4]

[4] Source: BSU.

The breach is almost 1 m wide at the waterline. Water had flooded the spaces within the forecastle. However, the collision bulkhead toward the cargo hold had remained intact, preventing further water ingress there, which was crucial for the ship's buoyancy.

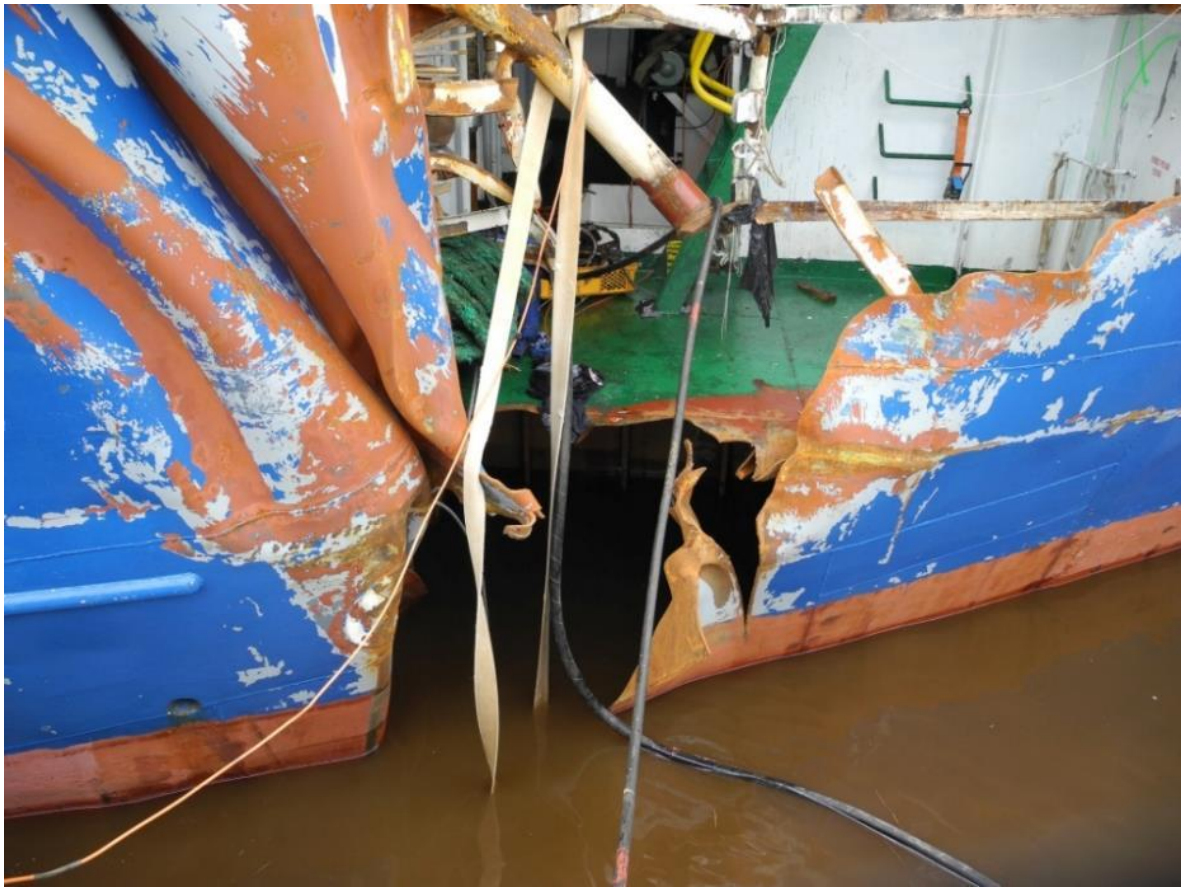

Figure 4: Breach at the waterline[5]

[5] Source: BSU.

Figure 5: Forecastle with view of the damage[6]

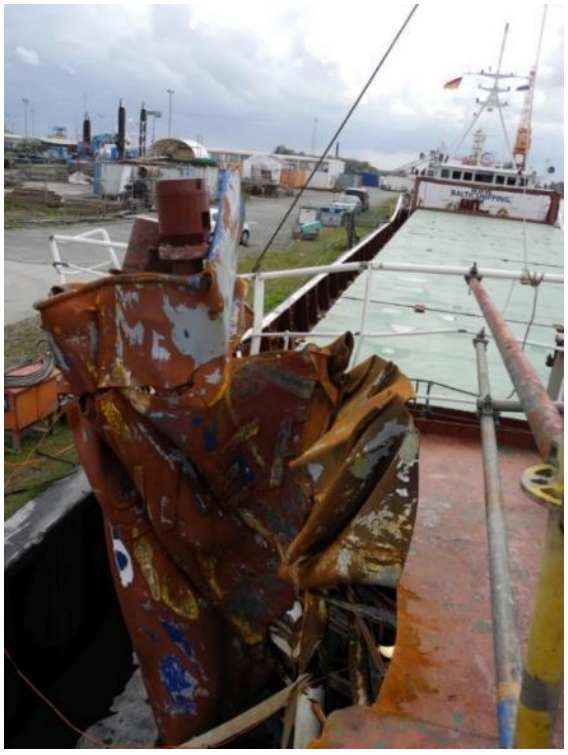

Figure 6: Rippled hull plating at the breach[7]

6 Source: BSU.
7 Source: BSU.

Figure 6 shows how the impact pushed the ship's hull metal backward, creating ripples in the process. This illustrates the immense forces that were at work. Finally, Figure 7 shows the breach directly from above.

Figure 7: The breach from above[8]

#### 3.2.1.2 Damage to the offshore wind turbine (OWT)

A visual inspection from on board a helicopter revealed damage to the boat landing[9] (fender) of OWT GOW R04. However, since such fenders are specifically designed for boats coming alongside and withstanding impacts, it only sustained minor buckling and paint abrasions. An assessment by in-house experts later concluded that the turbine could be restarted. This was also confirmed by the owners of the wind farm and the turbine was put back on line on 27 April 2023. A safety zone with a radius of 300 m was established around the turbine. A further inspection of the structure with a drone was set in motion as an additional measure. No damage was found that would prevent the OWT from remaining in operation.

[8] Source: BSU.
[9] Strengthened vertical round bars installed to the left and right of the access ladder. These are intended for supply vessels to make fast and transfer engineers.

### 3.2.2 AIS data

While Figure 8 still shows the regular course of the PETRA L at 1829, Figure 10 shows the beginning of the ship's course alteration to starboard.

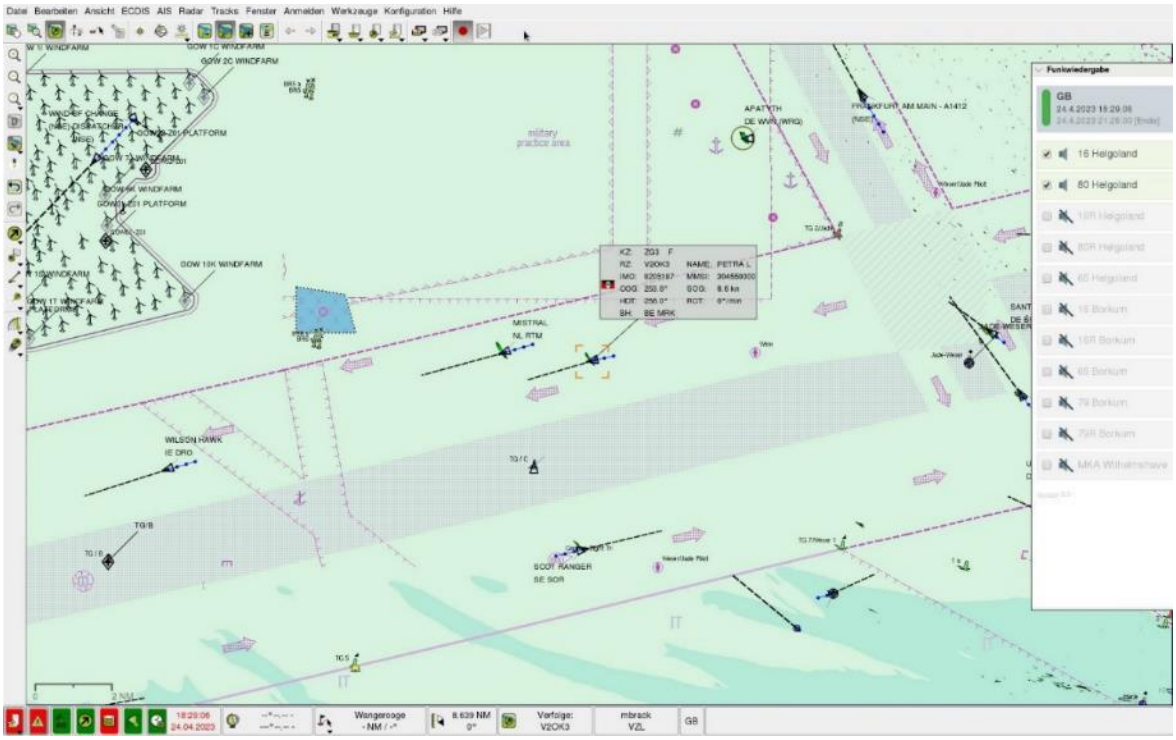


Figure 8: 1829 – the PETRA L navigates the TSS in compliance with regulations10

10 Source: VTS Wilhelmshaven.

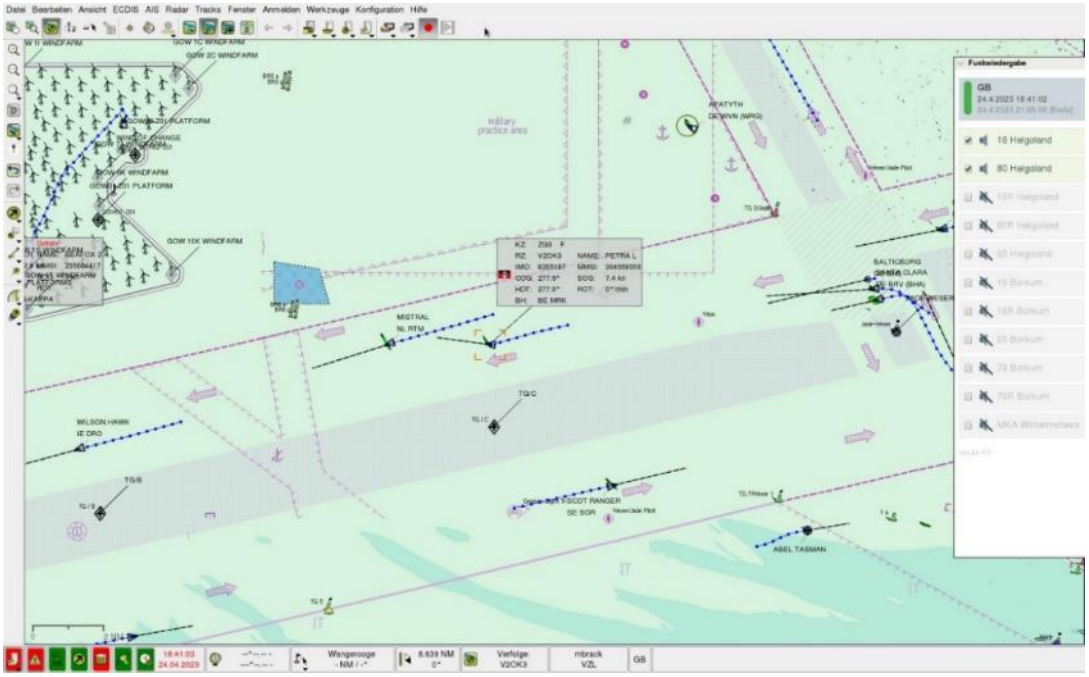

Figure 9: 1841 – the PETRA L alters course to starboard[11]

Figure 10 shows the point at which the course alteration by about 20° appears to have been completed. The PETRA L maintains this new course of approximately 280° (COG) until her allision with the wind turbine.

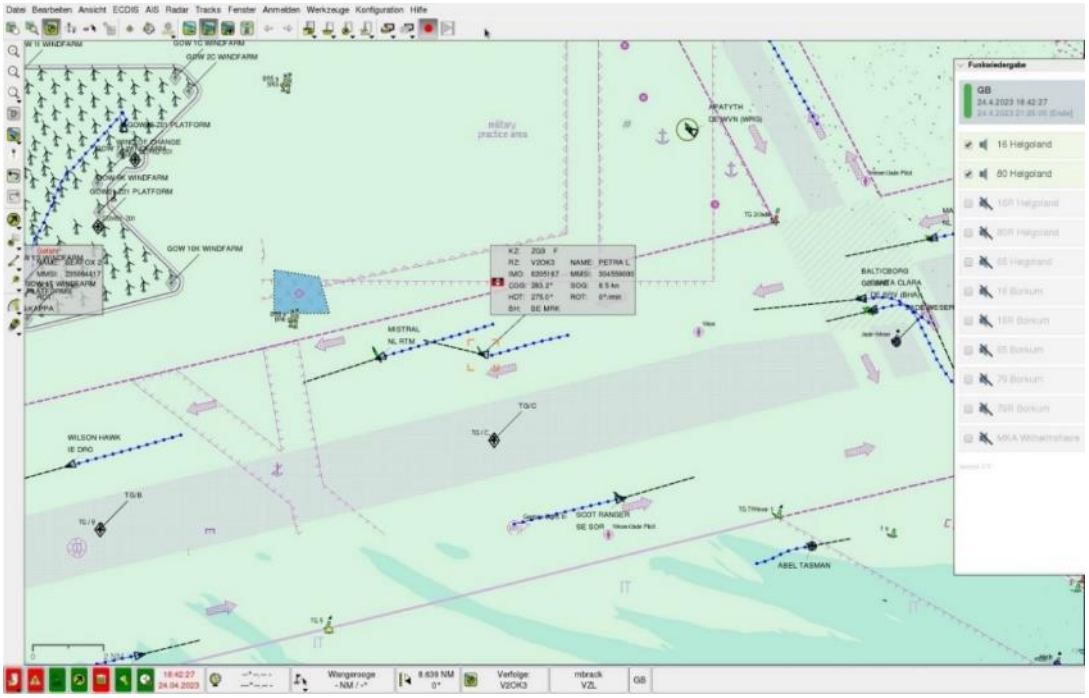

Figure 10: 1842 – 20° course alteration completed[12]

[11] Source: VTS Wilhelmshaven.
[12] Source: VTS Wilhelmshaven.

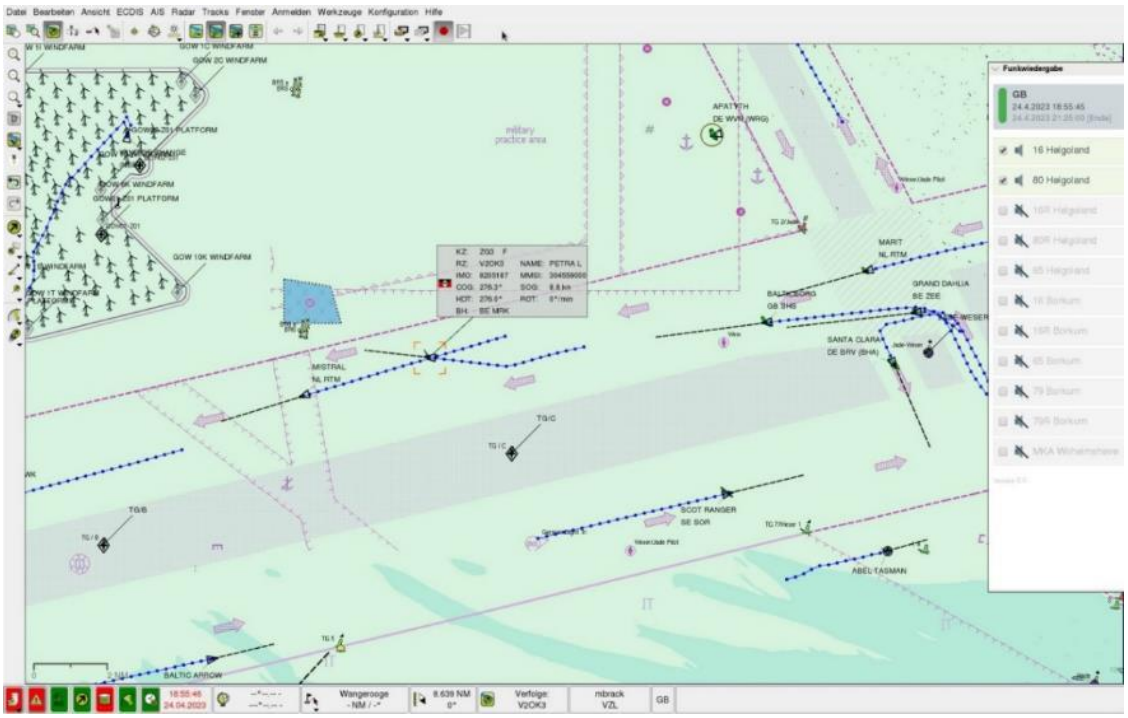

Figure 11: 1856 – the course is maintained[13]

The ship leaves the traffic separation scheme at 1917 and maintains a steady course and speed toward the wind farm.

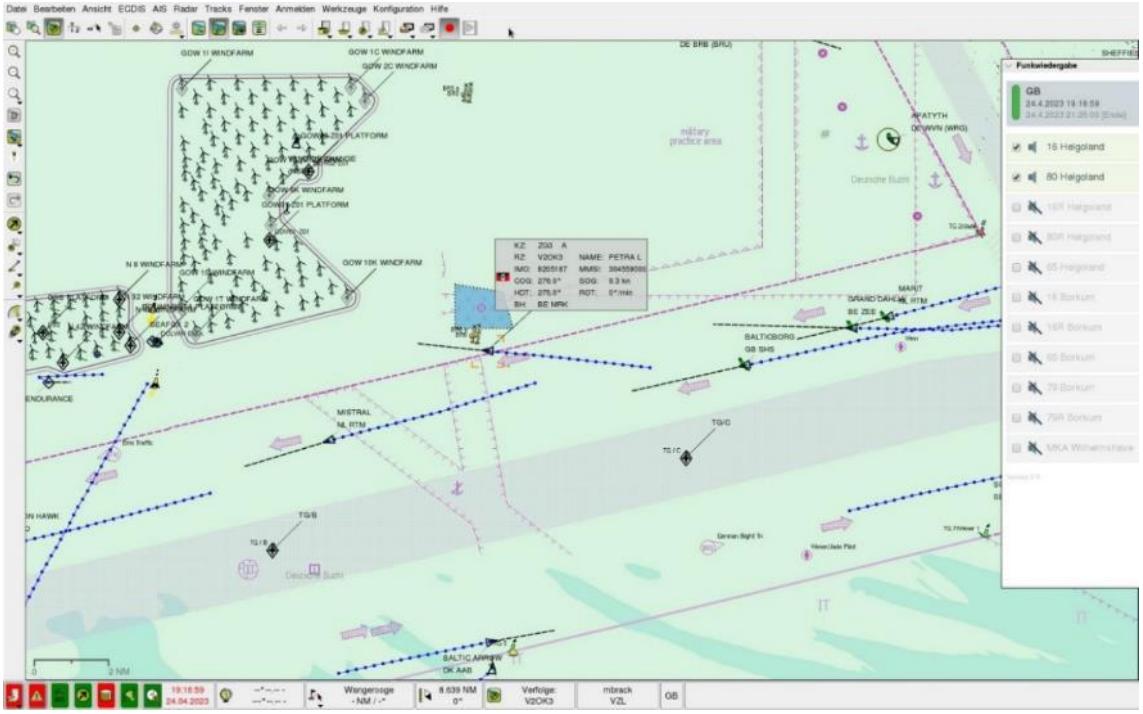

Figure 12: 1917 – the PETRA L leaves the TSS[14]

[13] Source: VTS Wilhelmshaven.
[14] Source: VTS Wilhelmshaven.

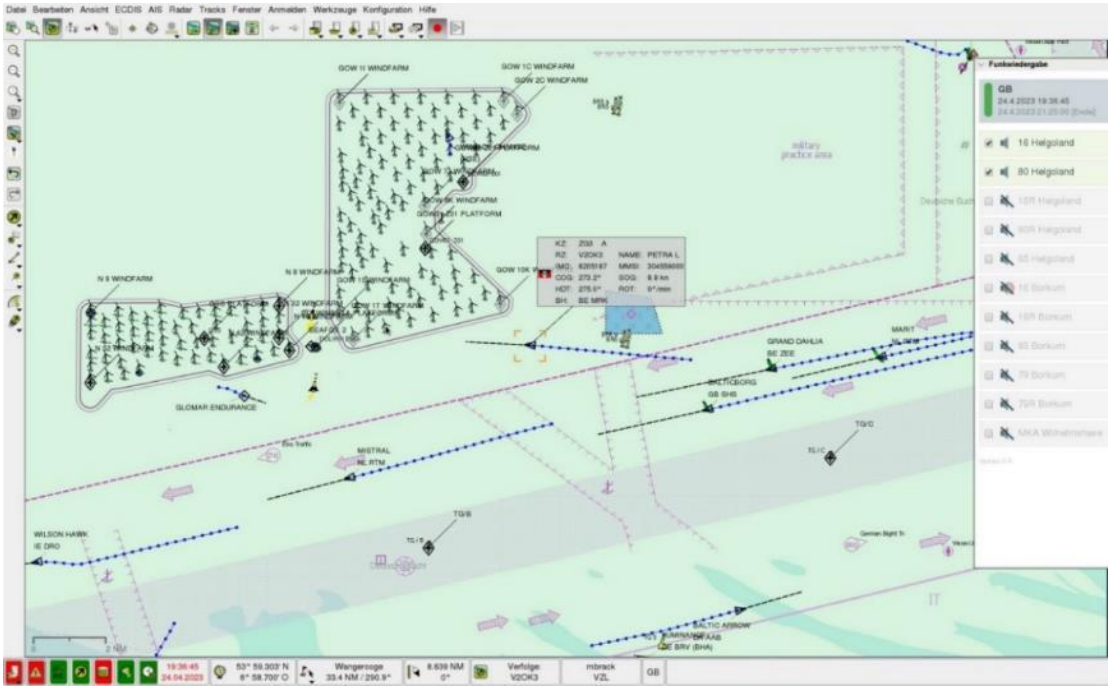

Figure 13: 1937 – the PETRA L continues to head for the wind farm[15]

At approximately 1955, the PETRA L reaches the Gode Wind 1 wind farm's 500 m safety zone and continues.

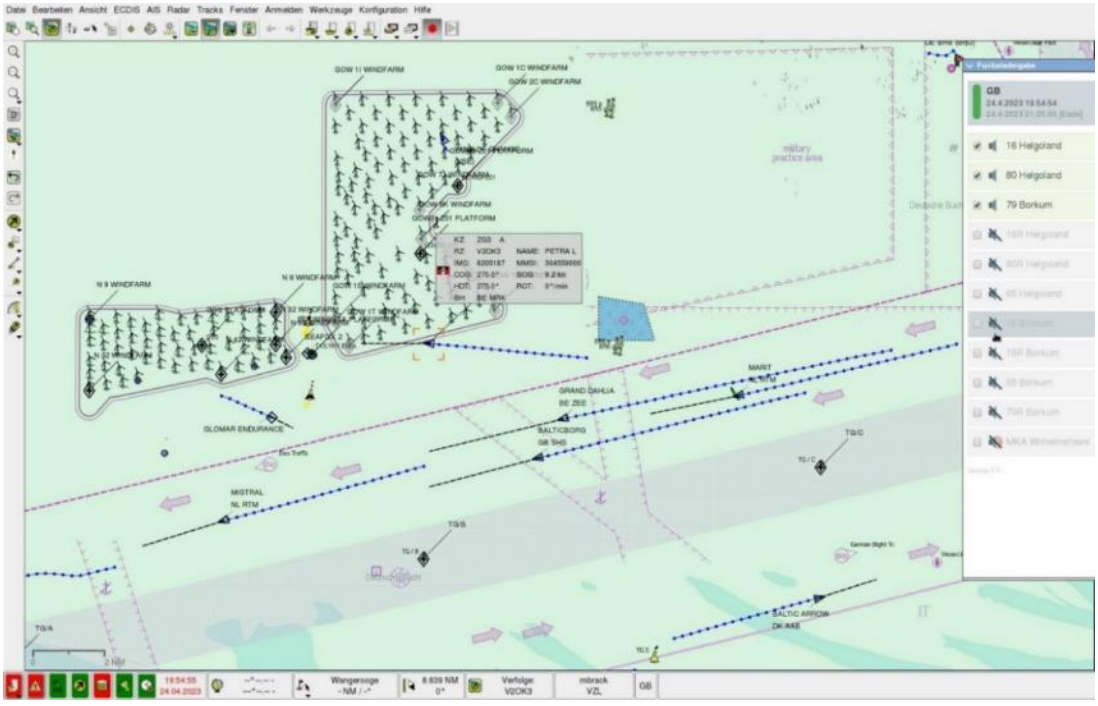

Figure 14: About 1955 – the PETRA L reaches the 500 m boundary[16]

[15] Source: VTS Wilhelmshaven.
[16] Source: VTS Wilhelmshaven.

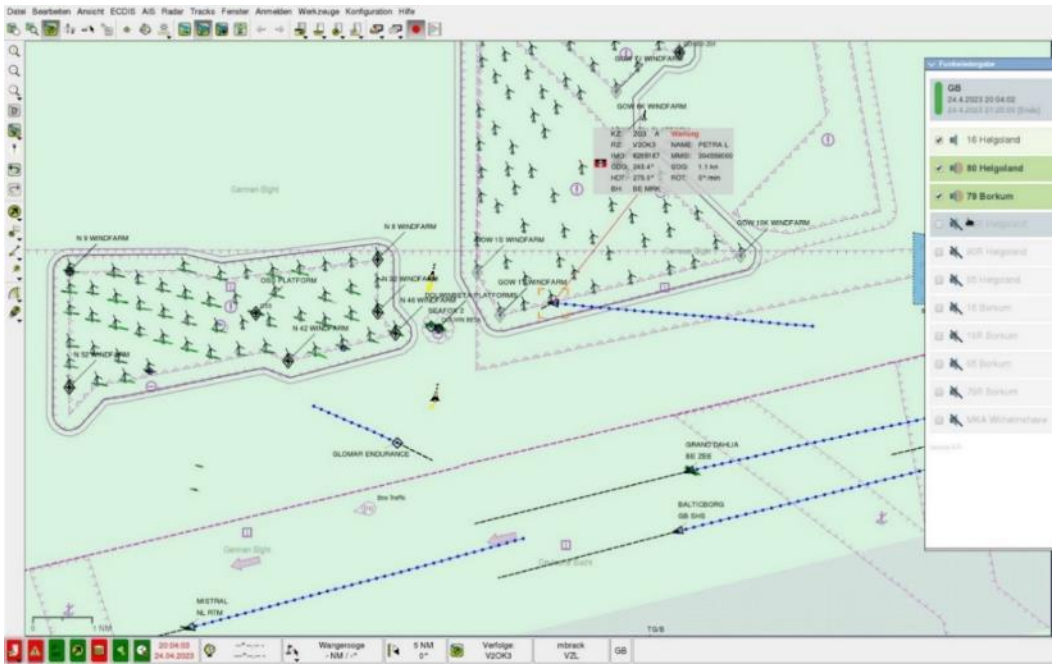

Figure 15: 2004 – time of the allision[17]

Figure 15 shows the time of the accident. At 2004, the PETRA L sails into the wind turbine OWT GOW R04. This is clearly evident from the sudden drop in speed. The ship picks up speed again shortly afterwards and leaves in a westerly direction.

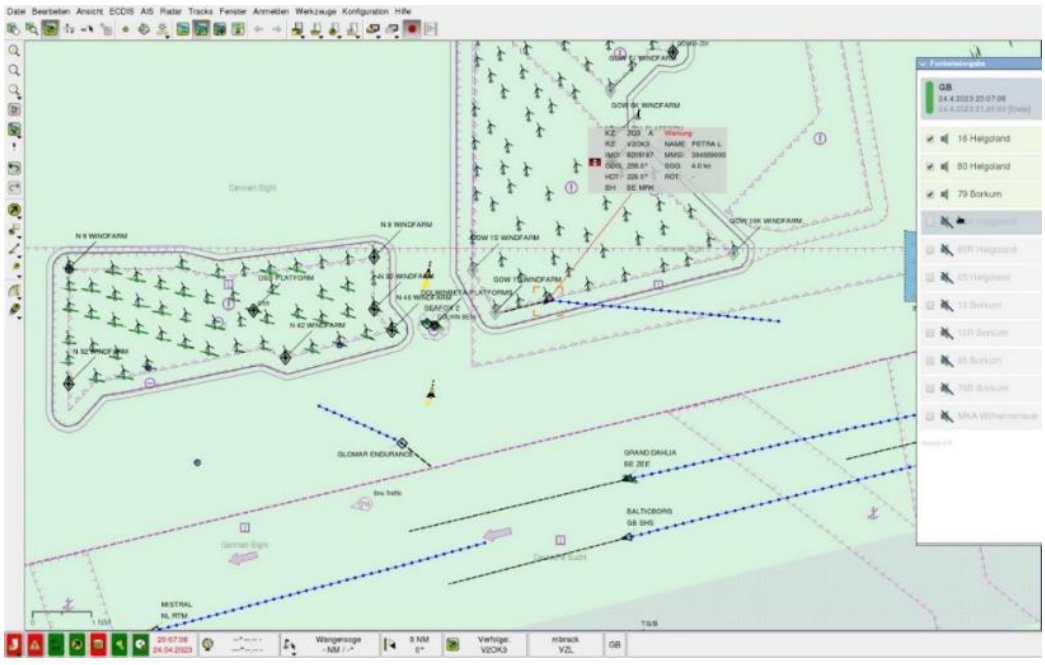

Figure 16: 2007 – the PETRA L picks up speed and leaves the wind farm[18]

[17] Source: VTS Wilhelmshaven.
[18] Source: VTS Wilhelmshaven.

Figure 17 shows how the PETRA L crosses the 500 m boundary again and approaches the TSS.

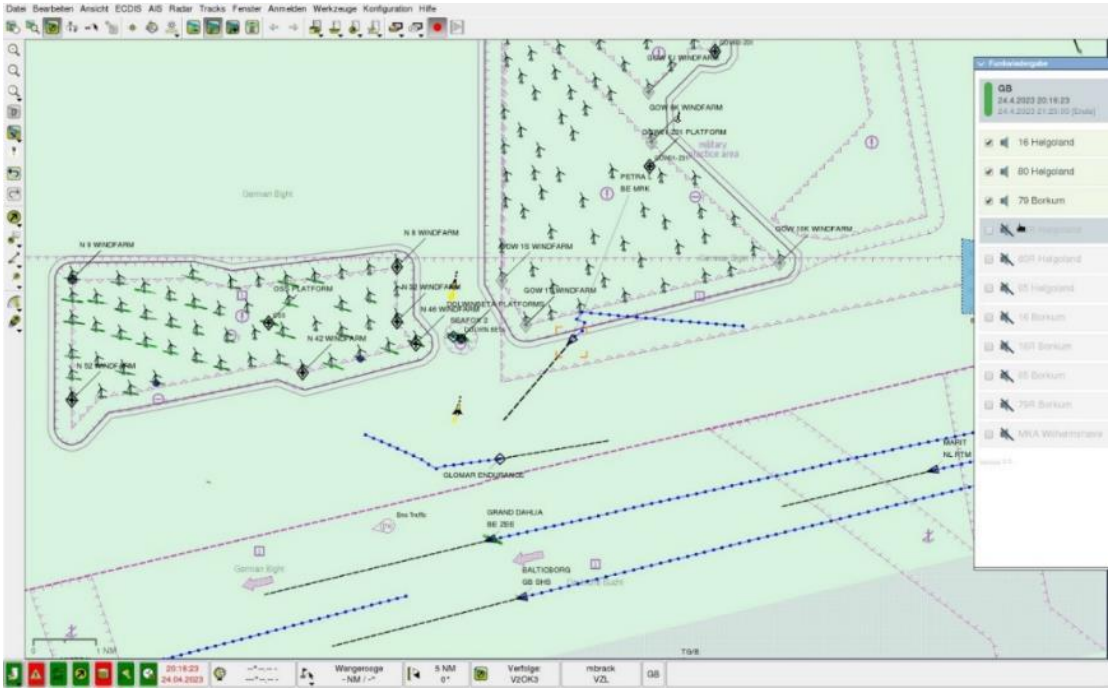

Figure 17: 2016 – the PETRA L crosses the 500 m boundary[19]

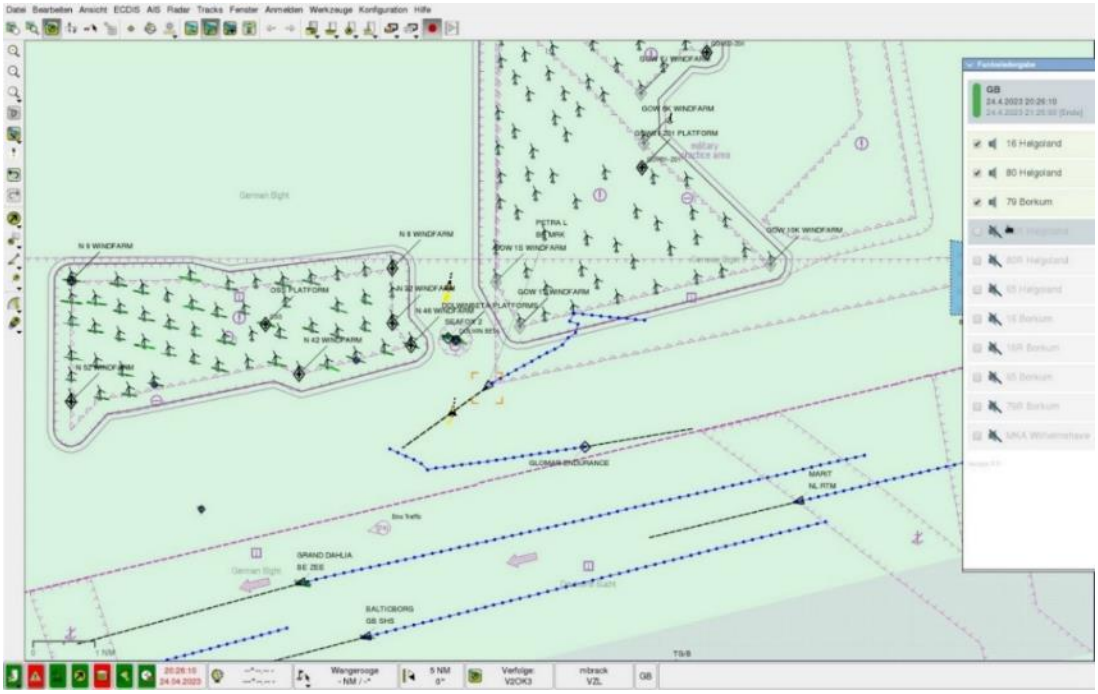

Figure 18: 2026 – the PETRA L maintains her course for the TSS[20]

[19] Source: VTS Wilhelmshaven.
[20] Source: VTS Wilhelmshaven.

### 3.2.3 Statement of the ship's command

Seven crew members (including the master) were on board the PETRA L on the day of the accident. The master has commanded this ship for 10 years. He had been on board since 22 February 2023.

The crew also included a chief mate, an engineer officer, two able seafarers and two officer cadets.

On 22 April 2023, the PETRA L left the port of Szczecin in Poland to sail to Merksem in Belgium. The ETA was 26 April 2023. After leaving the Kiel Canal locks in Brunsbüttel, she headed for the Terschelling-German Bight traffic separation scheme.

At the time of the accident, the master was keeping watch from 1900 to 2400. The BSU assumes that he took over the watch much earlier in the usual manner.

The master stated that he had intended to take a capsule of the dietary supplement RAMI SIRDIS to help him remain alert. However, he reportedly confused it with a capsule of the dietary supplement SALDUS MIEGAS, which contains melatonin and aids sleep. In fact, the products do have a very similar appearance. The BSU does not know how long or how regularly he had been taking such supplements.

The master stated[21] that he fell asleep shortly after the start of his watch at 1900 on 24 April 2023 and was woken up by the allision with the wind turbine at 2008[22]. He is reportedly unable to explain the course alteration. Based on an analysis of the AIS data, the BSU considers it likely that the relieved chief mate intended to sail westward on the northern edge of the TSS clear of other traffic sailing in the same direction.[23] The master did not return the vessel to the TSS course line and the PETRA L sailed across the TSS's northern boundary and toward the wind farm.

After the allision, the master reportedly put the helm to astern immediately to move away from the OWT. He then altered course toward the TSS.

The master stated that he had attempted to contact VTS German Bight on VHF channels 79 and 80 immediately and continued trying repeatedly. He reportedly only managed to contact the VTS 1.5 hours after the allision and reported the incident. GB instructed him to follow the TSS as far as the Borkumriff buoy and only then to alter course south in the direction of Emden. He acknowledged and complied with the instruction (see also 3.2.8.3).

[21] This statement could not be verified.
[22] He later corrected the time to 2004, as stated by other parties.
[23] There is no statement from the chief mate.

The PETRA L was made fast in the port of Emden at 0840 on 25 April 2023. All damage to the ship was comprehensively recorded there.

### 3.2.4 Manning and watchkeeping

According to the statement of the master, who was on watch at the time, he was alone on the bridge when the accident happened. The PETRA L was steered using the autopilot. A heading of 255° was entered in the logbook at 1700. According to entries made at 1800 and 1900, this course was maintained until the allision. The allision occurred before sunset[24] in good visibility. Under Rule 5 (Lookout) of the International Regulations for Preventing Collisions at Sea (COLREGs), the PETRA L and all other vessels "[...] shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision."[25]

Particular consideration was given to the below questions when investigating why this rule was presumably not sufficiently complied with.

- Were the basic navigational watchkeeping requirements complied with?
- Was the PETRA L manned in accordance with the minimum safe manning document?
- Were the hours of work and rest adhered to?
- Were there any signs of fatigue?
- Was the minimum safe manning document issued in accordance with mandatory international requirements?
- Having regard to the trading area in the German Bight, what are the relevant navigational watchkeeping requirements?

#### 3.2.4.1 Watchkeeping according to the watch schedule

The master had drawn up a schedule for watchkeeping at sea and in port. According to this schedule, two crew members were generally simultaneously assigned to the navigational watch at all times at sea, meaning a navigational watch consists of an officer in charge of the navigational watch and a rating (lookout/helmsman).

[24] Sunset on 24 April 2023 at 53°59.1'N 006°58.7'E at 2049.
[25] International Regulations for Preventing Collisions at Sea of 13 June 1977 (Federal Law Gazette I p. 816), as amended by Article 1 of the Regulations of 7 December 2021 (Federal Law Gazette I p. 5188).

At sea, the master was scheduled to serve as officer in charge of the navigational watch each day from 0500 to 1200 and from 1900 to 2400. The chief mate covered the remaining 12 hours. In addition, both the master and the chief mate were on call at all times for additional duties, as required.

Two ABs[26] and two officer cadets (deck) were available as ratings. The distribution of hours can be taken from the following schedule.

| a | c | | | | | | | | | | | | | | d | e | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rank | Scheduled daily work hours at sea | | | | | | | | Scheduled working hours in port | | | | | | Remarks | Daily rest periods | |
| | Watchkeeping | | | | Non-Watchkeeping | | | | Watchkeeping | | | | Non-watchkeeping | | | At sea | In port |
| | from | to | from | to | from | to | from | to | from | to | from | to | from | to | | | |
| Master | 5 | 12 | 19 | 24 | | | | | 5 | 12 | 19 | 24 | | | Any time if necessary | 12 | 12 |
| Chief Mate | 0 | 5 | 12 | 19 | | | | | 0 | 5 | 12 | 19 | | | Any time if necessary | 12 | 12 |
| Chief Engineer | | | | | 8 | 12 | 13 | 17 | | | | | 8 | 12 | 13 17 Any time if necessary | 16 | 16 |
| AB | | | 12 | 18 | 8 | 12 | | | | | | | 8 | 12 | 13 17 As per COLREG at sea as lookout on the bridge, otherwise on deck. | 14 | 16 |
| AB | 4 | 8 | 18 | 24 | | | | | | | | | 8 | 12 | 13 17 As per COLREG at sea as lookout on the bridge, otherwise on deck. | 14 | 16 |
| Cadet / deck | 8 | 12 | | | | | 13 | 17 | | | | | 8 | 12 | 13 17 | 16 | 16 |
| Cadet / deck | 0 | 4 | | | | | 13 | 17 | | | | | 8 | 12 | 13 17 | 16 | 16 |

Figure 19: Watch schedule (extract)[27]

However, the note "As per COLREG at sea as lookout on the bridge, otherwise on deck" implies that the ABs are generally assigned to deck duties rather than the navigational watch. The reference to the COLREGs is meaningless, as the requirements for manning the navigational watch with a lookout are not provided for by the COLREGs, but rather by the internationally binding watchkeeping standards (see A-VIII/2 STCW Code). According to the watchkeeping schedule, a two-person navigational watch is therefore only ensured during the periods 0800 to 1200 and 0000 to 0400.

### 3.2.4.2 Navigational watch at the time of the accident

On the day of the accident, the master took over the navigational watch at 1900, as scheduled. According to the entries in the logbook and the statements submitted, there was no lookout on the bridge from 1800 to 2010. The PETRA L was steered using the autopilot. The course alteration made at 1841 could not be explained to the BSU. The course alteration presumably continued after the change of watch. During the investigation, it was not possible to establish why the course alteration occurred.

[26] AB: Able seafarer deck – term according to point 1(34) of Regulation I/1 STCW.
[27] Source: Shipping company.

Therefore, having regard to the above questions, the investigation subsequently focused on the following aspects:

- the BNWAS[28],
- the hours of work and rest,
- the navigational watch requirements, and
- the manning of the vessel.

#### 3.2.4.3 Bridge navigational watch alarm system (BNWAS)

Pursuant to point 2.2.3 of Chapter V Regulation 19 of the International Convention for the Safety of Life at Sea, 1974, as amended by the 1988 Protocol (SOLAS), the PETRA L was equipped with a bridge navigational watch alarm system. Under SOLAS, the BNWAS must be operational when the ship is underway at sea. The BNWAS did not ensure that the master was sufficiently alert to recognise and avoid the risk of allision shortly before it happened. No indication of a technical problem with the BNWAS was found during the investigation.

#### 3.2.4.4 Hours of work and rest

The relevant hours of work and rest are internationally agreed in A 2.3 of the Maritime Labour Convention, which states that the maximum hours of work shall not exceed

- 14 hours in any 24-hour period, and
- 72 hours in any 7-day period.

The minimum hours of rest shall not be less than

- 10 hours in any 24-hour period, and
- 77 hours in any 7-day period.

Hours of rest may be divided into no more than two periods, one of which shall be at least 6 hours in length. The interval between two consecutive periods of rest shall not exceed 14 hours.

[28] BNWAS: Bridge navigational watch alarm system.

Drills and exercises shall be conducted in a manner that minimises the disturbance of rest periods and does not induce fatigue. The hours of work and rest must be recorded.

The minimum rest periods laid down in A-VIII/1 of the STCW Code for seafarers who are assigned watchkeeping duties correspond to those of the Maritime Labour Convention.

The crew of the PETRA L had recorded the hours of work and rest. These records indicate that the hours of work and rest were adhered to.

The master generally took over watches in accordance with the watch schedule. Additional hours of work were only occasional. According to the hours recorded, this would typically be when a shortened navigational watch either preceded or was expected to follow such work.

The chief mate also generally took over watches in accordance with the watch schedule. According to the time sheets, he only worked additional hours during the day if his scheduled watch was not required.

#### 3.2.4.5 Workdays of the master

The master took over the PETRA L in Klaipėda, Lithuania, on 22 February 2023. He had served on board the PETRA L for 63 workdays prior to the day of the accident. These workdays included 14 full days at sea and six full days in port. On the remaining 43 days, he called at 20 ports with the PETRA L, 15 of which were different. During the days at sea, he navigated high traffic coastal waters or narrow fairways and canals. Multiple locks were used during a total of five canal passages (Kiel Canal: two locks; Trollhätte Canal: six locks). Details of the course of the voyage are shown in Annex 9.1 to the report.

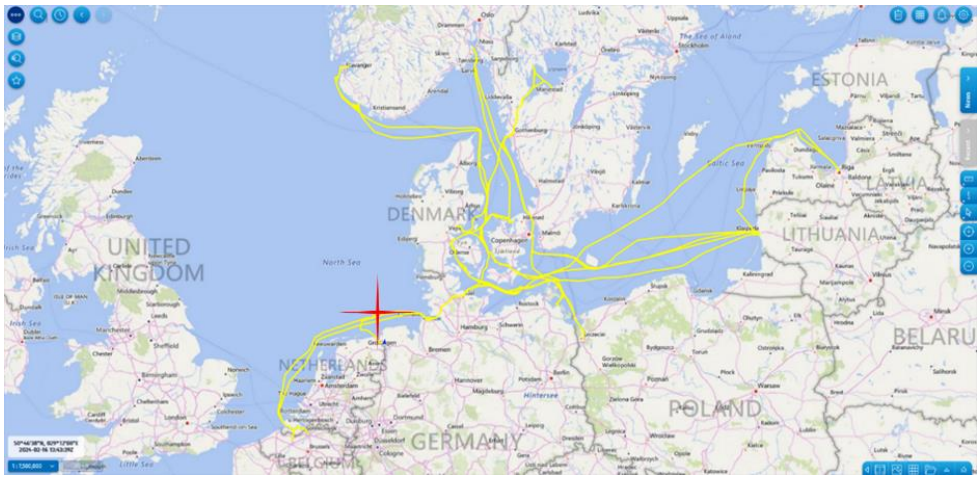


Figure 20: Courses of the PETRA L with this master on board[29]

[29] Source: AIS data and screenshot from SEG.

The course of the voyage (see Annex) and the hours of work recorded by the crew do not indicate the time spent on such tasks as the inevitable voyage planning, cargo operations, maintenance works, pilot transfers, catering or crew health and safety. However, such tasks are unavoidable and must be performed in addition to watchkeeping. Moreover, weather-related environmental influences must be taken into account. During the period in question, stormy winds and corresponding swell must be expected regularly in the PETRA L's trading area, leading to rolling and pitching movements of the vessel. Such external conditions generally have an additional negativ effect in terms of work-related stress, even if hours of work and rest are adhered to.

#### 3.2.4.6 Navigational watchkeeping requirements and regulations

The internationally binding minimum requirements for the navigational watch are set out in A-VIII/2 of the STCW Code[30]. According to paragraph 14 of A-VIII/2 STCW Code, a proper lookout shall be maintained at all times in compliance with Rule 5 COLREGs. In particular, the risk of collision or stranding shall be avoided and ships or aircraft in distress, shipwrecked persons, wrecks, debris and other hazards to safe navigation detected through a continuous state of vigilance by sight, hearing and all other available means.

It must be ensured that a proper lookout is maintained at all times (see paragraph 15 of A-VIII/2 STCW Code). According to paragraph 16 of A-VIII/2 STCW Code, the lookout may simultaneously perform the duties of a helmsman on smaller vessels under certain conditions. The officer in charge of the navigational watch may be the sole lookout in daylight under the following conditions if

- it has been established without doubt that it is safe to do so;
- full account has been taken of all relevant factors, such as the state of weather, visibility, traffic density, proximity of dangers to navigation, and the attention necessary when navigating in or near traffic separation schemes, and
- assistance is immediately available to be summoned to the bridge when any change in the situation so requires.

Furthermore, paragraph 17 of A-VIII/2 STCW Code states that in determining that the composition of the navigational watch is adequate to ensure that a proper lookout can continuously be maintained, the master shall take into account all relevant factors. In

[30] The 2010 Manila Amendments to the Seafarers' Training, Certification and Watchkeeping (STCW) Code. Part A. Mandatory standards regarding provisions of the Annex to the STCW Convention. CHAPTER VIII Standards regarding watchkeeping. Section A-VIII/2. Watchkeeping arrangements and principles to be observed. IMO VEGA (20240304). The German version is published in the Annex Volume to the Federal Law Gazette Part II No 18 of 4 July 2013: Eighth Ordinance on Amendments to the Annex to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, of 28 June 2013.

particular, these include all factors in A-VIII/2 STCW Code, as well as those listed below, which the BSU believes are highly relevant to this accident:

.1 visibility, state of weather and sea;

.2 traffic density, and other activities occurring in the area in which the vessel is navigating;

.3 the attention necessary when navigating in or near traffic separation schemes or other routeing measures;

.4 the additional workload caused by the nature of the ship's functions, immediate operating requirements and anticipated manoeuvres;

.5 the fitness for duty of any crew members on call who are assigned as members of the watch;

#### 3.2.4.7 Master's standing orders

The master had issued standing orders and instructed the chief mate and the chief engineer officer to countersign them. Five of these orders concern the navigational watch. The master had prohibited the use of personal electronic devices. For voyages in restricted visibility, he stipulated that

- the vessel must proceed at a safe speed;
- the required sound signals must be issued and an additional lookout must be posted;
- manual control of the ship must be considered;
- moreover, an additional lookout must be considered for voyages in areas of high traffic density.

#### 3.2.4.8 Manning and documents of compliance of the seafarers on the day of the accident

According to the crew list, seven crew members were on board when the accident happened. They consisted of a master, a chief mate, a chief engineer officer, two able seafarers and two officer cadets. With the exception of the chief engineer officer, all crew members were assigned to navigational watch duties according to the watch schedule.

The master held a valid certificate of competency issued by Lithuania under Regulation II/2 of the Annex to the STCW Convention, authorising service as master on ships of between 500 and 3,000 gross tonnage (GT). He first obtained the certificate of competency authorising service as master at the end of 2013. He had served on the PETRA L in the positions of chief mate and master for more than 10 years.

The chief mate held a valid certificate of competency issued by Russia under Regulation II/2 of the Annex to the STCW Convention, authorising service as chief mate on ships of 3,000 GT or more.

The chief engineer officer held a certificate of competency issued by Ukraine under Regulation III/1 of the Annex to the STCW Convention, authorising service as an officer in charge of an engineering watch for all propulsion systems.

The flag State had issued endorsements of recognition for the certificates held by the chief mate and chief engineer officer. The endorsement for the master's certificate was missing.

The able seafarers held certificates of proficiency under Regulation II/4 of the Annex to the STCW Convention, authorising them to perform navigational watch duties at the support level. Certificates of proficiency as able seafarer under Regulation II/5 of the Annex to the STCW Convention were not submitted for the investigation.

No certificates of proficiency under the STCW Convention for the two officer cadets were submitted for the investigation. A certificate of completion for a 40-hour navigational watchkeeping course approved by the Philippine Administration under Regulation II/4 of the Annex to the STCW Convention was submitted for one cadet.

The duties of the ship's cook were performed by a rating who held a health card.

#### 3.2.4.9 Minimum safe manning document

The flag State of Antigua and Barbuda issued a minimum safe manning document for voyages not exceeding 200 nautical miles from the coast on 19 May 2022. According to this document, a total of five crew members, including the master, would be able to man the vessel safely.

## MINIMUM SAFE MANNING DOCUMENT

Issued under the provisions of regulation V/14 of the:
INTERNATIONAL CONVENTION FOR THE SAFETY OF LIFE AT SEA, 1974, as amended
Under the authority of the Government of Antigua and Barbuda
by
The Antigua and Barbuda Department of Marine Services and Merchant Shipping

Particulars of the ship.

| | | | |
|---|---|---|---|
| Name of ship | PETRA L | | |
| Distinctive number or letters | 3807 / V2OK3 | IMO number. | 8205187 |
| Port of Registry | St. John's | Main propulsion power (kW) | 750 |
| GROSS TONNAGE (ITC) | 1162 | Periodically unmanned machinery space | Yes |
| Operating Company: | MP Shipping GmbH & Co. KG, Schlenzigstr. 9, 21107 Hamburg, Germany | | |
| Trading Area: | Restricted international voyages (voyages during which the ship is never more than 200 nautical miles off shore) | | |

The ship- named in this document is considered to be safely manned if, when it proceeds to sea, it carries not less than the number and grades / capacities of personnel specified in the table(s) below.

| Grade / Capacity | Certificate (STCW Regulation) | Number |
|---|---|---|
| Master | II/2; IV/2 | 1 |
| Chief Mate | II/2; IV/2 | 1 |
| Officer in Charge of a navigational watch | | - |
| Chief Engineer | | - |
| Second Engineer | | - |
| Officer in Charge of an engineering watch | III/1 | 1 |
| Able Seafarer Deck or<br>Ratings forming part of a navigational watch | II/5 or II/4 | 2 |
| Deck Rating | | - |
| Able Seafarer Engine or<br>Ratings forming part of a watch in a manned engine room or designated to perform duties in an unmanned engine room | | - |
| Engine Room Ratings | | - |
| Electro Technical Officer | | - |
| Cargo Engineer | | - |
| Cook | | - |

Figure 21: Minimum safe manning document of the PETRA L (page 1)[31]

[31] Source: The Antigua and Barbuda Department of Marine Services and Merchant Shipping.

**MINIMUM SAFE MANNING DOCUMENT**

Issued under the provisions of regulation V/14 of the:
INTERNATIONAL CONVENTION FOR THE SAFETY OF LIFE AT SEA, 1974, as amended
Under the authority of the Government of Antigua and Barbuda
by
The Antigua and Barbuda Department of Marine Services and Merchant Shipping

| | | |
|---|---|---|
| Other | | - |
| Total: | | 5 |
| Special Requirements or conditions if any: | None | |

Issued at Oldenburg on: 19. May 2022

Date of expiry: 18. May 2024

This document is signed electronically in accordance with IMO FAL .5/Circ.39/Rev.2. Validation and Authentication obtained from www.mycert.com/check by using the Unique Tracking Number (ADOMS UTN) stated below.

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M. Schnelder, Deputy Registrar

Signature: signed for and on behalf of The Government of Antigua and Barbuda

Figure 22: Minimum safe manning document of the PETRA L (page 2)[32]

At least four crew members, a master, a chief mate and two ratings were stipulated for the deck department and navigational watchkeeping duties. The master and the chief mate must hold certificates under Regulation II/2 of the Annex to the STCW Convention, authorising service on ships of 500 GT or more in the respective positions of master or chief mate. The minimum requirement for the ratings is a certificate of proficiency in navigational watchkeeping under Regulation II/4 of the

[32] Source: The Antigua and Barbuda Department of Marine Services and Merchant Shipping.

Annex to the STCW Convention. The alternative Regulation II/5 of the Annex to the STCW Convention listed in the minimum safe manning document refers to the minimum standards of competence for an able seafarer deck, which include the competence requirements under Regulation II/4 of the Annex to the STCW Convention (see paragraph 2.2 of Regulation II/5 of the Annex to the STCW Convention).

In addition to these four crew members for the deck and bridge department, one additional crew member for engineering watch duties under Regulation III/1 of the Annex to the STCW Convention was also required. Additional crew members whose presence could have facilitated a different distribution of work and would therefore have had a direct impact on the navigational watch, such as a cook, had not been made mandatory.

#### 3.2.4.10 Conditions for issuing the minimum safe manning document

The minimum safe manning document was issued in accordance with the endorsement entered under Regulation V/14(2) SOLAS[33], as amended. This Regulation states that the flag State shall issue an appropriate certificate based on a transparent procedure for determining the safe manning of the ship, taking into account the recommendations of Resolution A.1047(27) (Principles of Minimum Safe Manning) of the Maritime Safety Committee. The Resolution has five Annexes (see Annex 9.2 to this investigation report):

1. GUIDELINES FOR THE APPLICATION OF PRINCIPLES OF MINIMUM SAFE MANNING
2. GUIDELINES FOR DETERMINATION OF MINIMUM SAFE MANNIN
3. RESPONSIBILITIES IN THE APPLICATION OF PRINCIPLES OF MINIMUM SAFE MANNING
4. GUIDANCE ON CONTENTS AND MODEL FORM OF MINIMUM SAFE MANNING DOCUMENT
5. FRAMEWORK FOR DETERMINING MINIMUM SAFE MANNING

This Resolution provides guidance to operators responsible for the safe manning of ships and to the Administration responsible for certification. Comprehensive principles for determining minimum safe manning must be observed. The following are just some of the relevant factors in point 1.1 of Annex 2, which are mentioned by way of example but are of significance for the PETRA L in the opinion of the BSU:

- the ship's size;
- the ship's degree of automation;
- the sequence of ports as well as the length and nature of the voyages to be undertaken;
- the area of operation (trading area), and

[33] SOLAS: International Convention for the Safety of Life at Sea, 1974/88.

- the training activities on board.

With regard to the standards of competence for crew members, the functions and levels of responsibility (management, operational, support level) listed in the STCW Code must be observed. According to the guidelines, the following functions must be observed (only by way of example, details can be found in point 1.2 of Annex 2 to the Resolution):

- navigation (this includes such tasks as planning and conducting safe navigation, the navigational watch, handling the ship in all conditions, as well as mooring and unmooring the ship);
- cargo handling and stowage;
- operation of the ship and care for persons on board (maintenance of all lifesaving, firefighting and other safety systems, [...], operations to ensure protection of the marine environment, medical care on board the ship, administrative tasks, and the security of the ship;
- marine engineering;
- electrical, electronic and control engineering;
- radiocommunications;
- maintenance and repair (tasks required to carry out maintenance and repair work to the ship and her machinery, equipment and systems).

In addition to the factors and qualification requirements for crew members already discussed, further considerations apply. For example, point 1.3.2 of Annex 2 states: "except in ships of limited size, the provision of qualified deck officers to ensure that it is not necessary for the master to keep regular watches by adopting a three-watch system; [...]."

With regard to the above aspect, point 2.7 of Annex 3 states: "The Administration should consider the circumstances very carefully before allowing a minimum safe manning document to contain provisions for less than three qualified officers in charge of a navigational watch, while taking into account all the principles for establishing safe manning."

According to point 1.2.5 of Annex 3, when preparing a proposal for the minimum safe manning of a ship for the Administration, the ship operator must "ensure that the minimum safe manning is adequate at all times and in all respects, including meeting peak workload situations, conditions and requirements, [...]."

Standard A 3.2 (Food and catering) of the Maritime Labour Convention[34] sets out the requirements for having a "fully qualified cook" on board a ship. Paragraph 5 of this Standard states that by virtue of the size of the crew or the trading pattern, flag States may permit the omission of a fully qualified cook on board and the crew to perform the associated tasks. However, in the absence of a ship's cook, anyone processing food in the galley must be trained or instructed in such areas as food and personal hygiene as well as handling and storage of food on board ship.

Antigua and Barbuda has prepared a form for the ship's owner or operator to use when applying for a minimum safe manning document (see Annex 9.3).

The form takes into account references to Resolution A.1047(27). Applicants can state in the form the number of positions they deem necessary, including key tasks and estimated working hours. The form also contains a checklist, which is used by the officer assessing the submission. The checklist takes into account the criteria listed in point 3 of Annex 1 to Resolution A.1047(27). The checklist does not provide any space for comments.

The papers supporting the application for the PETRA L's minimum safe manning document were not submitted for the investigation.

#### 3.2.4.11 Navigational watchkeeping in the German EEZ/Bight

The accident occurred in the German Bight while navigating the Terschelling-German Bight traffic separation scheme (TSS).

The Terschelling-German Bight TSS is one of four TSSs in the German Bight. It runs along the line of the East Frisian islands in a west-south-west direction and is the TSS with the highest traffic density in the German Bight. According to the most recent traffic report from the GDWS, with figures from 2022, some 24,000 vessels of more than 50 m in length navigated this TSS.

[34] Maritime Labour Convention, 2006, as amended in 2018, Maritime Labour Convention, 2006 (deutsche-flagge.de) (2024-04-09).

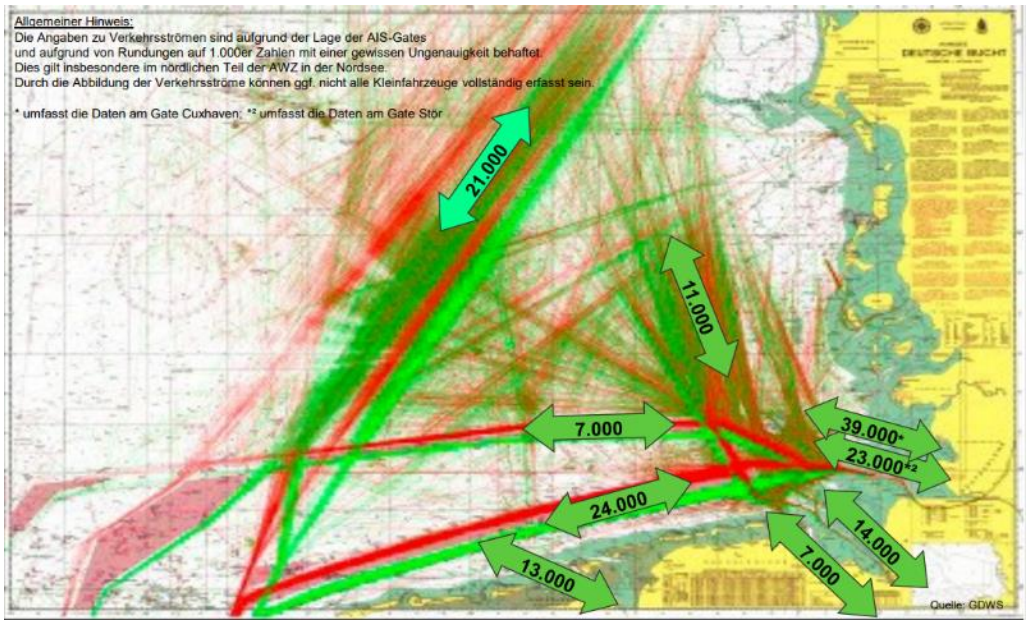


Figure 23: Traffic flows in the German North Sea (vessels > 50 m)[35]

Various allocations restrict the space available for maritime shipping in Germany's territorial sea and EEZ, as shown in the two charts below:

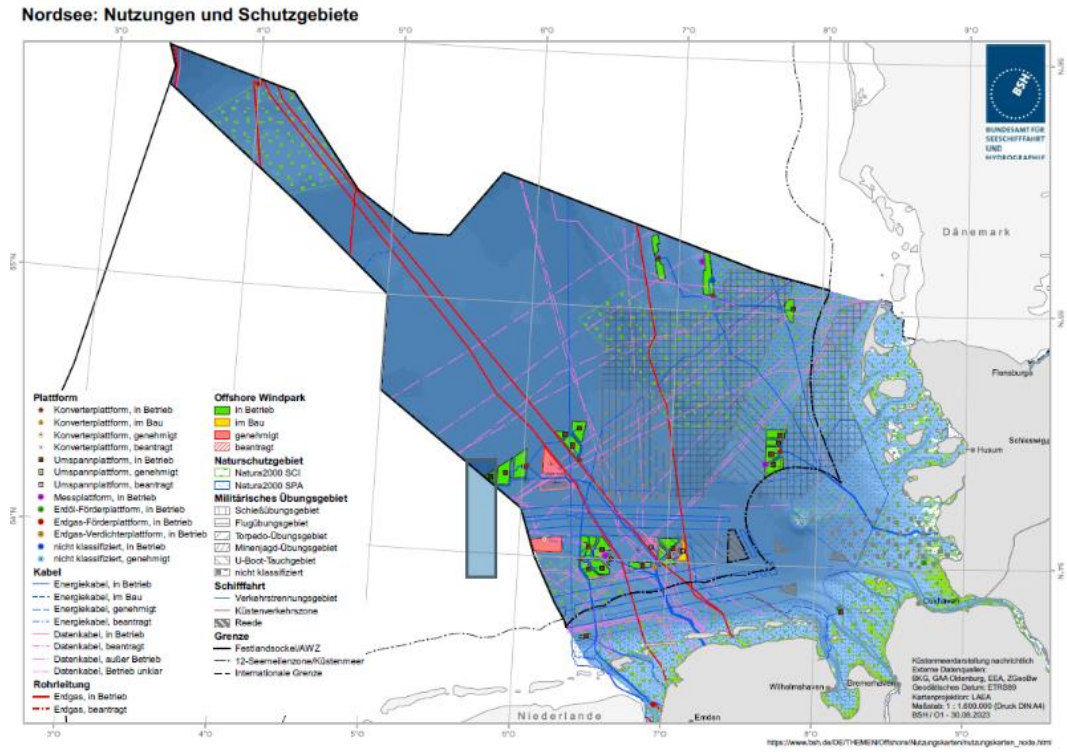


Figure 24: Allocated sections of the North Sea: German territorial sea and EEZ[36]

[35] Source: Page 10 of Transport Report 2022. Issued by: Federal Waterways and Shipping Administration.

[36] Source: BSH – Sea use maps, as at 30 August 2023 (2024-03-05).

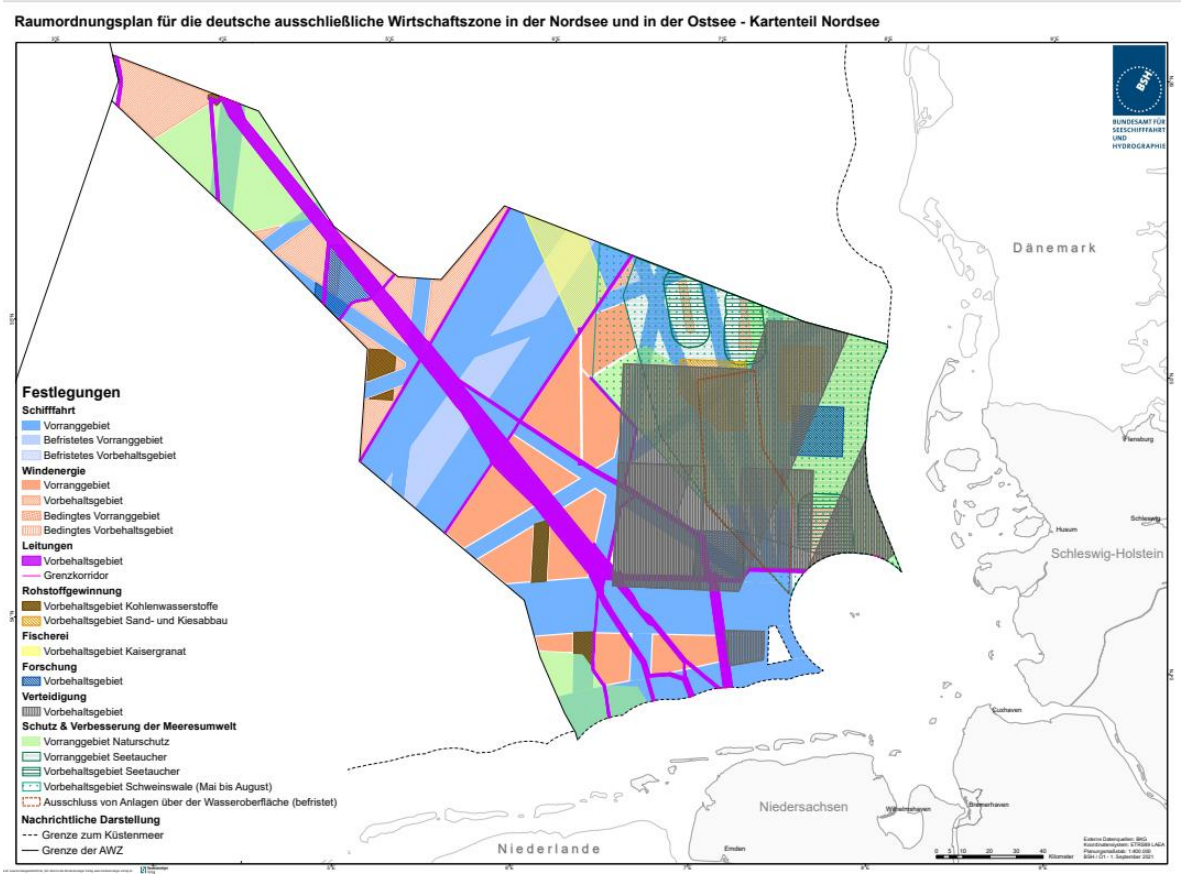


Figure 25: Spatial Plan for the German EEZ[37]

### 3.2.5 Weather report

The DWD prepared a weather report on behalf of the BSU. *The DWD has measurements and observations from the surrounding stations at its disposal for the accident area north of Norderney. These stations are partially or temporarily unmanned. Analyses of the Austrian Meteorological Service in Vienna (ZAMG), the UK Met Office in Exeter, and the American Global Forecast System (GFS) model were referred to for the account of the weather conditions. Moreover, forecasts of the ECMWF's (European Centre for Medium-Range Weather Forecasts in Reading, England) global weather and sea-state forecast model and the DWD's ICON and ICON-D2 global and regional weather forecast models, as well as the sea-state models derived from them were considered in the assessment. Satellite images, radar images and rawinsondes were also analysed.*

[37] Source: *Verordnung über die Raumordnung in der deutschen ausschließlichen Wirtschaftszone in der Nordsee und in der Ostsee* [Ordinance on Spatial Planning in the German Exclusive Economic Zone in the North Sea and the Baltic Sea] of 19 August 2021 (Federal Law Gazette I p. 3886). Annex Volume: Spatial Plan for the German Exclusive Economic Zone in the North Sea and Baltic Sea – North Sea chart section.

***Weather situation on 24 April 2023***

*The meteorological chart indicates a storm front (996 hPa) over Jutland, which later moved toward southern Norway, weakening somewhat in the process. It affected the accident area with a strong westerly to north-westerly current.*

***Observed weather/visibility and wind:***

*It was very cloudy to mainly overcast during the accident period with some early rainfall and later localised showers. Predominantly good visibility was recorded, initially at 4 km and later generally more than 10 km.*

*A westerly wind of 15-20 kts (4-6 Bft) was measured initially. The wind swung to the north-west in the hours that followed, increasing to a mean value of 30 kts (7 Bft) by the morning of 25 April. Due to unstable atmospheric stratification, gusts with wind forces of up to 2 over the mean wind were possible.*

***Model results for wind and significant sea state:***

*The DWD's high-resolution CWAM coastal model initially indicated westerly to north-westerly winds of 5 Bft in the accident area. Significant waves of 1.5 m were expected. As the night progressed, the wind and waves increased slightly with wind forces of 6 Bft and wave heights of 3.5-4 m being reached by the morning of 25 April.*

***Current patterns for 24 & 25 April 2023:***

*The mean current in the 0-5 m water depth layer from the operational model system of the BSH indicated an easterly current of 30-50 cm/s in the accident area, which veered to the west by midnight on 25 April and increased to 70-90 cm/s. It later veered eastward again by the morning, decreasing to 30-50 cm/s.*

### 3.2.6 Input from the wind farm operator

On 23 January 2024, two investigators and officials from the BSH visited the operating site of Ørsted, the wind farm operator, in Norden-Norddeich. The control centre (MHCC – Marine and Helicopter Coordination Centre) was presented and its operations were explained. The constructive discussions enabled the BSU's investigators to gain a comprehensive understanding of the responsibilities at this site.

At the request of the BSU, Ørsted prepared the following information (editorially revised):

#### 3.2.6.1 Operations of the MHCC

*Ørsted operates four offshore wind farms in the German EEZ (Borkum Riffgrund 1 & 2 and Gode Wind 1 & 2) in the North Sea. To maintain the safety and ease of shipping, Ørsted is required to observe the sea area in the wind farms and surrounding 500-m safety zones in accordance with legal requirements. These duties were initially performed by the Marine and Helicopter Coordination Centre (MHCC) in Grimsby, England. They were transferred to the MHCC in Norddeich in January 2022.*

*The MHCC in Norddeich is described below. The specific requirements for maritime observation comply with legal regulations and can be found in the Durchführungsrichtlinie Seeraumbeobachtung Offshore-Windparks (Stand: April 2024) [implementing directive for maritime observation at offshore wind farms (as amended in April 2024)] and in the permits for the respective wind farms.*

*Offshore coordinators work in shifts, with the number of on-site personnel varying between one and three, depending on the anticipated workload. When the Marine and Helicopter Coordination Centre (MHCC) is staffed by one person, their primary duty is maritime observation. However, they also perform offshore coordination and routine duties, with maritime observation always taking priority. To facilitate a structured and efficient process, routine duties are completed using checklists.*

*In the control centre in Norddeich, a distinction is currently made between two functions: offshore coordinator (OC) and control engineer (CE)[38].*

*The OCs are primarily responsible for maritime observation and the coordination of personnel and service providers in the OWFs.*

*[…]*

[38] In the interest of simplicity, only the generic masculine form is used below.

### 3.2.6.2 Internal investigation by Ørsted

*After notification of the PETRA L's allision with OWT GOW R04, Ørsted initiated an internal investigation into the incident to determine why the nautical coordinator on duty at the time of the allision[39] failed to notice the vessel's approach and allision with OWT GOW R04. Moreover, based on the findings of the internal investigation, recommendations for action were formulated to ensure that any alarms issued in the future are noticed. To facilitate an impartial assessment of the incident and the work of the Marine and Helicopter Coordination Centre (MHCC) in Norden (NOM), staff of the QHSE department at our London office conducted the investigation. […]* [40]

***Legal framework for operators***

*Pursuant to ancillary provisions 10 and 10.1 of the amendment notice dated 22 November 2010 to the permit for the 'Gode Wind 1' offshore wind farm (OWF) dated 28 August 2006, the project developer must submit a protection and safety concept to the licensing authority 6 months before construction of the first installation. The protection and safety concept must include a description of the type and scope of the planned observation of the adjacent sea area for the wind farm's own protection and the resulting measures. The protection and safety concept (including the descriptions of maritime observation) also requires the consent of the GDWS (formerly WSD Nordwest) for every amendment.*

*Maritime observation for the 'Gode Wind 1' OWF is part of a joint concept for observation of the BKR01, BKR02, GOW01 and GOW02 OWFs. Since 1 January 2022, observation has been conducted from the NOM site (previously by the MHCC in Grimsby, UK). The BSH approved the amended joint maritime observation concept (Version 4.1 of 1 November 2021) following consultation with the competent occupational health and safety authority, GAA Oldenburg, and after provisional conditional consent from the GDWS until 30 June 2023. A further amendment to the concept has already been submitted to the BSH for approval (submitted 1 June 2023).*

[39] The *Durchführungsrichtlinie Seeraumbeobachtung (2014)* [implementing directive for maritime observation] requires the assignment of personnel who have received at least adequate nautical training. At the time of the allision, fully trained nautical personnel with the relevant certificates of competency were assigned.

[40] Published with the kind permission of the wind farm operator (any changes made by the BSU are only of an editorial nature).

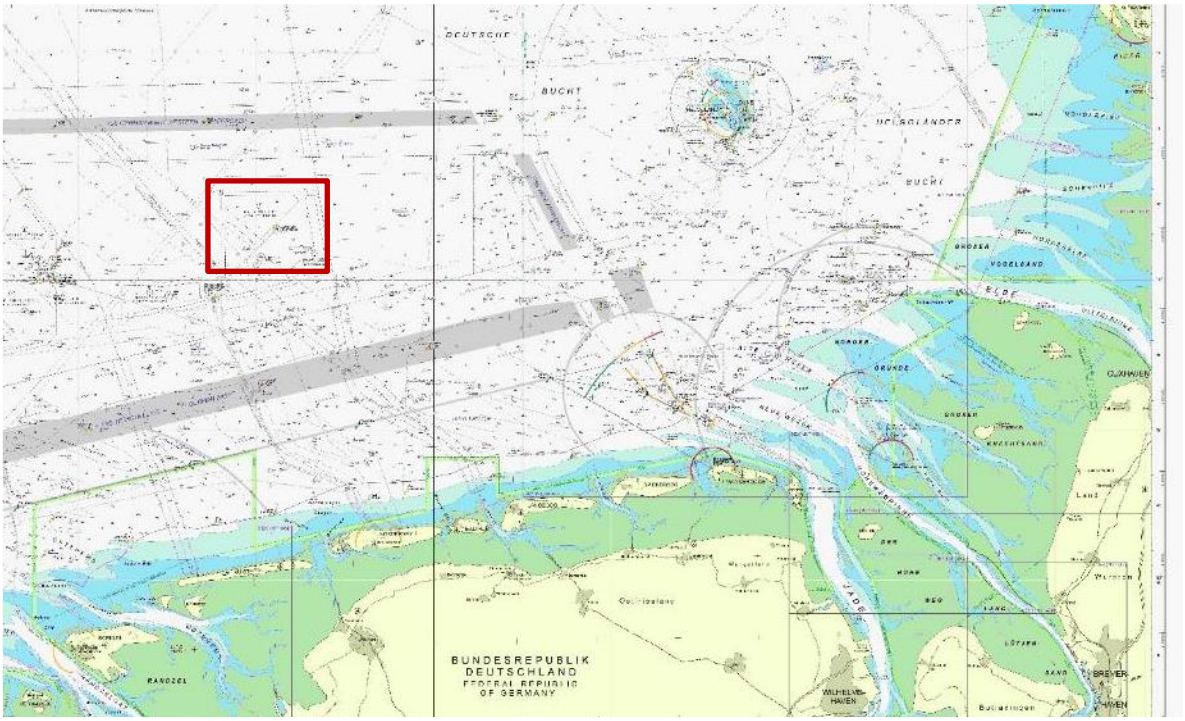


Figure 26: Location of the Gode Wind 1, 2, and 3 wind farms[41]

*The maritime observation 'operating area' covers traffic within the area of the OWF, including the 500-m safety zone, which we refer to as the 'internal farm area'. On the other hand, by 'areas in the vicinity of the farm' we mean the immediate surroundings of the safety zone, the 'external boundary' of which is undefined.*

*Maritime observation outside this zone is a sovereign responsibility carried out on behalf of the federal government as part of maritime traffic control by Vessel Traffic Service 'German Bight Traffic' (VTS GBT). If Ørsted conducts maritime observation beyond the scope described in the concept, then it does so on a voluntary basis. The concept thus complies with the implementing directive for maritime observation at offshore wind farms, which permits maritime observation in the vicinity of OWFs to be reduced to internal farm areas and areas in the vicinity of the farm if maritime traffic control is present.*

*Based on the traffic situation within and around the wind farm, the offshore coordinators independently decide on the extent to which they monitor the wind farm's surrounding area.*

[41] Source: Extract from Navigational Chart INT 1413, BSH (Edition 2 of 15 April 2021).

### *Maritime observation by the MHCC at the NOM site*

*Maritime observation at the NOM site includes AIS monitoring and VHF marine radio in accordance with legal requirements. The Systematic Offshore Management System (SOMS), which identifies ships by means of AIS and maps their positions on electronic navigational charts, is used for the observation of maritime traffic. Ships approaching the OWF trigger audiovisual alarms in the SOMS at specific intervals. The first alarm is triggered 15 minutes before a ship enters the safety zone (based on the ship's course and speed), while the final alarm is triggered upon entry into the 500-m safety zone. Once the ship leaves the safety zone, the alarms triggered deactivate. As described above in the legal framework for operators, observation of the area outside the safety zone is conducted in the operator's own interest.*

### *Findings of the internal investigation*

*In the course of the internal investigation, the incident was first reconstructed using existing AIS and alarm data. This indicated that the PETRA L altered course at approximately 1845 (local time/UTC+2) and headed for the OWF. As the ship proceeded, she triggered a total of four alarms in the SOMS – the first alarm at about 1945 (local time/UTC+2), about 15 minutes before entering the OWF safety zone, and the last upon entering the OWF safety zone at about 2002 (local time/UTC+2). The analysis of the AIS data indicates that the allision probably occurred 2 minutes later at 2004 (local time/UTC+2). At the time of the allision and in accordance with the shift schedule, the MHCC was routinely staffed by a nautical coordinator, who did not notice the alarms in the SOMS, however. Neither the PETRA L nor VTS GBT sent alarm notifications to the MHCC.*

*In the course of the internal investigation, several factors that contributed to the employee on duty's failure to notice the alarms were identified. These are detailed below.*

### *Audible alarms*

*The internal investigation revealed that the audible alarms in the SOMS were muted at the time of the allision. This is mainly due to the fact that maritime traffic – i.e. service traffic for the operator's and neighbouring OWFs and fishing boats in the vicinity of the OWFs, for example – triggers an extremely large number of alarms (about 1,000 every week) each day in the surrounding area (15-minute radius), which is also recorded in the system voluntarily.*

***System update***

*Approximately 2 weeks before the PETRA L's allision with OWT R04, an update to the SOMS was implemented to enable the long-term storage of warning and alarm notifications in a separate alarm tab. However, this also changed the visualisation of warning and alarm notifications. Previously, a red banner appeared on the screens, which the offshore coordinator on duty had to actively close. However, following the update, the notification was displayed as a smaller icon and automatically moved to the new alarm tab. For various reasons (e.g. staff availability), the staff training was scheduled for 25 April 2023 and therefore took place 1 day after the allision.*

***Functionality tests***

*The processes in place at the time of the allision did not provide for any system functionality tests during shift changes. As a result, the muted alarms went unnoticed.*

### 3.2.7 Input from the BSH

At the request of the BSU, the BSH prepared a technical report to answer the following questions:

1. What is the legal framework for your work, in particular for monitoring the sea area to protect wind turbines and shipping?

   *The Federal Maritime and Hydrographic Agency (BSH) monitors the Godewind* [sic] *01 offshore wind farm (OWF) based on Section 16 SeeAnlV in conjunction with Section 102(1)(1) WindSeeG, which state that wind turbines, their construction, and their operation are subject to monitoring by the BSH. The Federal Waterways and Shipping Agency (GDWS) is involved to the extent that the monitoring of wind turbines contributes to the safety and ease of traffic (Section 16(1)(2) SeeAnlV). An ancillary provision in the OWF's approval provides that the operator must submit a protection and safety concept, which must also include a maritime observation concept for the operating phase. The specific concept for monitoring the sea area is approved by the BSH after the GDWS has given its consent. Moreover, it is amended regularly and reapproved following the GDWS's renewed consent. The principles for monitoring the sea area of OWFs are set out in the Sicherheitsrahmenkonzept Offshore Windenergie [security framework concept for offshore wind energy] and the Durchführungsrichtlinie Seeraumbeobachtung [implementing directive for maritime observation] adopted by the Federal Ministry of Transport and Digital Infrastructure (BMVI; in each case, as amended in April 2014).*

2. How are responsibilities divided between the BSH and the GDWS?

   *The responsibilities of the BSH in this context are exclusively installation related. The BSH is responsible for the approval of offshore wind turbines and other installations under the WindSeeG in the EEZ (Sections 65, 66(2) WindSeeG). The approval of OWFs requires the consent of the GDWS (Section 69(10) WindSeeG and/or Section 8 SeeAnlV). The BSH is also responsible for monitoring installations in accordance with the WindSeeG (Section 79 WindSeeG), as well as the provisions of the SeeAnlV of 23 January 1997 (Federal Law Gazette I p. 57), which continue to apply in part to legacy projects (Section 16 SeeAnlV, Section 102(1)(1) WindSeeG). The BSH requires the GDWS's involvement in monitoring if so doing contributes to the safety and ease of shipping (Section 79(1)(2) WindSeeG and Section 14(1)(2) SeeAnlV). The general shipping police responsibilities of authorities of the Federal Waterways and Shipping Administration in the areas seaward of the border of the German territorial sea are set out in the Seeaufgabengesetz (SeeAufgG) [German Federal Maritime Responsibilities Act]. Please direct requests for more information on the competencies in this regard to the GDWS.*

3. How are responsibilities divided between the VTS and the wind farm operator, Ørsted?

   *The vessel traffic service centres are the operational arms of the river and shipping police authorities (GDWS) and an instrument for ensuring traffic safety and the prevention of risks to the safety and ease of traffic, of dangers emanating from shipping, and of harmful effects on the environment caused by shipping. They perform maritime traffic control. [...] Basic regulations on maritime observation and traffic monitoring by offshore wind farm operators can be found in the Sicherheitsrahmenkonzept Offshore Windenergie [security framework concept for offshore wind energy] and in the Durchführungsrichtlinie Seeraumbeobachtung [implementing directive for maritime observation] adopted by the Federal Ministry of Transport and Digital Infrastructure (BMVI; in each case, as amended in April 2014). The operator must carry out maritime observation in accordance with the maritime observation concept approved with the consent of the GDWS and report any hazardous situations to the competent vessel traffic service centre.*

4. Why is only AIS used for monitoring the sea area (i.e. no radar or video)?

   *The Sicherheitsrahmenkonzept Offshore Windenergie [security framework concept for offshore wind energy] and the Durchführungsrichtlinie Seeraumbeobachtung [implementing directive for maritime observation] adopted by the Federal Ministry of Transport and Digital Infrastructure (BMVI; in each case, as amended in April 2014) generally provide for AIS monitoring only.*

5. On what basis was a safety zone of 500 m established? Why is it not expressed in nautical miles or cables?

   *The BSH established the safety zone with the consent of the GDWS on the basis of Section 11 SeeAnlV. The navigation ban applies there in accordance with the general ruling of the GDWS on the regulation of navigation in a safety zone in accordance with Section 7(3) of the Verordnung zu den Internationalen Regeln von 1972 zur Verhütung von Zusammenstößen auf See [Ordinance to Implement the International Regulations for Preventing Collisions at Sea, 1972], dated 22 December 2014. Specification of the width of the safety zone in metres corresponds to the wording used in the SeeAnlV.*

6. Are plans/concepts in place for addressing allisions? What happens after an allision?

   *The procedure in the event of accidents, such as allisions, is determined on a case-by-case basis by lawyers and engineers after the BSH receives the report. In particular, technical investigations into the stability and operational safety of the affected installation are carried out with the involvement of a certified inspection officer if necessary and the need for further measures is determined. In addition to the GDWS, the competent occupational health and safety authority is also consulted.*

7. Following the PETRA L's allision, do you believe action should be taken to improve the maritime observation concept? If so, to what extent?

   *The operator's processes in the control centre are currently being investigated and it has been instructed to submit a report on this by the end of May 2023. Based on current knowledge, it is highly likely that the reported organisational measures taken by the operator immediately after the incident for handling alarm notifications (additional manual inspection of the alarm lists with acknowledgement) will be permanently incorporated into the concept for monitoring the sea area. It will become clear during the course of the ongoing investigations whether further modifications are necessary. If the BSU issues recommendations in this regard, these will have to be taken into account.*

### 3.2.8 Input from the GDWS

Upon request, the GDWS prepared a *technical report*[42] to answer the following questions of the BSU:

#### 3.2.8.1 Legal framework for the VTS

1. How is the security of a wind farm organised during construction and regular operation?

   *With regard to the construction and operation of offshore wind farms, the Federal Ministry of Transport and Digital Infrastructure (BMVI) set out basic security objectives for the prevention of shipping accidents in and around wind farms in the Sicherheitsrahmenkonzept Offshore Windenergie (OWE-SRK) [security framework concept for offshore wind energy], specifying a basic framework for implementing the security objectives in the process. This also sets out basic requirements that project developers [BSU: wind farm operating company] must comply with as part of their traffic control responsibilities.*

   *Traffic safety at the construction site and its surrounding traffic area is ensured during the construction phase by:*

   - *notices to seafarers and entry in the official navigational chart;*
   - *marking of the construction site with lit cardinal buoys;*
   - *temporary visual marking of installations being constructed;*
   - *deployment of a traffic control vessel suitable in terms of characteristics, sailing permit, equipment and manning.*

   *Traffic safety in the surrounding area of installations is ensured during the operational phase by:*

   - *visual and radio marking of the installations in accordance with the principles of the Richtlinie Offshore-Anlagen zur Gewährleistung der Sicherheit und Leichtigkeit des Schiffsverkehrs [directive on offshore installations to ensure the safety and ease of shipping], including proper implementation in accordance with the requirements of the WSV-Rahmenvorgaben Kennzeichnung Offshore-Anlagen [WSV framework specifications for marking offshore installations];*
   - *maritime observation by the offshore wind farm control centres in accordance with the Sicherheitsrahmenkonzept Offshore Windenergie [security framework concept for offshore wind energy] and the Durchführungsrichtlinie Seeraumbeobachtung [implementing directive for maritime observation]*

[42] Email dated 08/06/2023 (any changes made by the BSU are only of an editorial nature).

*adopted by the BMDV, as well as requirements of the GDWS specific to the sea area.*

*For the above-mentioned markings and the maritime observation, project developers are required to submit concepts in accordance with the provisions of the KPDs [BSU: key planning decisions], which require the consent of the GDWS and approval by the BSH.*

*It should also be noted that sea area monitoring is a defined term. It must be distinguished from maritime observation and maritime traffic control. The OWF operator is responsible for maritime observation. To illustrate, the purpose of maritime observation is to observe traffic in the immediate vicinity, 'similar to a laid up vessel'.*

*The vessel traffic service centre is responsible for maritime traffic control.*

2. What is the legal basis for this?

   *The binding legal basis for project developers for the arrangement and implementation of measures under point 1 is the (in each case project-related) key planning decision (KPD) for the wind farm in accordance with the SeeAnlV and/or the WindSeeG. The KPDs contain both explicit instructions and references to the rules and regulations of the BMDV and the GDWS as applicable documents.*

3. What is the role of the GDWS in this regard and what are the duties of the vessel traffic service centres?

   *The BSH is responsible for enforcing the KPDs. The GDWS advises the BSH internally on the implementation of shipping police orders but has no external interaction with project developers.*

   *In addition to their principal duty of maritime traffic control in accordance with relevant shipping police principles and administrative regulations, the task of vessel traffic service centres in the context of implementing KPDs is primarily to receive disruption and incident reports affecting shipping from project developers and to inform wind farm control centres about any risks to the safety of a wind farm.*

   *The basic responsibilities of vessel traffic service centres are set out in Section 55a Seeschifffahrtsstraßenordnung [German Traffic Regulations for Navigable Maritime Waterways] (SeeSchStrO), which assigns the following duties to vessel traffic service centres in Germany's territorial sea:*

   - *traffic information (Section 2(1)(23) SeeSchStrO);*
   - *traffic assistance (Section 2(1)(24) SeeSchStrO);*

- *traffic instructions (Section 2(1)(25) SeeSchStrO), and*
- *traffic flow control on the Kiel Canal (Section 2(1)(26) SeeSchStrO).*

*Maritime traffic control is defined in Section 2(1)(22) SeeSchStrO:*

*The [...] whole complex of traffic information and traffic assistance provided, and any restraints for the control and regulation of traffic issued or imposed, by a VTS centre for preventing collisions (where any form of collision is being referred to) and groundings, for controlling the traffic flow, or for preventing hazards to the marine environment as may arise from shipping.*

*The general administrative regulation of the Federal Waterways and Shipping Administration (VV-WSV 2408) and the supplementary administrative regulation of the Federal Waterways and Shipping Agency (VV-GDWS 24-X) for the operation of a specific vessel traffic service centre provide for the operation of the respective vessel traffic service centre.*

*Beyond the territorial sea, the vessel traffic service centre performs the duties defined in Sections 1(3), 3 ff. Seeaufgabengesetz [German Federal Maritime Responsibilities Act] when action is required seaward of the territorial sea, as far as is necessary or permissible under international law. The vessel traffic service centre is also tasked with the duties of the Maritime Assistance Service (A.950(23)) within and beyond the territorial sea.*

4. On what basis were the safety zones (of 500 m) established?

*The establishment of safety zones is governed by the United Nations Convention on the Law of the Sea (UNCLOS) of 1982. According to Article 60(5) UNCLOS, safety zones may not extend beyond a distance of 500 m measured from the edge of a structure, unless generally accepted international standards permit otherwise or the competent international organisation recommends otherwise. Similar regulations are enshrined in national law (see Section 74(2) WindSeeG and Section 7(1) VOKVR).*

*International standards or recommendations that would permit the extension of safety zones to more than 500 m from structures do not exist for reasons of the freedom of navigation (see Article 58(1) UNCLOS).*

5. Why is radar monitoring (or video or thermal imaging) not implemented when maritime observation concepts are formulated?

   *The minimum technical equipment required for maritime observation in the vicinity of wind farms for the detection of maritime traffic in the observation area is defined in the BMDV's Durchführungsrichtlinie Seeraumbeobachtung [implementing directive for maritime observation]. With regard to the potential use of additional sensors for the detection of maritime traffic (e.g. CCTV or infrared, etc.), the implementing directive refers to the provisions of the OWE-SRK, which do not include provisions in this regard, however.*

   *Moreover, the BMDV has explicitly prohibited the GDWS (Decree WS 23/528.2/2-2-2 of 11 January 2011) from requiring project developers to use radar for monitoring maritime traffic in the vicinity of wind farms.*

6. How is navigation within wind farms regulated?

   *Navigation within wind farm safety zones is regulated by general rulings of the GDWS. With the exception of vessels involved in construction, etc., navigation is generally prohibited during the wind farm construction phase. Subject to certain requirements and conditions such as a specific maximum wind force or a specified minimum visibility, navigation within the safety zone (including the developed area) is permitted for vessels up to 24 m in length after a wind farm has been commissioned. The specific requirements and conditions can be found in the attached general ruling on navigation within the shared safety zone around the 'Nordsee Ost' and 'Meerwind Süd/Ost' offshore wind farms and the 'HelWin alpha' and 'HelWin beta' converter platforms (https:/www.elwis.de). (Note: As of today, not all operational wind farms have been cleared for navigation by vessels up to 24 m in length.)*

   *[…]*

#### 3.2.8.2 Report of the VTS

Upon request, the BSU received the following *report* from the VTS. It is reproduced below with some minor editorial adjustments:

*At about 2000 LT on 24 April 2023, the MV PETRA L sailed into a wind turbine in the Godewind 1* [sic] *wind farm.*

*[...]*

*The course of the PETRA L and the VHF traffic on channels 16, 79 and 80 from 1830 LT on 24 April 2023 until the vessel entered the River Ems at about 0130 LT on 25 April 2023 were recorded in Replay on three DVDs. The DVDs were submitted to the BSU and the GDWS.*

*VTS 'German Bight Traffic' was initially fully staffed for the late shift (1400-2200) on 24 April 2023. Since the nautical supervisor (NvD) was absent due to illness, the NvD of 'Jade Traffic' took over the duties of the NvD of 'German Bight Traffic' from 1600. The VTS was fully staffed again during the night shift (2200-0600).*

*Neither the course alteration of the PETRA L in the TSS nor the subsequent allision with the wind turbine was detected by the VTS. However, due to the temporary understaffing, the NvD had to focus the observation of traffic movements on the Jade-Approach, Weser Approach, ULS 'German Bight' and ULS 'GW/Ems' crossing areas.*

*The PETRA L did not report the allision.*

*The wind farm's sea area monitoring personnel did not send a report to the VTS either before or after the allision.*

*The VTS only became aware of the incident on the morning of 25 April 2023 when the PETRA L was already in Emden.*

According to Article 29(3)(8) of the *Schifffahrtsordnung Emsmündung* [Ems estuary traffic regulations], every vessel is required to declare deficiencies in the ship or her cargo. Vessels are basically required to do this – there is no requirement to discuss potential damage. Moreover, there is no period specified for such a report.

#### 3.2.8.3 VHF recordings of VTSs Wilhelmshaven and Emden

The vessel traffic service centres provided the BSU with extensive VHF recordings.

At about 2225, the PETRA L notified VTS Ems-Traffic that she wanted to call at Emden. The VTS then asked standard questions about the

- length, breadth, and maximum draught of the ship;
- number of people on board, and
- cargo being transported,

  for example.

When asked when the PETRA L would reach the lock for Emden, the master replied that he first had to wait for instructions from the shipowner. He said nothing about the allision or the damage to his ship.

At 2257, the PETRA L called German Bight and said:

*"We change my course. We are going to Emden and I would like to report about accident to 2007 we touched windfarms.* [sic]*"*

The NvD did not respond to the final remarks but repeatedly stated that the PETRA L must first continue westward to the Borkumriff buoy and only then turn southward (see Figure 27).

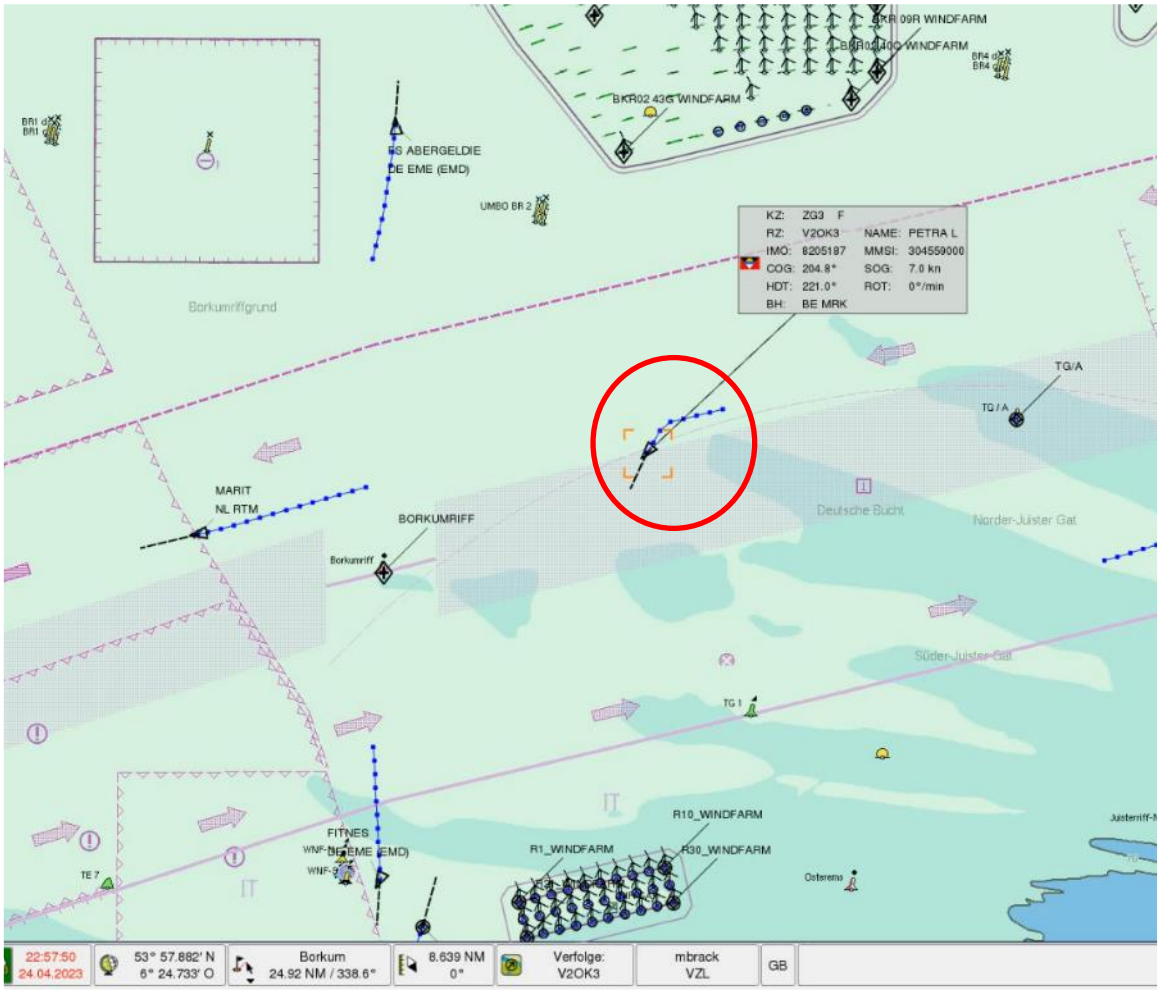


Figure 27: The PETRA L calls GBT at 2257[43]

The VHF recording of VTS Ems-Traffic included intensive communication between the NvD and PETRA L at about 0045. The master wanted to anchor at the Oterdum-Reede roadstead opposite Delfzijl and already close to Emden. However, the NvD insisted on sending him to the Dukegat-Reede roadstead. The master did not explain his reasons, nor did the NvD inquire. Accordingly, the damage to the ship and its cause was not raised during the conversation. The NvD eventually relented after the master assured him that he knew the area very well, particularly the roadstead.

Apart from brief position reports from the vessel to the VTS, no further audio recordings concerning the PETRA L were found.

[43] Source: VTS Wilhelmshaven.

# 4 ANALYSIS

The analysis of this investigation focuses on two points that significantly contributed to the accident. Firstly, the sequence of events on board the PETRA L is analysed, with consideration of the vessel's manning by two navigators (the master and a chief mate) as a basis for the ship's command suffering from fatigue. Secondly, the events in the vessel traffic service centre and the MHCC's monitoring activities are assessed.

## 4.1 Manning and watchkeeping on board the PETRA L

### 4.1.1 Hours of work and rest

According to the relevant records, the internationally binding maximum hours of work and minimum hours of rest were complied with on the PETRA L from a procedural point of view.

The BSU investigators questioned when in particular the master and the chief mate met their obligations relating to the ship's command (e.g. route planning), the cargo, general ship operations, and their duty of care vis-à-vis the people on board. During the watchkeeping duties in port and at sea, they are expected to focus on the watch. This applies in particular to the navigational watch.

With regard to the duty of care, the adequate daily provision of all persons on board with food and drinking water must not be overlooked. In accordance with the internationally binding Standard A 3.2(5) of the Maritime Labour Convention, a cook was not required on board. Accordingly, no ship's cook was on board. The usual tasks such as buying and storing provisions, preparing meals, serving food still exist and must be carried out by an instructed crew member when there is no ship's cook. In the case of the PETRA L, as many as seven people had to be provided for. In the opinion of the BSU, an instructed person without training as a ship's cook is likely to be fully occupied with this task.

### 4.1.2 Navigational watch requirements

The navigational watch requirements were evidently not met, otherwise this allision would not have occurred.

In view of the fact that the master regularly consumed dietary supplements with stimulating effects, it is reasonable to assume that he had recognised deficiencies in his own fitness for duty.

In the BSU's view, this is obvious, since the conditions described in Chapter 3.2.4.5 make it absolutely impossible to comply with the legally prescribed minimum rest periods if the master - as in this case - has to perform regular bridge watch duty.

According to A-VIII/2(19) of the STCW Code, the master should not have taken over the watch in the first place. It states: "The officer in charge of the navigational watch shall not hand over the watch to the relieving officer if there is reason to believe that the latter is not capable of carrying out the watchkeeping duties effectively, in which case the master shall be notified." Ironically, this norm is rendered ineffective on the PETRA L because the master himself always has the role of officer in charge of the navigational watch due to the size of the crew. In the opinion of the BSU, this means that he cannot perform his primary duties as master at all times, partly due to his own conflict of interest. The watchkeeping requirements of the STCW Code generally presuppose that officers perform the watch and masters only take over the watch in a few exceptional cases (see point 24.3 of A-VIII/2 STCW Code[44], for example). Moreover, due to the required qualifications, only the chief mate would have been permitted to take over the master's watch. However, this would have opposed the hours of work and rest that must be adhered to.

The master dispensed with posting a lookout during his watch. Lookouts may generally be dispensed with in daylight. However, this is only permissible under the conditions outlined in paragraph 17 of A-VIII/2 STCW Code.

The BSU believes that no master on a vessel with such a low level of automation as the PETRA L, as well as during coastal voyages with changing ports and canal passages, should dispense with a lookout – in addition to the officer on watch – at least until a pilot is present on the bridge. Added to this is the particularly high traffic density in the traffic separation schemes off the German coast (see 3.2.4.11).

However, the BSU understands the master's decision to dispense with a lookout, as so doing corresponds to the seamanship practised on comparable ships engaged in merchant shipping. Various investigation reports have shown that a lookout is often dispensed with, especially in good visibility, unless other regulations, such as Section 13(3)(2) of the *Schiffssicherheitsverordnung (SchSV)* [German Ordinance for the Safety of Seagoing Ships][45] stipulate otherwise and the regulation is known. The above norm requires that officers in charge of the navigational watch on ships flying the German flag post an adequately qualified lookout at all times when navigating in pilotage waters and from sunset to sunrise.

[44] It states: "The officer in charge of the navigational watch shall [...] continue to be responsible for the safe navigation of the ship, despite the presence of the master on the bridge, until informed specifically that the master has assumed that responsibility and this is mutually understood."

[45] *Schiffssicherheitsverordnung* [Ordinance for the Safety of Seagoing Ships] 18 September 1998 (Federal Law Gazette I pp. 3013, 3023), as amended by Article 2 of the Ordinance of 3 March 2020 (Federal Law Gazette I p. 412).

### 4.1.3 Bridge navigational watch alarm system (BNWAS)

The BNWAS did not meet the expectations associated with this system in ensuring the adequate attentiveness of the master on watch. The BSU believes that the conceptual approach of using the BNWAS to ensure the attentiveness of the navigational watch mirrors the idea of using dietary supplements. The actual problem – the predictable fatigue of the navigational watch team – is not resolved. Furthermore, the BNWAS does not replace an additional lookout. Even with the BNWAS, a fatigued officer on watch must first recognise a potential hazard in order to then take appropriate action.

### 4.1.4 The watch schedule and standing orders of the master

In accordance with the watch schedule, the able seafarers were only assigned to the navigational watch when required under the COLREGs. The reference to the COLREGs is meaningless, as the requirements for manning the navigational watch with a lookout (and/or helmsman) are not laid down in the COLREGs but rather in the internationally binding watchkeeping standards (see A-VIII/2 STCW Code).

According to the watchkeeping regulations, a lookout must always be planned for. In daylight, dispensing with a lookout is permissible only under the considerations outlined in the regulations. These considerations are directed at the master.

According to the watch schedule, two crew members (an officer on watch and a lookout) were consistently assigned to the navigational watch only from 0800-1200 and from 0000-0400. In the PETRA L's trading area, the sun regularly set before 0000 and a lookout is mandatory in darkness. Accordingly, the watch schedule was not consistent with the watchkeeping regulations.

The accident occurred in daylight. In this respect, it was generally permissible for the navigational watch to be maintained by one officer on watch and to dispense with a lookout. The master's standing orders indicate that this omission was presumably the norm. In any event, the standing orders do not specify the conditions under which an officer on watch can dispense with a lookout. The wording of the master's standing orders is not consistent with the applicable watchkeeping regulations: *When navigating in areas of high traffic density, the officer on watch should consider an additional lookout.* Based on the logbook entries and time sheets, the term 'additional' is understood to mean that the lookout supports the officer on watch 'in addition', rather than the officer on watch being supported by two lookouts.

### 4.1.5 Crew on the day of the accident

The PETRA L's manning was consistent with the requirements of the minimum safe manning document. With the two additional officer cadets, there were actually seven crew members on board instead of the minimum requirement of five.

Only the chief mate and the master met the requirement that the navigational watch be taken over by a deck officer. Accordingly, the master was forced to keep regular watches. The two ratings on board qualified to form part of the watch could have been assigned as additional lookouts at the support level. If one of the two officer cadets had been posted as a lookout on the bridge (as part of their training, for example), they would likely have noticed the constant bearing and decreasing distance to the wind turbine and have had several options for responding appropriately. In the opinion of the BSU, any attentive person would have recognised the risk of allision and alerted the master to prevent it. However, from the BSU's perspective, the question as to whether the crew had sufficient time to train two officer cadets in accordance with the mandatory standards of the STCW Convention arises. According to Annex 5 in conjunction with Annex 2 to Resolution A.1047(27), training activities should be considered when determining minimum safe manning.

### 4.1.6 Minimum safe manning document

The minimum safe manning document issued is consistent with the internationally agreed model.

On the PETRA L, only one chief mate qualified in accordance with Regulation II/2 of the Annex to the STCW Convention was required. Due to a lack of relevant documentation, it was not possible to establish during the investigation why the Administration believed that only one officer would be sufficient on the PETRA L, instead of the generally required three qualified officers.

The BSU investigators noted the following with regard to the minimum safe manning document that had been issued.

a) Officer in charge of the navigational watch

   No additional officer in charge of the navigational watch who held a certificate of competency in accordance with Regulation II/1 of the Annex to the STCW Convention or a higher qualification was required on the PETRA L. The BSU believes it cannot be in the interest of ship safety to man a ship operating a two-watch system with only one master and one chief mate. Reference is made to Resolution A.1047(27) and the watchkeeping regulations of the STCW Code. In the BSU's opinion, the master should not be assigned to watchkeeping duties on a regular basis.

b) Chief engineer officer

A chief engineer officer who holds a certificate of competency in accordance with Regulation III/3 of the Annex to the STCW Convention or higher is required on ships with a propulsion power of between 750 kW and 3000 kW. According to the document, an officer in charge of an engineering watch qualified in accordance with Regulation III/1 of the Annex to the STCW Convention would be sufficient on the PETRA L. In the opinion of the BSU, this is not permissible.

c) Able seafarer deck

Vessels such as the PETRA L always require two able seafarers deck who hold a certificate of proficiency in accordance with Regulation II/5 of the Annex to the STCW Convention. According to the STCW Convention, only such crew members are authorised to participate in such tasks as mooring, anchoring and the operation of technical equipment on deck, which includes the deployment and retrieval of gangways and pilot ladders, for example. Able seafarers deck are also qualified for watchkeeping duties under A-II/5 of the STCW Code (Regulation II/4 of the Annex to the STCW Convention) and may be ordered to operate survival craft and rescue boats (see paragraphs 1 to 4 of A-VI/2 STCW Code).

d) Cook

A cook was not required on the PETRA L. The minimum safe manning document does not indicate how catering and serving food was dealt with on the PETRA L in accordance with the minimum requirements of the Maritime Labour Convention. Although a fully qualified cook is not required on ships with fewer than 10 crew members, there must be at least one person who prepares meals in the galley and has received prior training or instruction. Moreover, this should be reflected in the minimum safe manning document.

e) Basic safety training

Seafarers with certificates of proficiency at the support level (Regulations II/4 and II/5 of the Annex to the STCW Convention) are not necessarily qualified under Regulation VI/1 of the Annex to the STCW Convention and therefore must not be included on any muster lists. Moreover, this should be reflected in a minimum safe manning document, in which an adequate number of crew members, in addition to officers, are appropriately qualified.

f) Security

There is an absence of requirements with regard to security-related qualifications under Regulations VI/5 and VI/6 of the Annex to the STCW Convention.

In the view of the BSU, the minimum manning did not meet minimum safe manning requirements at all times and in every respect (see point 1.2.5 of Annex 3 to Resolution A.1047(27).

## 4.2 Legal framework for offshore installations

*The establishment of safety zones is governed by the United Nations Convention on the Law of the Sea (UNCLOS) of 1982. According to Article 60(5) UNCLOS,* ***safety zones may not extend beyond a distance of 500 m*** *measured from the edge of a structure, unless generally accepted international norms permit otherwise or the competent international organisation recommends otherwise. Similar regulations are enshrined in national law (see Section 74(2) WindSeeG and Section 7(1) VOKVR).* (See subsection 3.5.2.1.)

A **slow** ship proceeding at 8 kts covers a distance of only 500 m in just under 2 minutes (i.e. 8 kts = 16 km per hour, i.e. 60 minutes ÷ 32 = 1.875 minutes for 500 m). During this period, a maritime observer would first have to recognise that a ship is proceeding on a dangerous course and would then only have the option of contacting the ship's command on VHF. If the observer manages to do so within just 1 minute, then the ship only has 1 minute (or 250 m) left to implement a course alteration to avoid an allision.

*The operator must carry out maritime observation in accordance with the maritime observation concept approved with the consent of the GDWS and* ***report any hazardous situations to the competent vessel traffic service centre****.* (See point 3 of subsection 3.2.7.)

This means that the wind farm operator's MHCC is not allowed to address the ship directly but must send a report to the VTS, which means that even more time is lost.

*With regard to the potential use of additional sensors for the detection of maritime traffic (e.g. CCTV or infrared, etc.), the implementing directive refers to the provisions of the OWE-SRK, which do not include provisions in this regard, however.*

*Moreover, **the BMDV has explicitly prohibited the GDWS** (Decree WS 23/528.2/2-2-2 of 11 January 2011) from requiring project developers to **use radar** for monitoring maritime traffic in the vicinity of wind farms.*

The BSU finds it difficult to understand why a tried-and-tested tool like radar is not used for monitoring a wind farm. While AIS offers many advantages, they only exist if a ship has an AIS device installed and actively uses it. However, many vessels are not required to use AIS and there will undoubtedly be ships where it does not transmit for technical or other reasons. A passive system like radar is always capable of detecting and tracking vessels. With today's ARPA functionalities and/or ECDIS, identifying and then preventing dangerous convergences is a quick and easy process. Moreover, the safety of **such critical infrastructure as a wind turbine** can only be fully ensured in this manner.

## 4.3 Behaviour of the VTS

The GDWS website states the following: *The monitoring of maritime traffic in the inner German Bight from Borkum to Heligoland and the River Jade is performed at Wilhelmshaven. Two river information service centres are located there and each shift is manned by five navigators, including two nautical supervisors and three nautical assistants.*[46]

At VTS GERMAN BIGHT TRAFFIC, an NvD was absent at very short notice and since it was not possible to arrange a replacement, the JADE TRAFFIC NvD had to take over his duties, resulting in such an increased workload that the latter failed to notice for almost 80 minutes that a ship was leaving the TSS and heading directly towards the wind farm. According to the GDWS, the VTS had to prioritise its tasks. The focus was therefore placed on traffic heading for the coast or crossing courses. Accordingly, vessels that were sailing away from the coast and required to navigate within a TSS, like the PETRA L, were deprioritised.

According to the GDWS, the vessel traffic service centres of WSAs have regularly adapted personnel contingency plans. In the event of sudden absences, internal arrangements exist within the WSA. The BSU is not aware of the exact arrangements, which were evidently insufficient in this particular case.

[46] Source: https://www.wsa-weser-jade-nordsee.wsv.de/Webs/WSA/Weser-Jade-Nordsee/DE/Schifffahrt/Verkehrszentralen/verkehrsundrevierzentralen_node.html;jsessionid=852D92649D35566C85AC165D4DB9D2F2.live11311 (10/09/2024).

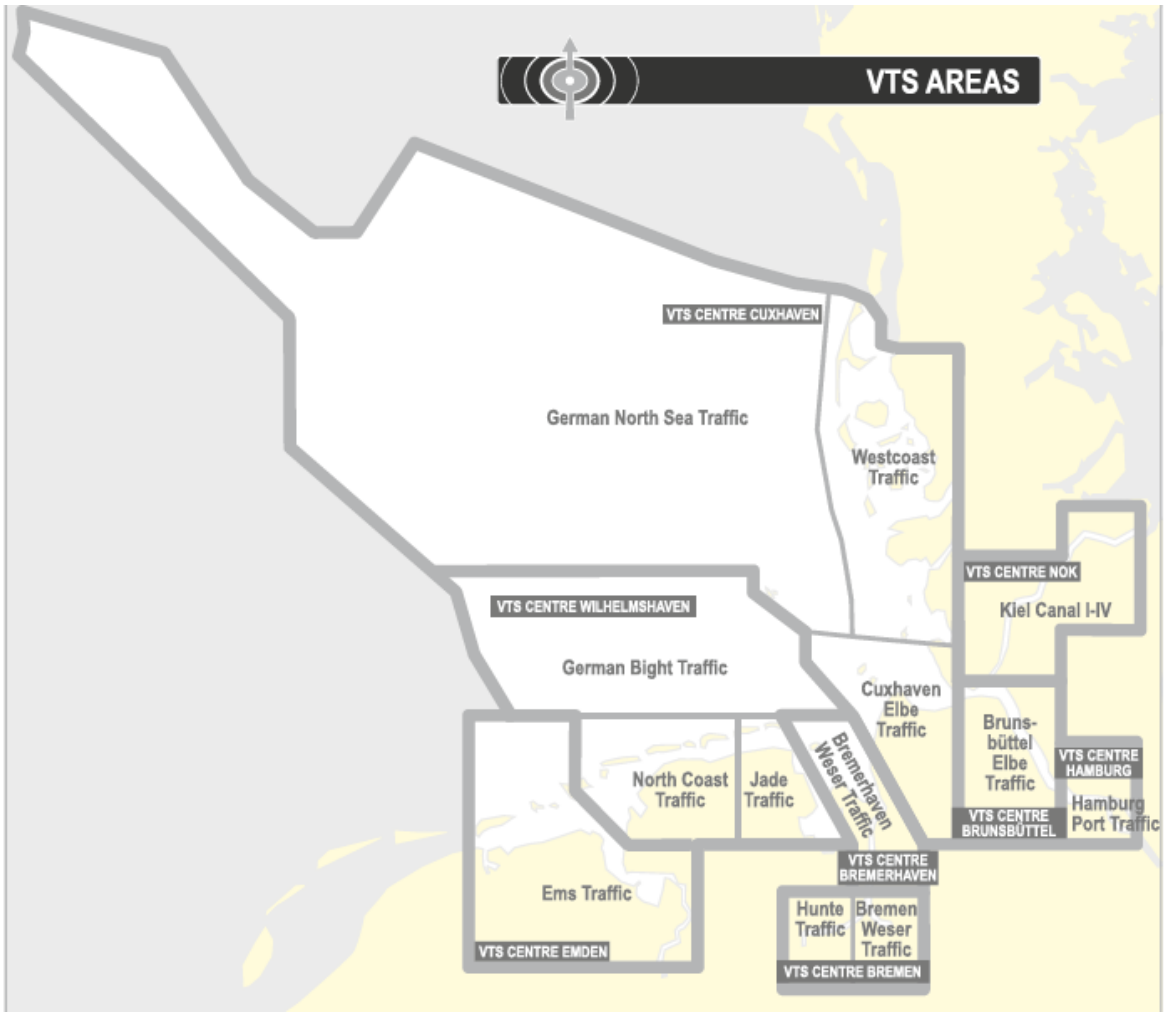


Figure 28: Overview of German vessel traffic service areas[47]

The claim that the PETRA L did not report the allision is inaccurate. As the VTS's VHF recordings show, the ship's command made radio contact on its own initiative and mentioned the incident only in passing. However, this was not until about 2300 and thus three hours after the allision. The VTS failed to take note of this.[48] Instead, it actually instructed the heavily damaged vessel to take a slightly longer route to Emden. On the other hand, the master did not make a distress call, such as mayday.

## 4.4 Behaviour of the MHCC

In the course of the wind farm operator's internal investigation, the existing AIS and alarm data were reconstructed. This indicated that the PETRA L altered course at approximately 1845 and headed for the OWF. As the ship proceeded, she triggered a total of four alarms in the SOMS – the first alarm at about 1945, some 15 minutes

[47] Source: BSH – VTS Guide Germany 15th Edition, 24/05/2024.

[48] The Fraunhofer Institute is currently developing an AI-based system to record and transcribe VHF conversations in real time with the aim of displaying them on a screen and reducing misunderstandings further.

before entering the OWF safety zone, and the last upon entering the OWF safety zone at about 2002. However, according to the VTS AIS recordings, the PETRA L reached the safety zone at about 1955 (see Figure 14) and then followed a diagonal course through the wind farm towards the OWT. According to the analysis of the AIS data, the allision occurred at 2004.

At the time of the allision, the MHCC was routinely manned by one coordinator responsible for maritime observation in accordance with the shift schedule; however, the alarms in the SOMS went unnoticed. Neither the PETRA L nor VTS Wilhelmshaven (GBT) sent alarm notifications to the MHCC.

In the course of the internal investigation, several factors that contributed to the employee on duty's failure to notice the alarms were identified. These are detailed below.

The internal investigation showed that the audible alarms in the SOMS were muted at the time of the allision. The wind farm operator attributed this to the fact that, in its view, maritime traffic in the surrounding area, which the system also monitors voluntarily, triggers an extremely large number of alarms each day. The BSU has identified only six alarms per hour (about 1,000 alarms per week, i.e. about 140 per day or about six per hour or about every 10 minutes).

Furthermore, the SOMS was updated about two weeks before the PETRA L's allision with OWT R04. However, this also changed the visualisation of warning and alarm notifications. Previously, a red banner appeared on the screens, which the offshore coordinator on duty had to actively close. However, following the update, the notification was displayed as a smaller icon and automatically moved to the new alarm tab. For various reasons (e.g. staff availability), the staff training was scheduled for 25 April 2023 and therefore took place 1 day after the allision.

# 5 CONCLUSIONS

## 5.1 Manning and watchkeeping

In the opinion of the BSU, the allision could have been prevented if a proper lookout had been maintained at all times in accordance with paragraphs 24.1 and 32 of Section A-VIII/2 STCW Code.

The allision occurred when the master, who was on navigational watch as scheduled, mistakenly took the wrong dietary supplement due to chronic fatigue and fell asleep. The BNWAS did not ensure that the only lookout, i.e. the officer on watch (the master), was sufficiently alert. There was no additional lookout alongside the officer on watch or any other alarm system with which the danger could have been detected and the allision prevented.

In addition to the master, there was only one chief mate, meaning the two individuals had to share watchkeeping duties around the clock, with the master also required at all times to perform additional duties. It must be noted that one master and one chief mate are not sufficient to ensure the safe operation of a vessel – this applies in particular to ships such as the PETRA L, which are equipped with only an autopilot, radar (ARPA), AIS, and BNWAS to support navigational watchkeeping duties.

### 5.1.1 Watch schedule and standing orders

Watch schedules and standing orders should reflect watchkeeping regulations. Based on the considerations outlined in the watchkeeping regulations, masters should assess the circumstances under which a lookout may not be required between sunrise and sunset. The results of this assessment should be documented in the standing orders.

### 5.1.2 Minimum safe manning document

In the opinion of the BSU, the Administration of the certifying State should use this accident as an opportunity to ensure that masters of ships such as the PETRA L can always maintain a navigational watch with at least two watchkeeping officers and additional lookouts in accordance with Resolution A.1047(27). The North Sea and Baltic Sea trading areas and the short port layovers offer the crew no opportunity for extended rest periods. In addition to the considerations outlined in the Resolution, the Administration should also take into account the time spent on board by crew members when approving a two-watch system. However, the BSU believes that potentially inadequate accommodation facilities on board should no longer be accepted for any transitional provisions. At least in Germany, this argument has been known for decades[49] and cited in the reasoning for amendments to relevant legal norms for nearly

[49] See German Bundestag, Publication 2962 of 5 December 1956; explanatory memorandum to Section 139 *Seemannsgesetz* [German Seamen's Law], page 78 (2024 -08-12).

half a century. Exceptions to this principle can certainly be made for ships that do not have to carry out changes of watch under working time regulations.

Furthermore, in the opinion of the BSU, qualified crew members and a cook are always required under Regulation II/5 of the Annex to the STCW Convention. The minimum safe manning document should specify whether other crew members can assume the cook's duties and what qualifications the cook should have. Furthermore, in the context of safe manning, the minimum safe manning document should contain the standards for qualifications in ship safety and security.

With regard to the clarifications in minimum safe manning documents addressed to the Administration of the flag State, Resolution A.1047(27) should be more clearly formulated. This would provide all flag States and ship operators with an improved basis for determining manning requirements and make manning requirements more transparent.

## 5.2 Legal framework for offshore installations

The current 500 m safety zone around an offshore installation seems to be outdated. Given the size and speed of modern ships, significantly longer reaction times are now needed. It raises the question as to why monitoring by the wind farm operator should be limited to the safety zone.

Moreover, to detect *every* vessel in the vicinity of a wind farm installation, radar monitoring should not be dispensed with. Of course, to achieve the best possible result, this should be integrated with AIS and ECDIS.

## 5.3 Vessel traffic service centres

The sudden absence of the NvD at the Wilhelmshaven vessel traffic service centre was to be compensated for by the NvD of the neighbouring VTS assuming responsibility. However, the resulting area being monitored is so extensive that it cannot be managed by just one VTS. This accident clearly demonstrates the need for a faster and more immediate standby system to address the sudden absence of an NvD.

The remaining manning (one NvD and three nautical assistants) was evidently not sufficient for the unusual course of the PETRA L to be noticed within 50 minutes of her leaving the TSS.

It should also be mentioned that neither the NvD of Vessel Traffic Service Wilhelmshaven nor later the NvD of VTS Emden inquired why the PETRA L wanted to go to Emden at such short notice. The ship's plight was only recognised in the lock at Emden.

On the other hand, the transmission of an (automated) distress call (mayday) was at the master's discretion.

The Fraunhofer Institute[50] is currently in the process of developing a new option for improving radio communication. They have been actively working in the field of maritime speech recognition for several years and have now developed a speech recogniser (marFM®). This system is designed to display VHF conversations in real time on a screen using artificial intelligence, *inter alia*. In addition to German and English, it is intended to function with an increasing number of other languages to prevent misunderstandings.

As part of the BMDV's 'LEAS' project, the use and benefits of this software are being investigated and a speech to context concept developed. Once the project is complete, the software will be tested for usability in the VTS.[51]

## 5.4 MHCC

The wind farm operator's internal investigation revealed that alarms in the SOMS were muted when the allision happened, as the numerous alarms were considered disruptive. The BSU believes that an average of six alarms per hour should not overwhelm a sea area monitoring coordinator. Accordingly, this should be changed.

Another issue is software updates. Associated training should be provided to all users promptly so as to avoid operating errors and/or misinterpretations.

[50] Fraunhofer Centre for Maritime Logistics and Services CML Hamburg.
[51] https://www.fkie.fraunhofer.de/en/press-releases/leas.html
https://www.kpler.com/research-projects/leas-shore-side-decision-support-for-traffic-situations-with-highly-automated-or-autonomous-vessels-using-ai

# 6 ACTIONS TAKEN

## 6.1 Wind farm operator

Immediately after the allision was reported, various measures were implemented to improve the effectiveness of maritime observation by the MHCC. For example, a manual alarm check every 5 minutes was established and regular inspections of the MHCC by senior management staff were introduced. Moreover, the muting of audible alarms has been discontinued. Additionally, the MHCC now compiles statistics on incoming alarms. All unauthorised entries into the wind farm's safety zone are also recorded and documented in the system. Work has also begun on evaluating the effectiveness of the SOMS in terms of maritime observation and establishing how to ensure that future alarms are presented such that the offshore coordinators on watch can better recognise and process them (e.g. reduction of audiovisual alarm signals by filtering out ships that are authorised or regularly in the vicinity of the wind farm). The internal communication of system updates should also be improved. The introduction of more frequent functionality tests is also conceivable.

Due to the extensive measures taken by the operator, the BSU does not consider it necessary to issue safety recommendations to Ørsted.

## 6.2 Shipping company

Since the ship has now been sold, neither the previous nor the current shipping company saw any reason for improvements.

## 6.3 GDWS

To prevent future accidents, the following technical adjustments were made at VTS Wilhelmshaven:

1. the previous 500 m safety zone around wind farms, in which a signal in the form of a flashing AIS symbol is triggered to attract attention when a ship entered, was increased to 2 nm;
2. in addition to the flashing AIS symbol, a pop-up window displaying the ship's name in red now appears in the direct line of sight of the nautical assistant in the VTS when a ship enters the safety zone.

# 7 SAFETY RECOMMENDATIONS

The following safety recommendations do not constitute a presumption of blame or liability in respect of type, number or sequence.

## 7.1 Federal Ministry for Digital and Transport (BMDV)

The BSU makes the following recommendations to the BMDV:

.1 that it works toward effecting a revision of Resolution A.1047(27). All ships operating a multi-shift system should be required to have a sufficient number of deck officers on board so that the master is not forced to keep regular watches. In accordance with the Maritime Labour Convention, each ship should have a cook and the minimum safe manning document should specify the qualifications required. Further qualification requirements, such as in the context of maritime safety, security, etc., should be clearly specified in the minimum safe manning document;

.2 to prescribe the use of radar for maritime surveillance and to amend Decree WS 23/528.2/2-2-2 accordingly.

## 7.2 Ship operator of the PETRA L

The BSU makes the following recommendations to the ship operator:

.1 that it reapplies for the PETRA L's minimum safe manning document in accordance with the conclusions in Chapter 5.1.2;

.2 that it deploys at least two deck officers on its ships in addition to the master.

## 7.3 The flag State Antigua and Barbuda

The BSU makes the following recommendations to the flag State Antigua and Barbuda:

.1 that it considers the conclusions in Chapter 5.1.2 when issuing minimum safe manning documents;

.2 that it amends accordingly comparable minimum safe manning documents already issued, taking into account point 2.3 of Annex 3 to Resolution A.1047(27).

## 7.4 GDWS

The BSU makes the following recommendation to the GDWS:

.1 that it ensures that standby personnel are available for its vessel traffic service centres;

.2 that it stipulates that wind farm operators must ensure that monitoring is carried out in a safety zone beyond the 500 m radius so that they can take appropriate action in good time to prevent an allision;

.3 that it allows wind farm operators to contact vessels within the safety zone directly to save time in dangerous situations;

.4 that it raises awareness among its NvDs of the need to inquire about the reasoning behind reported deviations from planned routes;

.5 that it continues to monitor the transcription of conversations on VHF so as to enable vessel traffic service centres to make use of the technical option of reading conversations in real time.

# 8 SOURCES

- Enquiries of the waterway police (WSP)
- Written explanations/submissions
  - Ship's command
  - Shipping company
- Witness testimony
- Technical report from the GDWS, the BSH and the wind farm operator
- Navigational charts and ship particulars, Federal Maritime and Hydrographic Agency (BSH)
- Official weather report by Germany's National Meteorological Service (DWD)
- Radar, AIS and VHF recordings of the ship safety services/vessel traffic service centres

# 9 ANNEXES

## 9.1 Course of the PETRA L prior to the accident with this master on board

| Date | Time (UTC) | Place | Occurrence |
|---|---|---|---|
| February | | | |
| 22 | | Klaipėda, Lithuania | on board |
| 23 | 0208 | | proceeding to sea |
| 24 | | at sea | 3 days at sea |
| 25 | | | |
| 26 | | | |
| 27 | 0933 | Horten, Norway | calling at port |
| 28 | 1300 | | proceeding to sea |
| March | | | |
| 1 | 1320 | Frederiksværk, Denmark (Zealand) | calling at port |
| 2 | 1525 | | proceeding to sea |
| 3 | 1047 | Kiel, NOK lock | lockage |
| | | NOK | passage |
| | 2039 | Brunsbüttel, NOK lock | lockage |
| 4 | | at sea | 1 day at sea |
| 5 | 1632 | Antwerp, Belgium | calling at port |
| 6 | 1413 | | proceeding to sea |
| | 2253 | Ghent, Belgium | calling at port |
| 7 | | | 1 day in port |
| 8 | 0244 | | proceeding to sea |
| 9 | 1703 | Brunsbüttel, NOK lock | lockage |
| | | NOK | passage |
| 10 | 0025 | Kiel, NOK lock | lockage |
| 11 | | at sea | 1 day at sea |
| 12 | 2052 | Riga, Latvia | calling at port |
| 13 | 1511 | | proceeding to sea |

| Date | Time (UTC) | Place | Occurrence |
|---|---|---|---|
| 14 | | at sea | 1 day at sea |
| 15 | 1115 | Klaipėda, Lithuania | calling at port |
| 16 | 0740 | | proceeding to sea |
| 17 | | at sea | 1 day at sea |
| 18 | 0628 | Søby, Denmark (Ærø) | calling at port |
| | 1640 | | proceeding to sea |
| 19 | | at sea<br>Little Belt, Denmark | 2 days at sea |
| 20 | | | |
| 21 | 0813 | Tau, Norway | calling at port |
| 22 | | | 3 days in port |
| 23 | | | |
| 24 | | | |
| 25 | 1618 | | proceeding to sea |
| 26 | 0528 | Rekefjord, Norway | anchored |
| | 1713 | | |
| 27 | | at sea | 1 day at sea |
| 28 | 0638 | Horsens, Denmark | calling at port |
| | 1239 | | proceeding to sea |
| 29 | | at sea | 1 day at sea |
| 30 | 0901 | Klaipėda, Lithuania | calling at port |
| 31 | 2037 | | proceeding to sea |
| April | | | |
| 1 | | at sea | 3 days at sea |
| 2 | | | |
| 3 | | | |
| 4 | 1011 | Gothenburg, Sweden | transit |
| | | Trollhätte Canal (six locks) | passage |
| | 1822 | Trollhättan, Sweden | transit |

| Date | Time (UTC) | Place | Occurrence |
|---|---|---|---|
| 5 | 0145 | Hällekis, Sweden | calling at port |
| | 1432 | | proceeding to sea |
| | 1813 | Åmål, Sweden | calling at port |
| 6 | 1032 | | proceeding to sea |
| | 1848 | Trollhättan, Sweden | transit |
| | | Trollhätte Canal (six locks) | passage |
| 7 | 0206 | Gothenburg, Sweden | transit |
| 8 | 0503 | Masnedø, Denmark | calling at port |
| | 1458 | | proceeding to sea |
| 9 | 0602 | Frederiksværk, Denmark (Zealand) | calling at port |
| 10 | | | 1 day in port |
| 11 | 1242 | | proceeding to sea |
| 12 | 0014 | Fredericia, Denmark | calling at port |
| | 1128 | | proceeding to sea |
| | | Little Belt | transit |
| 13 | 1211 | Lubmin, Germany | calling at port |
| 14 | | | 1 day in port |
| 15 | 1149 | | proceeding to sea |
| 16 | 1656 | Gothenburg, Sweden | transit |
| | | Trollhätte Canal (six locks) | passage |
| 17 | 0132 | Trollhättan, Sweden | transit |
| | 0829 | Hällekis, Sweden | calling at port |
| 18 | 1504 | | proceeding to sea |
| | 1850 | Åmål, Sweden | calling at port |
| 19 | 1249 | | proceeding to sea |
| | 1934 | Trollhättan, Sweden | transit |
| 20 | | Trollhätte Canal (six locks) | passage |
| | 0329 | Gothenburg, Sweden | transit |

| Date | Time (UTC) | Place | Occurrence |
|---|---|---|---|
| 21 | 0436 | Masnedø, Denmark | calling at port |
| | 1350 | | proceeding to sea |
| 22 | 0718 | Szczecin, Poland | calling at port |
| | 2041 | | proceeding to sea |
| 23 | | at sea | 1 day at sea |
| 24 | 0017 | Kiel, NOK lock | lockage |
| | | NOK | passage |
| | 0808 | Brunsbüttel, NOK lock | lockage |
| | 1805 | allision with the wind turbine | accident |
| 25 | 0628 | Emden, Germany (port of refuge) | calling at port |

## 9.2 Resolution A.1047(27)

**Notice of Resolution A.1047(27) of the Maritime Safety Committee, 'Principles of Minimum Safe Manning'**

Hamburg, 7 February 2013

Ref.: 11-3-0

The Ship Safety Division (BG Verkehr) hereby gives official notice of Resolution A.1047(27) of the Maritime Safety Committee, 'Principles of Minimum Safe Manning', in German. Published in BMVI Gazette 4/2013 No 48 p. 201.

## 9.3 Application form for a minimum safe manning document

Application for a Minimum Safe Manning Document.[52]

This form should be completed by any owner or manager on applying for a Minimum Safe Manning Document as required by Regulation 14 of Chapter V of SOLAS.

In completing the application owners and managers should take account of the Principles in IMO Resolution A.1047 (20th December 2011[53]) “Principles of Safe Manning” and also the requirements on hours of rest contained in ILO Convention 180, the STCW Convention and the Maritime Labour Convention.

[52] FO-T29 – Revision 02 – 11.12.13 Application for a Minimum Safe Manning.
[53] The Resolution was adopted on 30 December 2011.

Applicants are asked to provide as much detail as necessary in order that ADOMS may quickly agree the level of manning.

| | | | | |
|---|---|---|---|---|
| Ship's name | | | | |
| IMO No. | | Year of Build | | |
| Ship Type | | | | |
| Gross Tonnage | | Length | | |
| Engine Power (kW) | | UMS (Yes/No) | | |
| Expected trading pattern | | | | |
| No. of lifeboats | | Type of boats, | | |
| Special features<br>E.g., DP operations, self unloading, etc. | | | | |
| Are crew members require to operate ship´s<br><br>Equipment for cargo operations?<br><br>If yes, give details. | | | | |

| | |
|---|---|
| Are ship's crew members required to undertake any tasks associated with care for cargo, cargo securing, cargo security etc while at sea?<br>If Yes, give details. | |
| Additional information | |

In the following table, applicants are invited to enter the proposed numbers for the ship's manning based on their assessment of the requirements and the principles in A.1047.

| | No. | Main duties. | Planned working hours schedule |
|---|---|---|---|
| Master | | | |
| Chief Mate | | | |
| Navigational Watchkeeping Officer | | | |
| Chief Engineer | | | |

| | | | |
|---|---|---|---|
| Second Engineer | | | |
| Engineering Watchkeeping Officer | | | |
| Electro technical Officer | | | |
| Deck rating (Watch rating qualified) | | | |
| Other Deck Ratings | | | |
| Engineering Ratings (Watch rating qualified) | | | |
| Other Engine Ratings | | | |
| Cargo engineer | | | |
| Cook | | | |

| | | | |
|---|---|---|---|
| Doctor | | | |
| Others | | | |
| Total | | Please attach any other supporting documentation that is necessary to support the application. ADOMS will endeavour to respond within 10 days of receipt with a draft Safe Manning Document. | |

Submitted by:

Date submitted:

This section is for the use of the officer assessing the submission. References are to Section 3 of Annex 1 to A.1047(27)

| Sufficient personnel to: | Yes | No |
|---|---|---|
| Maintain safe navigational, port, engineering and radio watches in accordance with Reg. VIII/2 STCW and also maintain general surveillance of the ship. 3.1.1.1 | | |
| Moor and unmoor the ship safely.<br><br>3.1.1.2 | | |
| Manage the safety functions of the ship when employed in a stationery or nearstationery mode at sea (if applicable).<br><br>3.1.1.3 | | |
| Perform operations as appropriate for the prevention of damage to the marine environment.<br><br>3.1.1.4 | | |
| Maintain the safety arrangements and the cleanliness of all accessible spaces to minimise the risk of fire.<br>3.1.1.5 | | |
| Provide for medical care on board. | | |

| | | |
|---|---|---|
| 3.1.1.6 | | |
| Ensure safe carriage of cargo during transit.<br><br>3.1.1.7 | | |
| Inspect and maintain, as appropriate, the structural integrity of the ship.<br><br>3.1.1.8 | | |
| Operate in accordance with the ship's Security Plan.<br><br>3.1.1.9 | | |
| Operate all watertight closing arrangements, maintain them, and deploy a competent damage control party.<br><br>3.1.2.1 | | |
| Operate all on-board fire fighting and emergency equipment and life-saving appliances, carry out maintenance required to be done at sea, and muster and disembark persons on board. 3.1.2.2 | | |
| Operate main propulsion and auxiliary machinery including pollution prevention equipment and maintain them in a safe condition.<br>3.1.2.3 | | |
| | | |
| Functions above can be carried out within the applicable limits on hours of rest. | | |
| | | |
| There are sufficient personnel proposed to deploy an emergency party and to launch and operate the ship's lifesaving appliances. | | |
| | | |

Manning proposal agreed.

Assessed by:..... Completed on: