



Bundesstelle für Seeunfalluntersuchung
Federal Bureau of Maritime Casualty Investigation
Federal Higher Authority subordinated to the Ministry of Transport,
Building and Urban Development

Investigation Report 301/09

Marine Casualty

**Occupational accident on board the
TMV ECE NUR K
on the Lower Elbe
on 1 August 2009**

1 March 2012

The investigation was conducted in conformity with the law to improve safety of shipping by investigating marine casualties and other incidents (Maritime Safety Investigation Law - SUG) of 16 June 2002.

According to said act, the sole objective of this investigation is to prevent future accidents and malfunctions. This investigation does not serve to ascertain fault, liability or claims.

This report should not be used in court proceedings or proceedings of the Maritime Board. Reference is made to art. 19 para. 4 SUG.

The German text shall prevail in the interpretation of this Investigation Report.

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1 Summary

On 1 August 2009, the chemical tanker ECE NUR K, sailing under the Turkish flag, anchored in the Twielenfleth roadstead on the Lower Elbe, where her tanks were to be prepared for taking on new cargo. To this end, in order to remove caustic soda residues by means of a mobile pump, the third officer and an ordinary seaman (O/S) entered tank no. 1 on the port side at about 1430¹. Both were wearing protective equipment. The bosun stood at the coaming of the entry hatch to tank no. 1 and the master was also at the forward part of the vessel.

While the caustic soda was being pumped out, the hose parted from the pressure side of the pump causing the third officer to be splattered with the caustic solution. Here, a small quantity of caustic soda also entered his eyes. Alarmed by the screams of the injured, the O/S requested assistance by radio. The master and the bosun took the injured to his cabin, where they continued to rinse his eyes until the arrival of rescue services, which had been requested in the meantime.

After being evacuated from the tanker, the injured was taken to Eppendorf University Medical Centre by helicopter, where he was treated as an in-patient for ten days. Environmentally hazardous substances were not released during the accident.

¹ All times in this report are local times = Central European Summer Time (UTC + 2 hrs.).

2 SHIP PARTICULARS

2.1 Photo



Hasenpusch Photo-Productions

Figure 1: Photo

2.2 Vessel particulars

Name of vessel:	ECE NUR K
Type of vessel:	Chemical tanker
Nationality/flag:	Republic of Turkey ²
Port of registry:	Istanbul
IMO number:	9508720
Call sign:	TCTR2 ²
Owner:	K Tankering & Ship Management Co., Istanbul, Turkey
Year built:	2009
Shipyard/yard number:	Torgem Shipbuilding Industry & Trade, Istanbul, 89
Classification society:	Bureau Veritas
Length overall:	149.95 m
Breadth overall:	23.20 m
Gross tonnage:	12,162
Deadweight:	19,968 t
Draught (max.):	9.20 m

² The information refers to the time of the accident. The ECE NUR K is sailing under the flag of Malta since March 2010 with the call sign 9HA2323.

Ref.: 301/09

Engine rating:	5,920 kW
Main engine:	MAN 2 stroke 8 cylinder diesel
(Service) Speed:	15 kts
Hull material:	Steel
Hull design:	Double hull
Minimum safe manning:	15

2.3 Voyage particulars

Port of departure:	Stade, Germany
Port of call:	Ravenna, Italy
Type of voyage:	Merchant shipping international
Cargo information:	Caustic soda residue
Manning:	17
Draught at time of accident:	n.n.
Pilot on board:	No
Canal helmsman:	No
Number of passengers:	0

2.4 Marine casualty or incident information

Type of accident:	Marine casualty, occupational accident
Date, time:	1 August 2009, 1440
Location:	Lower Elbe, Twielenfleth roadstead
Latitude/Longitude:	ϕ 53°36.9'N λ 009°33.0'E
Ship operation and voyage segment:	At anchor
Place on board:	Tank no. 1, port side
Consequences:	One severely injured seaman

Excerpt from ENC DE 421055, German Federal Maritime and Hydrographic Agency (BSH)

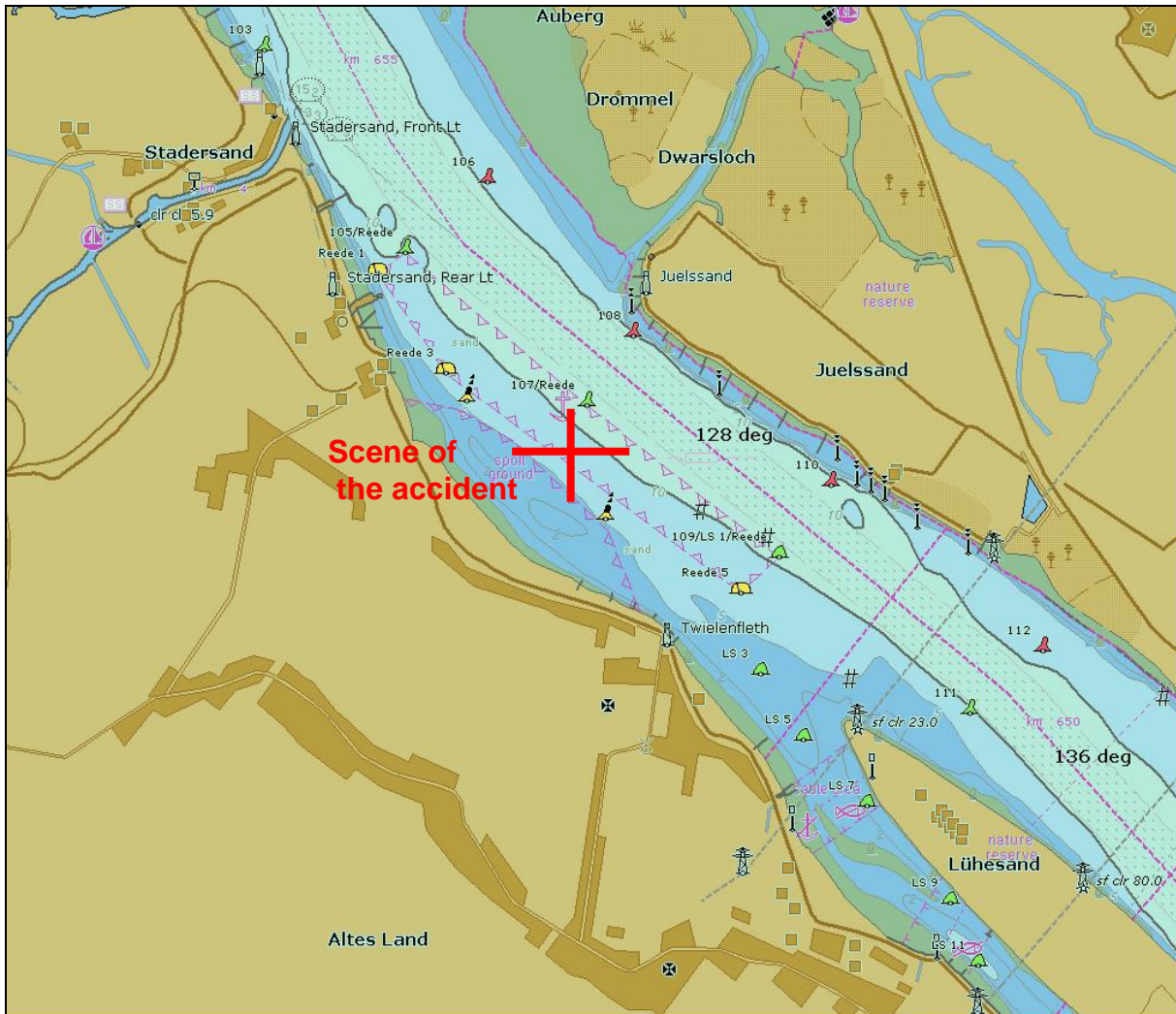


Figure 2: Chart

2.5 Shore authority involvement and emergency response

Agencies involved:	Waterway police (WSP), Stade Volunteer Fire Brigade, Eppendorf University Medical Centre (UKE), Stade Rescue Coordination Centre, See-Berufsgenossenschaft ³
Resources used:	FLORIAN-1 lifeboat, Rescue helicopter
Actions taken:	Eyes of the casualty rinsed out
Results achieved:	Injured evacuated and flown to the UKE

³ Today: Ship Safety Division (BG Verkehr)

3 COURSE OF THE ACCIDENT AND INVESTIGATION

3.1 Course of the accident

On 1 August 2009, the chemical tanker ECE NUR K, sailing under the Turkish flag, anchored in the Twielenfleth roadstead on the Lower Elbe, where her tanks were to be prepared for taking on new cargo. To this end, in order to remove the residues of 50% sodium hydroxide solution, also known as caustic soda, by means of a mobile pump, the 26-year-old third officer and an ordinary seaman (O/S) entered tank no. 1 on the port side at about 1430. Both were wearing protective equipment. The bosun stood at the coaming of the entry hatch to tank no. 1 and the master was also at the forward part of the vessel.

While the caustic soda was being pumped out from inside the tank, the hose parted from the pressure side of the pump causing the third officer to be spattered with the caustic solution. Here, a small quantity of caustic soda also entered his eyes. Alerted by the screams of the injured, the O/S requested assistance by ship radio. The master and the bosun took the injured to his cabin, where they continued to rinse his eyes with water until the arrival of rescue services.

The emergency call was received by the Stade Rescue Coordination Centre at 1443. The FLORIAN-1 lifeboat of the Stade Volunteer Fire Brigade was deployed at 1500 and reached the ECE NUR K at 1509. At 1523, the injured was taken to Stadersand by the FLORIAN-1, from where he was flown to the Eppendorf University Medical Centre (UKE) in Hamburg by the rescue helicopter waiting there.

The injured was treated as an in-patient for ten days. The BSU is not aware whether the injuries sustained have caused permanent damage.

3.2 Investigation

The ship's operator cooperated with BSU after the marine accident investigation authority of Turkey (Turkish Marine Accident Investigation Commission - DEKIK) became involved. Additionally, it was the information seized by the BSU and Waterway Police Hamburg on the day of the accident which provided a basis for the investigation. Here, the ship's command and crew of the ECE NUR K cooperated with the investigating authorities to some extent. Certain documents were provided by the classification society as well.

Reports about the port state controls carried out were obtained from the Ship Safety Division (BG Verkehr). Furthermore, several chemical companies provided additional information about handling chemical substances on board, tank cleaning procedures and the safety-related aspects.

Regarding the investigation of the course of the rescue operation, the BSU worked closely with the DGzRS⁴ and the rescue coordination centres of the federal States of Hamburg, Schleswig-Holstein and Lower Saxony.

3.2.1 Survey of the ECE NUR K

The Federal Bureau of Maritime Casualty Investigation (BSU) boarded the vessel on the day of the accident.

3.2.1.1 General condition

The unusually high level of contamination on the deck area (see Fig. 3) was apparent on boarding the ECE NUR K. A mobile pump was installed amidships on the starboard side, obviously to pick up some of the contamination. However, the film extended, on both sides of the deck, from the forecastle to the superstructure. Seemingly, it was palm oil residue.



Figure 3: Contaminated deck (port side)

The ECE NUR K was built in 2009 and had been in operation for only four months at the time of the accident. The 31-year-old master and his Turkish crew had been on board since April 2009.

3.2.1.2 Scene of the accident – tank no. 1 p/s

The accident occurred in the first tank (no. 1 p/s) on the port side (see Fig. 4, red marking). This tank has a capacity of nearly 800 m³ when full laden. The tank had

⁴ Deutsche Gesellschaft zur Rettung Schiffbrüchiger (German Maritime Search and Rescue Service)

already been cleaned by the time of the survey; accordingly, it was no longer possible to re-establish the condition at the time of the accident.

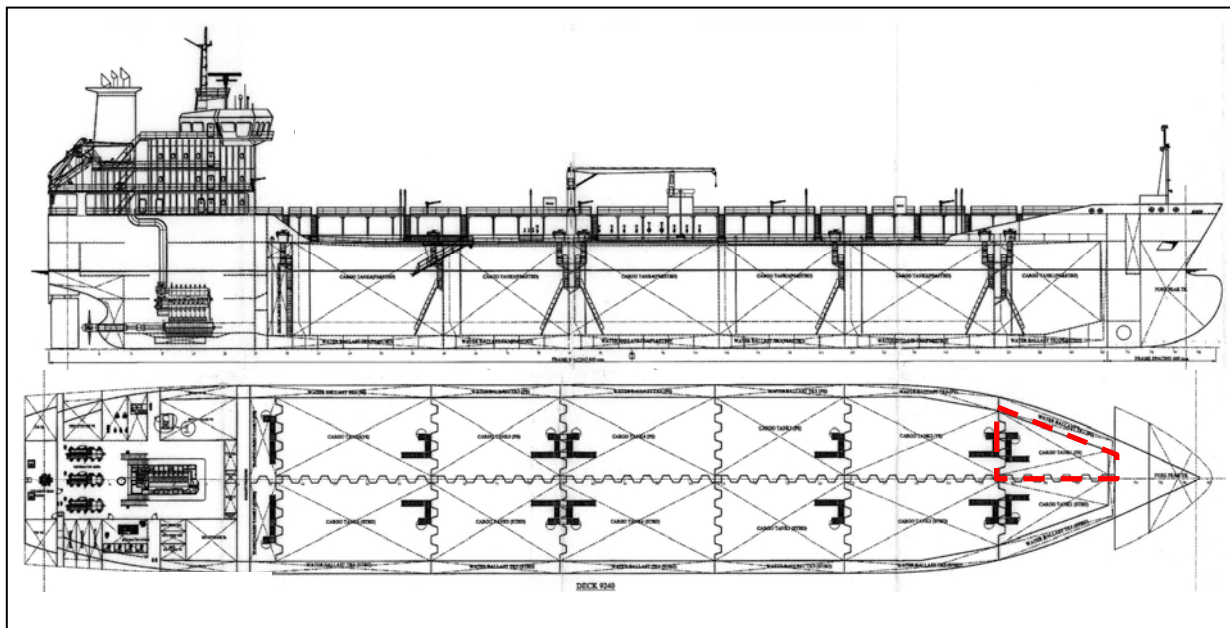


Figure 4: Excerpt from the general arrangement plan



Figure 5: Tank no. 1 p/s hatch coaming

3.2.1.3 Mobile pump

The mobile pump used on the day of the accident is a 2-inch membrane pump powered by compressed air, type RAN, manufactured by Gisan Makine (see Fig. 6). Made of polypropylene, the pump has a pumping capacity of 520 l/min at a maximum working pressure of 8 bar.

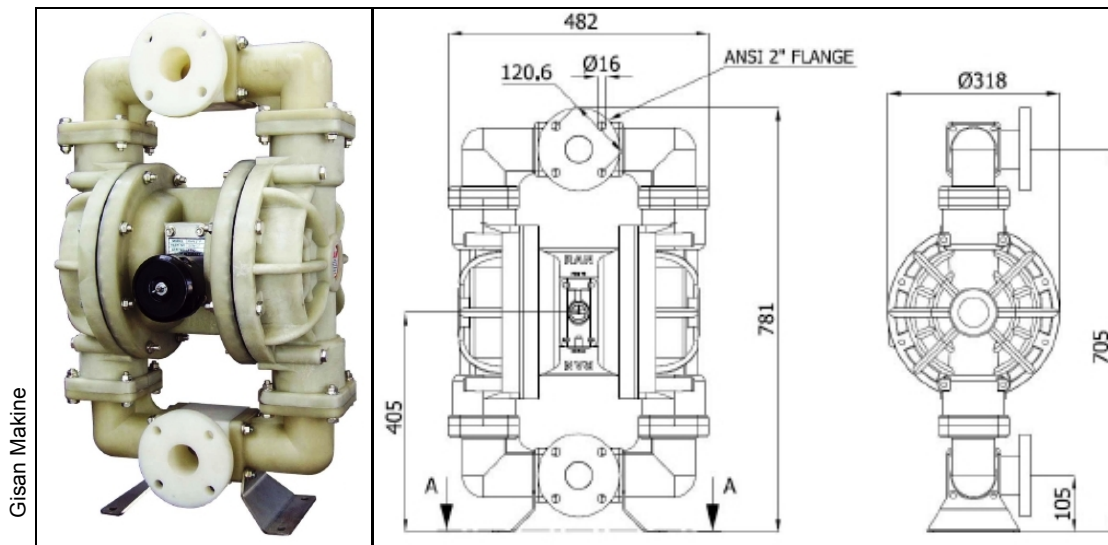


Figure 6: 2-inch membrane pump, type RAN

The hoses for the pressure and the suction line were each attached to the pump used on the day of accident with hose clamps (see Figs. 7 and 8). According to statements of the crew, it had not been possible to find the clamp that had parted from the pressure line.

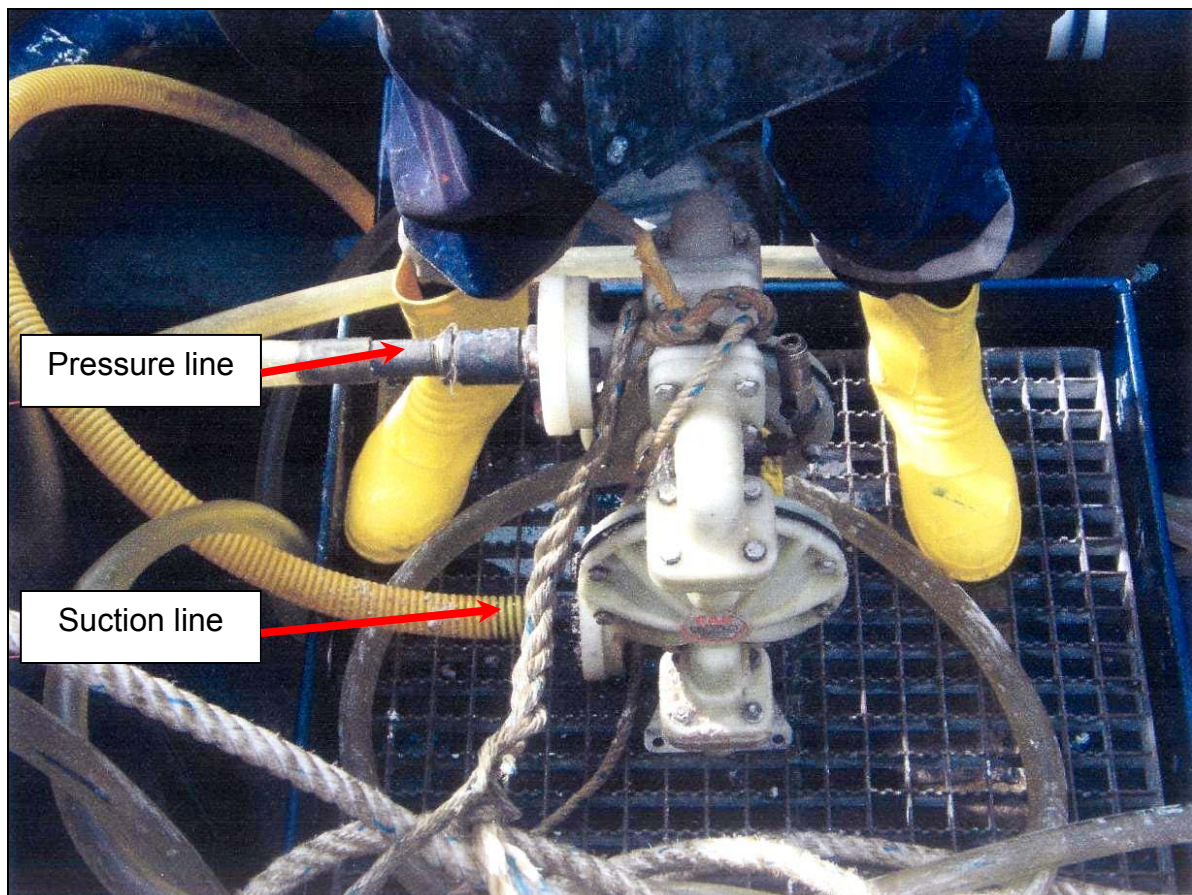


Figure 7: Pump used on the day of the accident

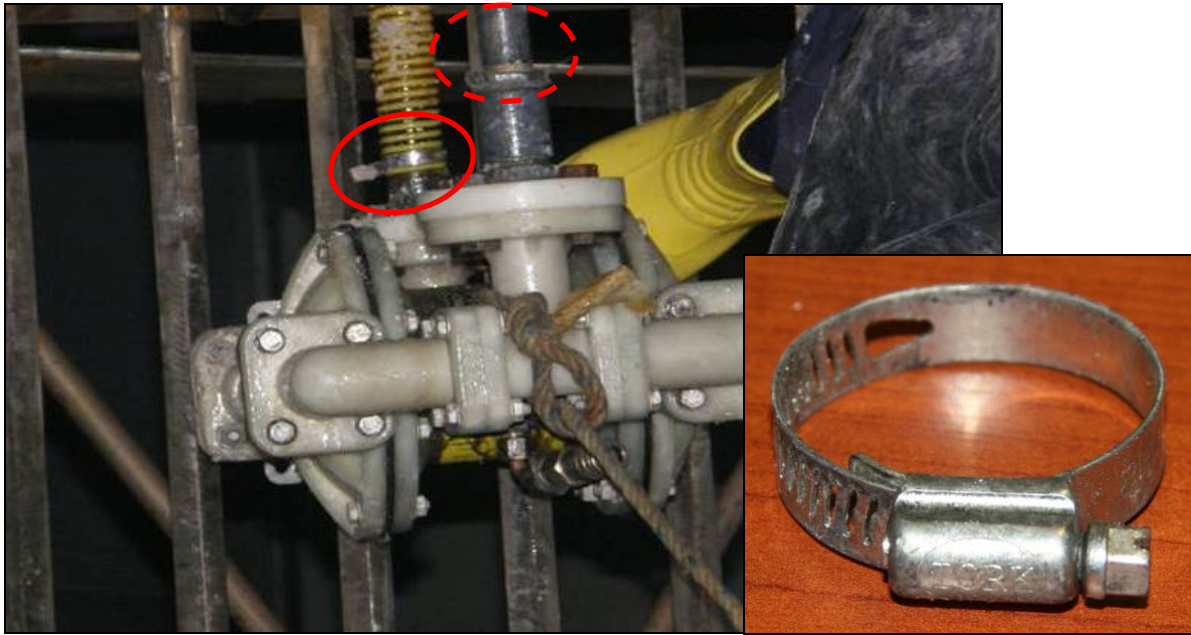


Figure 8: Remaining hose clamp on the suction line and sample clamp

3.2.1.4 Safety equipment

While cleaning the tank on the day of the accident, the third officer was wearing his personal protective equipment. This consisted of a cotton overall, a rubberised jacket, safety boots, protective gloves, eye goggles and a safety helmet (see Figs 9 and 10).



Figure 9: Work overall



Figure 10: Personal protective equipment used by the injured

3.2.2 Hazardous substance – caustic soda

The third officer of the ECE NUR K suffered chemical burns caused by 50% sodium hydroxide solution. Caustic soda as solution of sodium hydroxide (NaOH) in water is one of the chemicals most commonly used by laboratories and industry. Due to chemical reactions, it is capable of causing serious harm after contact to both living tissue and certain metals.

According to European Standard 896, the following requirements apply to the labelling of solutions with a mass fraction of sodium hydroxide in excess of 5%:

- Hazard symbol and labelling:
C: Corrosive
- Labelling of the particular hazard:
R 35: Causes severe chemical burns
- Safety advice:
S 2: Keep out of reach of children;
S 26: In case of contact with eyes, rinse thoroughly with water;
S 27: Immediately remove contaminated, saturated clothing;
S 37/39: Wear suitable protective gloves and eye/face protection when working.
S 45: Seek immediate medical attention in the event of an accident or nausea.
- Transport regulations and labelling:
Sodium hydroxide solution is registered under UN Number⁵ 1824.
IMDG⁶: Class 8 (corrosive substances), Packing Group II (substances and preparations presenting medium danger).



The IBC Code⁷, which sets an international standard for the safe transportation of dangerous chemicals in bulk on sea-going vessels, in Chapter 17 lists sodium hydroxide solution in Pollution Category "Y" as a so-called noxious liquid substance in accordance with MARPOL⁸ Annex II, from which both safety and pollution risks emanate.

3.2.3 Tank cleaning

The owner of the ECE NUR K did not provide information to the BSU regarding the usual tank cleaning procedure. Neither the relevant excerpts from the Safety Management Manual according to the ISM⁹ Code, nor the Procedures and Arrangements Manual according to MARPOL Annex II, nor the tank cleaning plan for the day of the accident were submitted. Accordingly, the prescribed safety measures on the ECE NUR K, the residue drainage system and the tank cleaning facilities remain unclear.

⁵ United Nations Number

⁶ International Maritime Dangerous Goods Code

⁷ International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk

⁸ International Convention for the Prevention of Pollution from Ships

⁹ International Management Code for the Safe Operation of Ships and for Pollution Prevention

The crew made general statements to the tank inspector, who had been engaged by the chemical company, regarding the amount of water and additives used during tank cleaning, which are discussed in detail in sub-para. 3.2.4. However, safety precautions were not discussed on this occasion.

At the request of the BSU, the classification society provided the guidelines of the ship's operating company for the tank cleaning procedures for the entire fleet, excerpts of which are below.

„TANK CLEANING PLAN

Prior to commencing any tank cleaning a written plan must be produced by the Chief Officer, in consultation with the Chief Engineer, and approved by the Master. The plan is to include, but not be limited to the following:

- Full details of the tanks to be cleaned.
- The positioning of machines and the proposed time scheduled.
- Details of pumps required.
- Intended ballast changes and time schedule in relation to the cleaning program.
- Stability during cleaning the programme before, during and after any ballast changes.
- Line washing plan.
- Watches and duties of personnel involved in the operation.
- Instructions to cleaning personnel.

Once the tank cleaning plan has been approved by the Master all personnel involved in the cleaning operation are to sign for acknowledgement and understanding.

The setting up of valves and lines in accordance with the plan is the responsibility of an officer and line and valve setting is to be double checked by another responsible person already briefed in the tank cleaning plan. Should there be any apparent need to deviate from the written plan, and then the Chief Officer must be advised who in turn is to consult with the Master in order that the change can take place. Any such change must be logged, the plan amended and relevant personnel re-briefed.

Tank cleaning is to be considered a critical operation and therefore a suitable checklist should be constructed using Form in order to ensure that all relevant parts of the operation are carried out in accordance with the plan and that the operation is conducted in a safe and proper manner.

(...)

LINE WASHING

As part of any tank cleaning program it is essential that all residues of the previous cargo or grade are also removed from all affected pipelines, separators, strainers, pumps and other places where they may collect.

Lines must be washed into a dirty tank immediately prior to loading clean ballast, and after discharge of dirty ballast and tank cleaning. Lines are washed by pumping clean water through them in a systematic way to ensure that all parts of the cargo system are attended to. It is important that a full flow is established throughout each part of the system including all cargo pipelines and pumps. The line washing program will be included in the Tank Cleaning Plan, produced by the Chief Officer.

(...)

SAFETY DURING TANK CLEANING

Tank cleaning is a hazardous operation which requires an increased level of safety awareness. Additional safety precautions must include, but not be limited to the following:-

- Smoking regulations must be in force as for a load or discharge port.
- All doors and windows kept closed
- Air conditioning must be on full recirculation.
- No unauthorised personnel allowed on deck.

The other guidelines of the operator for the tank cleaning procedures for the fleet refer to oil tankers and therefore do not apply to the ECE NUR K since she is a chemical tanker. In particular, the BSU has not been provided with specific guidelines of the operator regarding the personal protective equipment that must be worn during tank cleaning.

3.2.4 Reconstruction of events before and after the accident

Originally, the ECE NUR K was to load caustic soda in ten of her twelve cargo tanks. The previous cargo in six of the tanks, including tank no. 1 p/s, the tank subsequently involved in the accident, was RBD¹⁰ palm stearin. Untreated palm oil, coconut oil and palm methyl ester (biodiesel) were previously transported in the other tanks (see Fig. 11). All the cargo tanks were empty when the ECE NUR K entered the Lower Elbe.

¹⁰ RBD = refined, bleached, deodorised

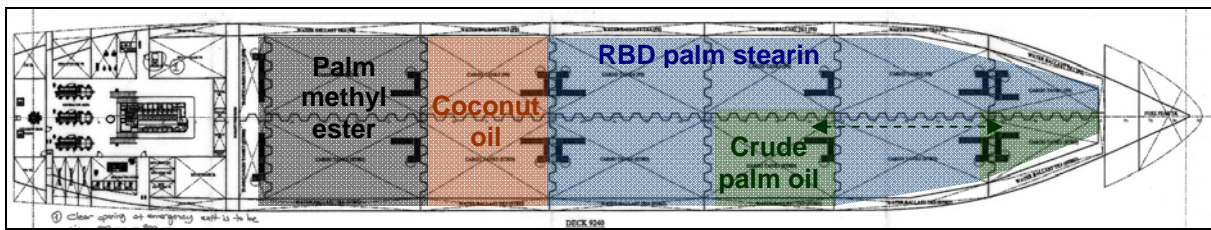


Figure 11: Previous cargo distribution

When the accident occurred, the crew had already been trying to clean the cargo tanks for a week; however, each time they failed to meet the quality requirements of the chemical company from which the next cargo was to be carried.

The first tank inspection was carried out in the night of Friday 24/Saturday 25 July 2009. Here, the tank subsequently involved in the accident, no. 1 p/s, was inspected and rejected as cargo residues were still found everywhere. ECE NUR K then moved to the Twielenfleth roadstead, where the crew cleaned the tanks again. On Monday 27 July 2009, another pre-inspection of tank no. 1 p/s took place and the previously notified deficiencies still existed. During the next pre-inspection on Tuesday 28 July 2009, the tanks no. 4 p/s and stbd. were rejected on account of residues.

It was not until the morning of 29 July 2009 following a successful tank inspection that a cargo sample (caustic soda) was loaded onto the vessel and circulated through the other tanks in which the cargo was to be loaded. The crew gave the tank inspector the following information regarding the cleaning methods previously used. At first, 50 m³ of fresh water and 220 l of cleaning agent were reportedly circulated for 60 minutes. After that, ballast water with fresh water heated to 80°C was reportedly circulated for 60 minutes and then, for another 60 minutes, each tank was washed again with fresh water and another cleaning agent, vaporised, drained and then dried.

Following the usual procedure, the cargo sample was circulated for two times and after each circulation a specimen was taken from the original tank. This specimen was tested for the level of contamination and water content to ensure that the product could subsequently be processed as intended. Both the specimens taken after the first and after the second circulation were contaminated beyond the range of tolerance. Therefore, early in the morning of 30 July 2009 the ECE NUR K moved back to the Twielenfleth roadstead, where the accident occurred on Saturday 1 August 2009 while the tanks were being cleaned once again.

Another tank inspection with a negative result took place on the night of Saturday 1/Sunday 2 August 2009, after which the lines were cleaned again. Another cargo sample was circulated for the last time on Sunday at midday following a further tank inspection. After this was also rejected, the chemical company eventually and permanently refused to load the cargo onto the ECE NUR K. Therefore, at 1800 on 2 August 2009 the tanker continued her voyage without any cargo.

3.2.5 Safety management

The owners of the ECE NUR K evidently conducted a risk assessment for tank cleaning, the result of which was incorporated in the above-mentioned tank cleaning guidelines for the fleet. Whether more detailed guidelines exist for the fleet's chemical tankers, or specifically for the ECE NUR K, could not be clarified during the casualty investigation.

On 19 March 2009, the classification society issued the ECE NUR K an interim SMC¹¹ valid until 16 September 2009. The formal requirements for safety management on board as prescribed by the ISM Code were thus given. The first ISM audit took place on 10 September 2010. At that time, the ECE NUR K was issued with an SMC valid until 9 September 2013.

3.2.6 Port state controls

The Ship Safety Division (BG Verkehr) conducted a port state control on 2 August 2009, the day after the accident. Here, four deficiencies were found:

- Work spaces and accident prevention:
Due to a lot of cargo residues access to the decks is unsafe.
- ISM related deficiencies:
Due to the current situation it seems that the crew was not very familiar with handling the cargo (palm oil) or has not enough experience with chemical tanker operations. Internal audit is required.
- MARPOL annex I:
Found wrong or missing entries in Oil Record Book. Dirty oil tank not in item 3.1 IOPP¹². Heavy Fuel Oil drain tank and incinerator sludge tank were not recorded.
- Ship's certificates and documents:
Prevention of pollution by oil (IOPP) - Missing.
Dirty oil tank not in the item 3.1 IOPP. Has to be proved by class society.

No deficiencies were reported during the next port state control of the ECE NUR K on 6 January 2010 in Portugal. A further control made on 9 September 2010 in New Zealand found four deficiencies in the following areas:

- One deficiency relating to certification and watchkeeping for seafarers
- Two deficiencies in the area of safety of shipping
- One operational deficiency with respect to the SOLAS Convention¹³

The BSU is not aware of the period of time the owner of the ECE NUR K was given to rectify the deficiencies. They still existed during a follow-up inspection in Australia on 28 September 2010.

¹¹ Safety Management Certificate

¹² International Oil Pollution Prevention Certificate

¹³ International Convention for the Safety of Life at Sea

3.2.7 Technical failures in the aftermath

On 3 November 2009, two technical failures occurred on the ECE NUR K in German waters. These were investigated by the Waterway Police (WSP) Kiel. At about 0800, a dirty oil filter caused the controllable pitch propeller (CPP) control to fail. The main engine was briefly stopped because the tanker was just off Kiel Lighthouse. After switching to the second oil filter, the CPP control worked again and it was possible to continue the voyage.

On the same day, the ECE NUR K's steering gear failed just before she entered the Schwartenbek siding area in the Kiel Canal. The ship's command conducted an emergency anchoring manoeuvre. The steering gear was operated in manual mode with two pumps in operation when the port pump failed and it was not possible to switch it back on. Following that, the WSP issued a detention order, which was released after the two hydraulic pumps had been replaced and the required class approval was given on 6 November 2009.

The BSU is not aware of any other technical malfunctions.

3.2.8 Rescue coordination

As part of the safety investigation, the BSU also looked at the shore-based coordination of the rescue operation for the injured crew member. This revealed various coordination-related problems and uncertainties within the rescue chain, which gave rise to the BSU conducting a thorough examination of the rescue coordination.

During the investigation, it became apparent that the responsibilities for rescuing persons in distress on navigable maritime waterways, here in the Lower Elbe area, are spread across different agencies and authorities. This concerns both evacuating casualties/injured persons from sea-going vessels as well as rescuing people from the water. With regard to this issue, the BSU held numerous meetings with the agencies involved in rescuing persons in distress on the Lower Elbe (DGzRS, the Fire and Rescue Coordination Centre (FRL) of the Stade administrative district, the Joint Regional Control Centre (KRLS) of the Pinneberg administrative district, the Hamburg Port Authority, the Central Command for Maritime Emergencies/Maritime Emergencies Reporting and Assessment Centre (MERAC) in Cuxhaven) and included at an early stage the Federal Ministry of Transport, Building and Urban Development (BMVBS) as well as the Waterways and Shipping Directorates (WSDs) North and North West in the proceedings.

The following comments concern the rescue of persons in distress outside so-called complex emergency situations, for which the Central Command is responsible for the overall coordination. The accident on the ECE NUR K did not represent a complex emergency situation and therefore the rescue operation was coordinated between and carried out by several agencies.

3.2.8.1 Legal background

Provision of the necessary search and rescue service¹⁴ for distress situations involving seagoing shipping is incumbent on the federal government. This obligation follows the relevant provisions of international law, in particular, the SOLAS Convention and the SAR Convention¹⁵. The German SAR area was established by the former Federal Ministry of Transport (BMV) and notified to the International Maritime Organisation (IMO). According to the reported coordinates, it covers the territorial waters and the Exclusive Economic Zone (EEZ) in the North Sea and Baltic Sea (see Fig. 12), but does not explicitly include the navigable maritime waterways.

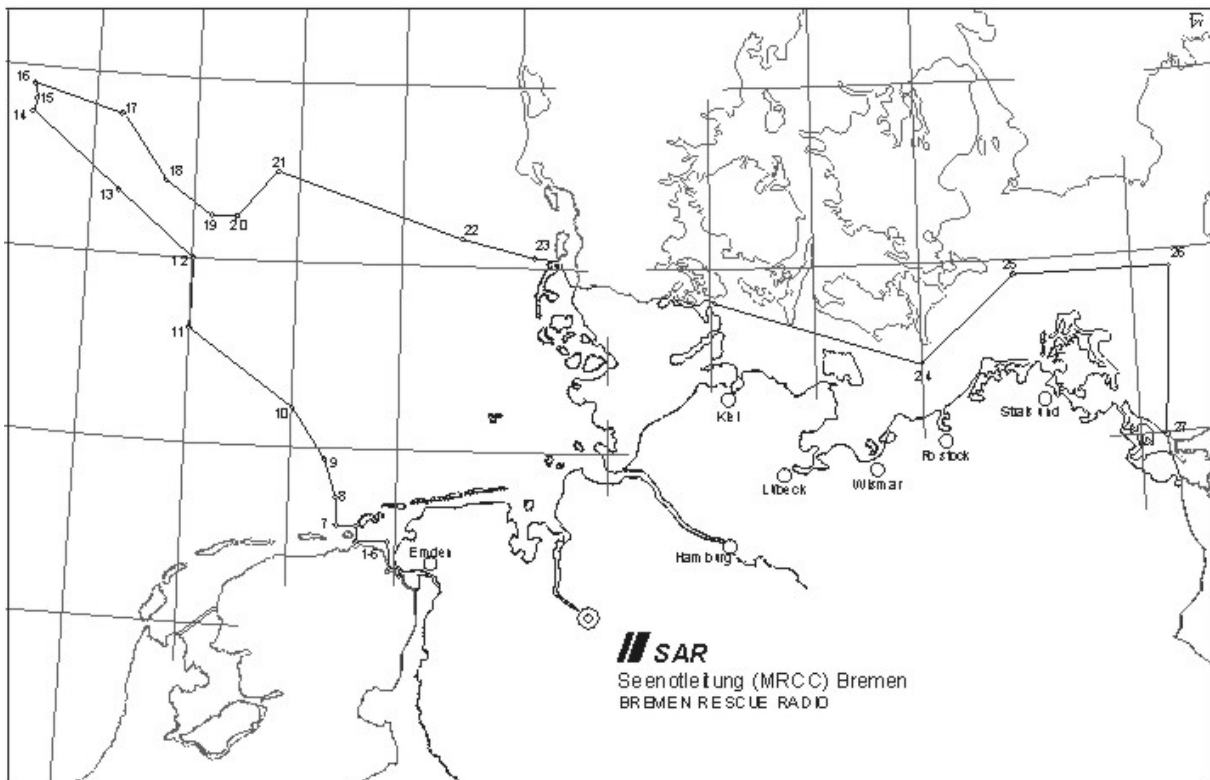


Figure 12: German SAR area

In 1982, the former BMV transferred implementation and coordination of the SAR responsibilities incumbent on the federal government to the DGzRS, which, based on its own charter, already carried out maritime rescue operations before the mentioned transfer and still does according to its own criteria. In 1984 and at the request of the DGzRS, the former BMV clarified in a letter that the transferred SAR responsibility "also extends to those waters that are directly linked to the sea, that are used by seagoing vessels and for which the federal government is responsible, i.e. navigable maritime waterways."

The Kiel Canal was exempted from this without special justification.

Accordingly, the DGzRS at present is obliged to assist people in distress also in navigable maritime waterways (with the exception of the Kiel Canal) on behalf of the

¹⁴ See art. 1 (7) of the Federal Maritime Responsibilities Act (Seeaufgabengesetz - SeeAufgG)

¹⁵ International Convention on Maritime Search and Rescue

federal government. Territorial jurisdiction on the Lower Elbe extends to the Hamburg port boundary. However, the term 'distress at sea', for which there is no standard definition, generally only includes marine casualties; accidents, injuries and illnesses on board a sea-going vessel; as well as man overboard situations. In this respect, water rescues, e.g. involving swimmers or water sports enthusiasts in distress are the responsibility of federal States and therefore not included. This distinction is irrelevant in the case of the ECE NUR K because the personal accident was clearly a distress situation on board a seagoing vessel (distress at sea).

Due to lack of own capacity for the area of the Lower Elbe to Hamburg, the DGzRS agreed with the State administrative district that it would be supported by operational units for the conduct of rescue operations between Brunsbüttel and the Hamburg port boundary (Lower Saxony's local sections of the DLRG¹⁶ and fire brigades). To that end, the DGzRS resources are here placed under the command of the State administrative district. There is no such agreement with Schleswig-Holstein.

In summary, this means that the DGzRS conducts maritime rescue operations on behalf of the federal government in the fairway of the Lower Elbe to Brunsbüttel, and additionally conducts life saving operations in general on the basis of its own charter. From Brunsbüttel to the Hamburg port boundary, however, the State administrative district, as agreed with the DGzRS, is responsible for both the water rescues in the area of the State of Lower Saxony and also for maritime rescue operations within the fairway, while Schleswig-Holstein is only responsible for the water rescues in the area of its own State. With their respective administrative districts, the federal States are responsible for water rescues in the area between the fairway boundary and the mean high water line (MHW line). However, in the area between the MHW line and the fore-side of the embankment, the respective local authority is responsible, with suburbanized water areas representing a special case. Regardless of that, the exact course of the borderline between Schleswig-Holstein and Lower Saxony in the Lower Elbe is unclear.

Regarding reporting scheme, the following guidelines and regulations exist:

In a decree issued in 2004, the Federal Ministry of Transport, Building and Housing (today the BMVBS) assigned to the vessel traffic service centres of the Federal Waterways and Shipping Administration (WSV) the functions of SAR stations. Details were to be coordinated directly with the DGzRS. During the implementation, the DGzRS and the WSV agreed upon a SAR operation plan, under which a vessel traffic service centre, upon becoming aware of a distress situation, would have to arrange any initial measures necessary and notify the MRCC¹⁷. The administrative

instruction 2408¹⁸ in conjunction with the specific administrative instructions for the relevant areas, as well as the emergency, alarm and notification schemes serve as an additional legal basis for the notification. In case an event occurring in navigable

¹⁶ Operational units of the German Life Saving Society

¹⁷ Maritime Rescue Coordination Centre

¹⁸ Administrative Instruction of the Federal Waterways and Shipping Administration for the Operation of the Vessel Traffic Service Centres (VV-WSV 2408)

waterways is classified as a water rescue task, the responsible federal state authorities are to be notified via the responsible water police department.

According to the cooperation agreement between the DGzRS and the Stade administrative district, the Stade Fire and Rescue Coordination Centre, upon becoming aware of an accident (water rescues, fire protection and assistance), will alert the appropriate operational units in the Stade administrative district directly. In cross-border areas they will inform the relevant local rescue coordination centres (Schleswig-Holstein, Hamburg), and for distress at sea situations immediately the MRCC.

With regard to the units and resources to be deployed, the Stade administrative district has issued an alert and response order for the Elbe and tributary waters. This has four alert levels, for which different resources will be used:

- W0 – simple technical assistance (e.g. tree in the water): only one boat
- W1 – assistance on the water, people or animals not in danger (e.g. rope caught in propeller) or transport for rescue and emergency medical services: one boat from the volunteer fire brigade and one from the DLRG
- W2 – person in the water or in mortal danger, animals or valuable property at risk: two boats from the volunteer fire brigade and two from the DLRG
- W3 – large-scale operations and searches for missing persons: deployment of larger formations of the volunteer fire brigade, DLRG and rescue services

Accordingly, based on this alert and response order the severe injuries to the crew member of the ECE NUR K would have fallen between alert levels W1 and W2. According to the plan, in the area of the Twielenfleth roadstead the Stade Volunteer Fire Brigade and the Stade DLRG should have each deployed one boat.

3.2.8.2 Actual rescue operation for the accident

The crew of the ECE NUR K reported the accident to the Brunsbüttel vessel traffic service centre via VHF. VTS Brunsbüttel forwarded the message to the Stade Fire and Rescue Coordination Centre, which took over coordination of the rescue at 1443. The operation log contains, inter alia, the following:

Time	Action
1443	Operation started, 'water rescue'; Stadersand DLRG not reached by phone or radio; therefore, only volunteer fire brigade by phone
(...)	
1459	Note: contact with caustic soda
(...)	

Time	(Cont.) Action
1500	Boat alerted (FLORIAN-1)
1509	Boat (FLORIAN-1) arrived on scene
(...)	
1523	Boat (FLORIAN-1) proceeding slow ahead to Stadersand with patient
(...)	
1613	Operation accomplished

Table 1: Excerpt from the operation log of the Stade Fire and Rescue Coordination Centre

The separate operation report of the Stade Volunteer Fire Brigade indicates that an emergency doctor as well as a paramedic were transferred to the ECE NUR K by the FLORIAN-1. The boat then took the injured to Stadersand, where he was handed over to the rescue services. The onward transport to the Hamburg-Eppendorf University Medical Centre was carried out by the helicopter CHRISTOPH HANSA.


Regarding the availability of the Stadersand DLRG on the day of the accident, the BSU has been given different accounts. The DLRG became aware of the accident via means other than the official alerting channel and briefly assisted the Volunteer Fire Brigade in transferring the injured at the jetty in Stadersand.

The Maritime Rescue Coordination Centre in Bremen was neither informed by the Brunsbüttel vessel traffic service centre nor the Stade Fire and Rescue Coordination Centre.

3.2.9 Rescue capacity

The last DGzRS station on the way to Hamburg is located in Brunsbüttel. The 9.5 metre search and rescue vessel GILLIS GULLBRANSSON is stationed there. Due to the distance to the Twielenfleth roadstead (at buoy no. 107, 25 nm away from Brunsbüttel), deployment of this vessel was not an option on the day of the accident. The Stade administrative district has divided the Elbe into several operational areas. For the third area from the northern point of Pagensand (at buoy no. 93) upstream to about the middle of Lühesand (at buoy no. 110), boats of the Stade Volunteer Fire Brigade and the Stade DLRG are available on the Lower Saxony side.

The Stade Volunteer Fire Brigade does not have its own station. In case of an alarm, rescue units are called in by wireless alarm device. The boat group of the Volunteer Fire Brigade consists of 26 members, including six skippers and 11 boatmen. Three boats are available for operations:

Boat	Length	Specifications
FLORIAN-1 	5.40 m	200 hp engine, speed approx. 38 kts, mainly used for rapid response rescue operations





(Cont.) Boat	Length	Specifications
BRUNSHAUSEN 	12.60 m	258 hp engine, speed approx. 18 kts, mainly used for rescuing persons in distress; closed cabin <u>Equipment:</u> inter alia, towing gear, radar equipment, GPS, electronic chart, floodlighting, emergency kit
MAX 		Multi-purpose boat for smaller operations

Table 2: Rescue equipment of the boat group of the Stade Volunteer Fire Brigade

The Stade DLRG station is not a rescue station within the ambit of the Lower Saxony Law on Rescue Services (Rettungsdienstgesetz - NRetDG). Depending on availability, the station is manned by volunteers on weekends usually from early May to late September. Similar to the Volunteer Fire Brigade, alerts are generally received via wireless alarm device, irrespectively of a station being manned or not. The rapid response unit of the Stade DLRG consists of 35 members, including 18 skippers. Four boats are available to the volunteers for operations:

Boat	L/B/D	Specifications
KIEK UT 	6.90 m 2.10 m 0.90 m	Closed motor lifeboat for rescuing people, recovering material and technical assistance, medical first aid on board; 165 hp engine, speed about 26 kts <u>Equipment:</u> inter alia, marine radio, 2 x searchlights, portable spotlight, radar equipment, public address system, GPS, medical emergency kit, (folding) scoop stretcher, blankets, fog signal device, rescue platform, flashing blue light This boat will be replaced by a new one in 2011.
GOOD WILL 	6.65 m 1.85 m 0.50 m	Open high-speed motor lifeboat for rescuing people, recovering material and technical assistance, first aid on board; 210 hp engine, speed about 33 kts <u>Equipment:</u> inter alia, marine radio, searchlight, medical emergency kit, (folding) scoop stretcher, blankets, horn, flashing blue light




(Cont.) Boat	L/B/D	Specifications
KIEK WIET 	5.08 m 1.79 m 0.30 m	Open motor lifeboat for rescuing people, recovering material and technical assistance, able to operate in shallow water, 50 hp engine, speed about 27 kts <u>Equipment:</u> inter alia, searchlight, folding stretcher, blanket, first aid equipment, horn, flashing blue light
PASS OPP 	4.30 m 1.70 m 0.20 m	Open motor lifeboat for rescuing people, recovering material and technical assistance, able to operate in shallow water, especially suitable for operations ashore, 30 hp engine, speed about 26 kts <u>Equipment:</u> inter alia, searchlight, stretcher as needed, blanket, first aid equipment, tools

Table 3: Resources of the rapid response unit of the Stade DLRG

On the Schleswig-Holstein side of the Elbe, the Volunteer Fire Brigade and the Wedel DLRG are responsible for this area opposite the Twielenfleth roadstead. The fire brigade has one and the DLRG two motor lifeboats available for rescue operations; these vessels are capable of operating on the Elbe without any restrictions. The DLRG additionally operates a water rescue station from early May to late September; which is permanently manned at weekends. Beyond that, during the summer months the “water hazards” section of the Pinneberg Technical Relief (THW) keeps a multi-purpose working boat ready for use, at 30 minutes notice, in the Tonnenhafen.

Boat	L/B	Specifications
BÜRGERMEISTER BALACK 	n.n.	Multi-purpose boat of the Wedel Volunteer Fire Brigade




(Cont.) Boat	L/B	Specifications
KLAR KIMMING 	6.22 m 2.40 m	Half covered Campion Explorer 622 of the Wedel DLRG for technical and medical assistance; 205 hp engine, speed about 36 kts <u>Equipment:</u> inter alia, marine radio, floodlighting, searchlight, emergency bag with oxygen, trauma bag
HOVPOD 	3.63 m 1.86 m	Hovercraft lifeboat of the Wedel DLRG <u>Equipment:</u> inter alia, emergency bag with oxygen, immobilisation equipment
MzAB 	n.n.	Multi-purpose working boat of the Wedel THW Two 70 hp outboard engines

Table 4: Rescue equipment of the Volunteer Fire Brigade, the DLRG and the Wedel THW

In the area of the port of Hamburg, the rescue of persons in distress is coordinated centrally by the Hamburg Port Authority (HPA), or, respectively, after initial notification by the vessel traffic service centre. It is conducted predominantly using units of the professional fire brigade with the involvement of pilot boats and any civilian boats (launches, tugboats) available in the accident area. A request for additional rescue personnel from nearby rescue stations (e.g. Wedel) is more the exception.

4 ANALYSIS

4.1 Cause of the accident

In retrospect, it was not possible to establish the actual cause of the hose clamp parting from the mobile pump as the clamp could not be found. In this respect, it remains open whether a case of material fatigue existed.

4.2 Causes of the serious injury to the crew member

The BSU investigation focused on clarifying the reasons for the serious eye injury to the third officer.

4.2.1 Safety equipment

In the opinion of the BSU the protective equipment used by the injured on the day of the accident was inadequate for the planned tank cleaning. Chapter 14 subparagraph 14.1.1 of the IBC Code states, inter alia, that protective clothing made of chemical-resistant material as well as tightly fitting eye goggles and/or face shields must be used. The cotton overall and the eye goggles, which were open at the sides, used by the third officer did not meet these requirements, whereby not only his eyes but also his skin was exposed to the caustic soda with virtually no protection.

The requirements of the IBC Code are reiterated in publications of the chemical company from which the ECE NUR K was to take on cargo and also in the safety data sheet for the hazardous substance 50% sodium hydroxide solution, where simultaneous use of tightly fitting eye goggles and a transparent face shield fitted to the helmet is recommended. Contact with only 5% sodium hydroxide solution can cause extremely severe chemical burns. It is, therefore, difficult to understand why at all the used protective equipment had been chosen for the tank cleaning operations on the ECE NUR K. After all, the guidelines of the operator for the tanker fleet point explicitly to the need for safe and proper tank cleaning.

4.2.2 Safety management

The operator of the ECE NUR K did not submit the tank cleaning plan. Therefore, it was not possible to establish precisely whether any, and if so which, safety precautions were considered sufficient. There is no evidence to suggest that the injured ignored the guidelines for the use of protective clothing intentionally. Rather, the BSU assumes that the – with exception to the helmet, gloves and shoes – inadequate clothing worn was to the protective equipment typically used. This assessment is also supported by the level of contamination on the deck area found after the accident and the findings of the port state control inspection on the following day, according to which the crew was not familiar with the handling of chemicals and routine operating procedures on board chemical tankers.

4.2.3 Training

It is quite obvious that there was a substantial lack of training on the ECE NUR K with respect to the crew's ability to handle cargo on a chemical tanker. Otherwise, it is not possible to explain why in eight days the crew was unable to clean the tanks in the manner required for new cargo to be taken on board. Despite detailed information provided by the external tank inspector, it was not possible to eliminate the existing deficiencies.

Moreover, the safety awareness of the ship's command, deck officers and deck crew was not sufficient for safe and proper handling of the hazardous substance sodium hydroxide solution. Master, tank cleaning team and bosun were all around in the forward part of the vessel without any of them taking action with regard to the quite obviously inadequate safety clothing of the tank team. A sufficient level of awareness relating to handling caustic soda would not only have prompted appropriate safety clothing, but also the positioning of an eye wash facility close to the tank, even though this is not required under the IBC Code. But ultimately, with caustic soda burns the severity of the injury is determined by the amount of time that passes before the affected eyes or skin are/is rinsed.

4.3 Rescue coordination

The basic problem with regard to rescue coordination on navigable waterways is the differing responsibility of the federal government (distress at sea cases) and the state government (water rescue cases). At present neither a uniform reporting scheme nor a SAR coordination and implementation plan arranged between all the agencies and authorities involved at federal, state and local level exist.

Currently, the majority of emergency calls pertaining to the Lower Elbe are made to the vessel traffic service centres, which in their role as SAR stations arrange for the initial measures (e.g. alert the local rescue services) before transferring coordination – usually directly to the State Fire and Rescue Coordination Centre. When coordinating the operations, the State FRL generally deploys Lower Saxony-based units of the Volunteer Fire Brigade and DLRG.

In Schleswig-Holstein, there is no clear division of competence in the Law on Fire Protection (Brandschutzgesetz) and the Law on Rescue Services (Rettungsdienstgesetz). Therefore, the operation planning for rescue services is conducted by the respective body responsible for this service together with the Joint Regional Control Centre West. For the fire service and technical components of water rescue, however, the planning is conducted by the local senior officer of the municipality responsible for the relevant section of the Elbe.

Today, cross-border operation coordination between Lower Saxony, Schleswig-Holstein and Hamburg is the exception.

Regarding the operation involving the ECE NUR K, which occurred in the area of the federal government, the State FRL deviated from the alert and response order as it requested only one boat rather than two (one from the DLRG and one from the Volunteer Fire Brigade). The open high-speed patrol boat of the fire brigade,

FLORIAN-1, was alerted at 1500 and arrived on scene with an emergency doctor nine minutes later. The slight delay in alerting was caused by another water rescue incident involving a diver operation, which was received almost simultaneously and for which units of the Volunteer Fire Brigade and DLRG were requested. The injured was then evacuated 13 minutes later. Also in previous cases an emergency doctor had been transferred in a high-speed patrol boat, yet the evacuation of the injured had then been conducted in a closed boat in the interest of optimum further treatment. After completion of the rescue operation neither the Brunsbüttel Vessel Traffic Service Centre nor the Stade FRL reported the operation to the DGzRS, although both were required to do so.

Two different schemes for unified notification were proposed to BSU during informal exchange of ideas as well as in a received comment in order to improve rescue coordination (see Figs. 13 and 14):

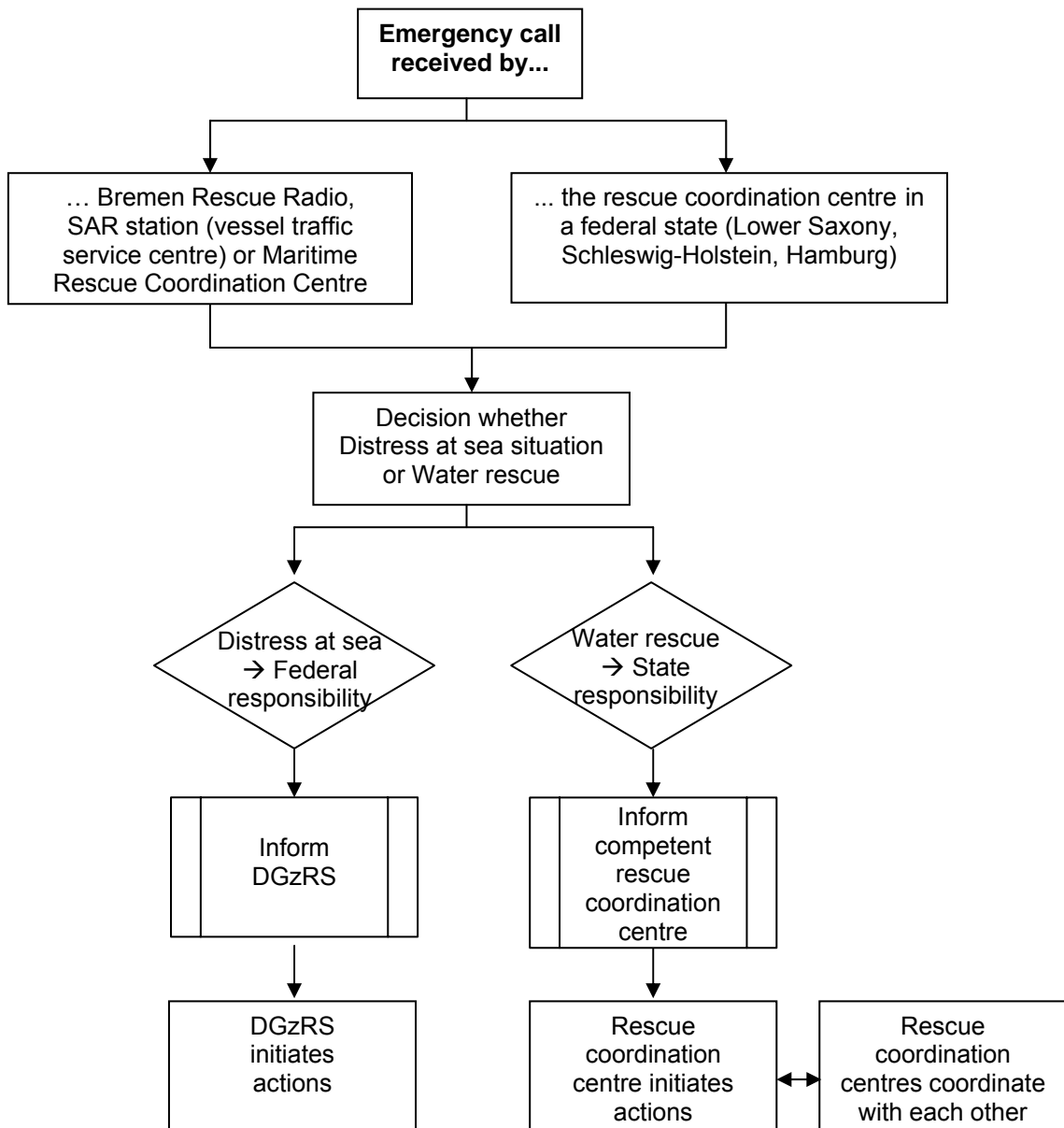


Figure 13: Proposed notification scheme

This proposal contains the following difficulties as regards practical implementation:

- Due to the lack of capacity, the DGzRS is unable to cope with distress at sea situations upstream of Brunsbüttel on its own. Furthermore, due to the different communication systems of the various land and sea rescue services, coordination by MRCC is only to a very limited extent possible. If a distress at sea situation occurred just before the Hamburg port boundary, then the DGzRS would need several hours to reach the scene from Brunsbüttel.
- Theoretically, the emergency call "Person in the water off buoy xy" would give rise to a number of requests in order to be able to decide on how the call should be handled: Does the person look like a swimmer, water sports enthusiast or the crew member of a sea-going vessel? Is she/he swimming inside or outside the fairway, and if outside, then in whose jurisdiction?

The following alternative notification scheme has also been proposed:

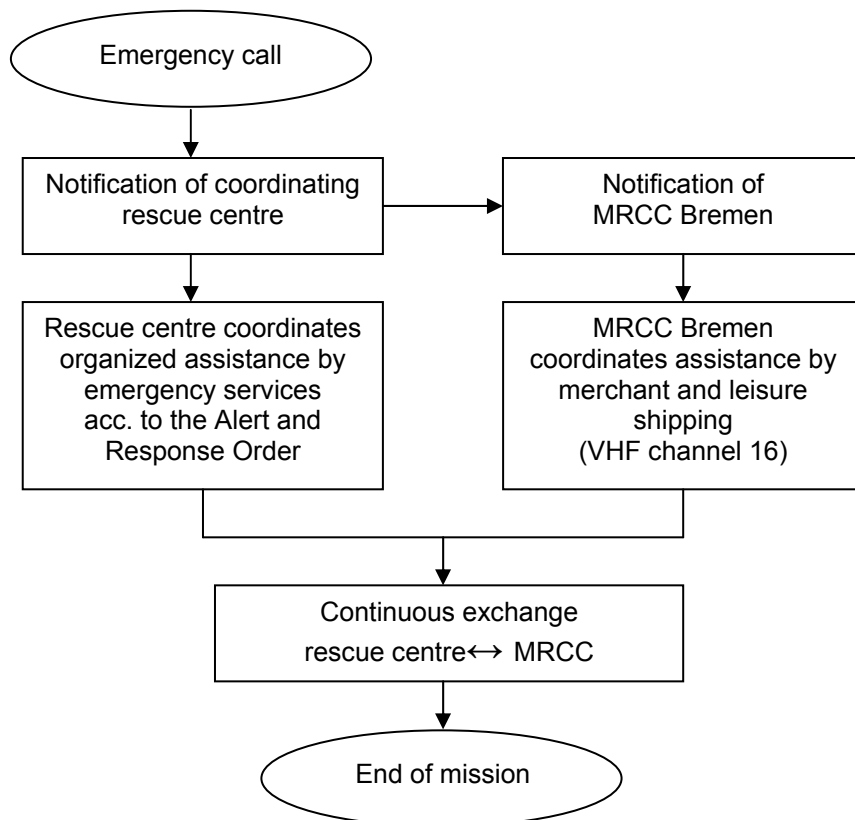


Figure 14: Further proposed notification scheme

This scheme as well does not cover the equipment and training aspects of voluntary rescue personnel, both of which are limited when it comes to a distress at sea situation. Additionally, it is not in the best interest of the DGzRS that MRCC Bremen be informed about every single case of water rescues (e.g. technical assistance). After all, the DGzRS does not provide for own survival crafts upstream of

Brunsbüttel, and merchant as well as leisure shipping could also be informed via the vessel traffic service centres.

Both schemes point out the intention of the parties involved in rescue operations to re-organize the existing notification schemes as practical as possible. This approach is very much welcomed by BSU. For this purpose, many further meetings of the relevant participants will be necessary.

The daily practise of neither the rescue stations nor the operational units is based on the legal doctrine of definition criteria when it comes to distress at sea or water rescue situations, for ultimately the goal has always been and will always be to rescuing persons in distress regardless of whether this entails acting outside one's own jurisdiction.

With respect to SAR operations that fall within federal jurisdiction, the BMVBS is currently considering having these conducted by the DGzRS only on navigable seaways. The DGzRS would then only need to respond to distress at sea situations up to the estuary of the Elbe. Strictly speaking, this would mean that search and rescue operations would no longer be carried out for distress at sea situations between Cuxhaven and Hamburg. The States would not be responsible for these accidents and the DGzRS could consider case by case whether it would engage in an operation purely on the basis of its charter.

From the perspective of the BSU, it would be desirable if Federal, States and Local administrations could come to an agreement on assigning central responsibility for personal injuries on the Lower Elbe to one centre, despite differing legal administrative competences. This has been discussed on a number of occasions over the past 20 years between the agencies and authorities involved in SAR operations, but so far without any specific result.

Due to the current guidelines and individual arrangements, and in the absence of an agreement between the parties involved, there is always the risk that for distress at sea situations in the area between Brunsbüttel and Hamburg, rescue services with no specific education and training, or that are not permanently available (depending on season, at weekends) will be deployed. One aspect in this regard is also the equipment of personnel from the Volunteer Fire Brigade and DLRG with rescue devices. Although readily suitable for rescuing individuals from the water, it is only suited to a limited extent to the much larger demands of evacuating casualties from sea-going vessels. By transferring the currently existing obligation of the federal government for maritime rescue operations within navigable maritime waterways to volunteers, the requirements of the SAR Convention are not met (in particular, operational readiness of a station around the clock, English language skills, appropriate life saving equipment and detailed response plans).

During the course of the investigation, the BSU held numerous meetings with volunteer rescue personnel from the fire brigades and DLRG in Schleswig-Holstein and Lower Saxony. It emerged here that besides the issues of constant availability, special training, and equipment, another problem was that of competitive pressure among the volunteer rescue personnel. The operation statistics kept by the rescue

coordination centres, the DLRG, and by the Volunteer Fire Brigades can be used, amongst other things, as a basis to determine future manning and equipment needs. The BSU is in possession of documents for the years 2007 to 2010, according to which there were conflicts in the selection of rescue services or cooperation between the rescue coordination centres of several federal States in 12 life saving incidents on the water (both distress at sea and water rescue situations). The most common complaint relating to these cases concerned the lack of communication to rescue teams that were operational and closer to the accident site than the units actually deployed.

Fortunately, the scenarios discussed here are exceptions to the normally efficiently and properly conducted rescue operations on the water. Compared to the total number of rescue operations carried out on the Lower Elbe each year, the proportion of contested operations is negligible. Nevertheless, the BSU is of the view that there is room for improvement to ensure, to the furthest possible extent from an organisational standpoint, that existing rescue plans are followed and executed by the best and fastest available units.

4.4 Actions taken

The ship's operator of the ECE NUR K has carried out an internal accident investigation. As a result of this assessment, the following measures were taken:

- A training has been carried out on board the ECE NUR K from 26 to 28 August 2009, covering the following topics: tank washing, dangerous slippery surface effect, using PPE, preparation of port discharging and loading operations, preparation of PSC and planned maintenance, human factor, team building, team working, time efficiency, risk assessment.
- The tank cleaning operation and check lists regarding work permit have been revised by the Designated Person Ashore (DPA) and circulated to the fleet.
- The casualty scenario has been included into the company incident/accident training centre's programme.

At the suggestion of the Federal Ministry of Transport, Building and Urban Affairs (BMVBS), the BSU invited to a discussion about "rescuing persons in distress on navigable maritime waterways". For this, representatives of the Federal States of Lower Saxony, Bremen, Hamburg and Mecklenburg-Vorpommern met with representatives of the BMVBS, the Waterways and Shipping Directorates Northwest and North, the Central Command for Maritime Emergencies and the German Maritime Search and Rescue Service (DGzRS) The Federal State of Schleswig-Holstein could not send a representative and was therefore involved informally.

The participants agreed on the fact that functioning reporting channels and procedures are basically in place. The legal embodiment, however, requires improvement. A progress to this effect would enhance the safety of the rescue forces and could be the basis for a better technical equipment. The BMVBS agreed to jointly develop a practise-orientated legal solution with the other parties involved and assume further initiative for this.

5 CONCLUSIONS

5.1 Safety equipment

The serious injury to the third officer is largely due to inadequate safety equipment. The eye goggles worn were open at the sides, allowing the caustic soda to enter the eyes of the injured more or less freely. Neither the eye goggles nor the cotton overall complied to European safety regulations or the information on the safety data sheet for the hazardous substance caustic soda, respectively.

5.2 Safety management

The safety management implemented and practised on board did not meet international standards. The tank cleaning crew had only inadequate safety clothing available and a tank cleaning plan based on a thorough risk assessment was not prepared. The level of contamination found on the chemical tanker, which had only been in operation for four months, indicated that the whole crew was not sufficiently familiar with the normal operation and, in particular, the cleaning procedures.

5.3 Training

At the time of the accident, there was a substantial lack of training in crew's ability to handle cargo on the ECE NUR K. The safety awareness of the crew, especially the tank cleaning team, was weak. The crew was unable to remove cargo residues from the tanks and lines safely and properly within eight days even after receiving external guidance with instructions on proper tank cleaning.

5.4 Rescue coordination

Rescue operations on the Lower Elbe as well as on the other navigable maritime waterways are in need of realignment. In practically all cases, the results of rescue operations carried out on the Lower Elbe do not give rise to objection. But rather than being due to the existing arrangements, this has to be attributed to the commitment of the rescue services involved and the conscientious personnel of the various rescue stations. Workable areas of responsibility, appropriate equipment and a uniform reporting scheme are essential in terms of supporting the decision making process in the course of coordinating and executing rescue operations. This enhances the safety of all those who are reliant on external assistance on the Lower Elbe navigable maritime waterway in the future.

6 Safety Recommendation(s)

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

6.1 Ship's command and operator of the ECE NUR K

The Federal Bureau of Maritime Casualty Investigation recommends that the ship's command and the operator of the ECE NUR K provide all crew members who are exposed to hazardous substances in the course of daily shipboard operations with appropriate protective clothing, which conforms to international, European and national standards.

The donning of appropriate protective clothing before engaging in dangerous activities, such as tank cleaning, should be logged in the prescribed tank cleaning plan and verified by a responsible member of the crew. The crew members should be extensively informed about the hazards associated with the substances with which they come in contact during tank cleaning as well as about appropriate first aid measures.

The deck area should be kept in a condition which permits work to be carried out safely.

It must be ensured that the crew is familiar with the demands of day-to-day operation on a chemical tanker and made aware of the hazards associated with handling chemical substances through regular and documented training.

6.2 BMVBS, DGzRS, WSDs North and North West, Ministries of the Interior of the States of Hamburg, Schleswig-Holstein and Lower Saxony

The Federal Bureau of Maritime Casualty Investigation recommends that the ministries, agencies and authorities involved in rescuing people in distress on navigable maritime waterways continue the dialogue started, aiming at developing a standardised reporting and emergency plan for both the distress at sea situations and the water rescues on the Lower Elbe and concentrate existing responsibilities to the extent legally permissible.

It is further recommended that an appropriate reporting and emergency plan be also developed for the other navigable maritime waterways.

7 SOURCES

- Written and oral statements by the ship's command and individual crew members
- Certificates of registry
- Reports of the inspector engaged by the chemical company for the period 24 July to 2 August 2009
- Information on caustic soda and tank cleaning procedures from various chemical companies
- Reports of the port state controls carried out
- Tank cleaning guidelines of the ship operator for the entire fleet
- Investigation records of Waterway Police Cuxhaven
- Excerpts from the European Chemical Substances Information System (ESIS) of the European Commission
- Various safety data sheets for 50% sodium hydroxide
- Operation logs of the Stade Fire and Rescue Coordination Centre and the Stade Volunteer Fire Brigade
- Product information and user manual of the pump manufacturer
- Chart of the Federal Maritime and Hydrographic Agency