



Bundesstelle für Seeunfalluntersuchung
Federal Bureau of Maritime Casualty Investigation
Bundesoberbehörde im Geschäftsbereich des Bundesministeriums
für Verkehr, Bau- und Wohnungswesen

Investigation Report 155/04

Very Serious Marine Casualty

Collision
MV PUDONG SENATOR
with
MT ENA 2
and subsequent capsizing of
MT ENA 2
on 28 June 2004
in the Port of Hamburg
Parkhafen Waltershofer Hafen
and Petroleumhafen

15 June 2005

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 24 June 2002.

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

The German version shall prevail in the interpretation of the Investigation Report.

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1 SUMMARY OF THE MARINE CASUALTY

Shortly after 18:22 h¹ on 28 June 2004 the inland motor tanker ENA 2, designed to transport sulphuric acid, ran into the Parkhafen from the main Norderelbe navigation channel within the Port of Hamburg in order to continue further to the Petroleumhafen.

At the same time the container vessel PUDONG SENATOR departed from its berth at the Eurogate container terminal and was running out of the Waltershofer Hafen on its way towards Rotterdam.

The two vessels collided in the area where the Parkhafen opens into the Norderelbe. PUDONG SENATOR survived the collision without any major damage and after approval from the VTS Hamburg ran into the Elbe navigation channel and continued its voyage downstream along the River Elbe. Before Brunsbüttel it was checked by Waterway Police officers from a boat from the water. Since no further damage apart from paint abrasion could be seen, the vessel was allowed to continue the voyage to Rotterdam with the provision that it will be surveyed there by the Classification Society Germanische Lloyd.

The special transport vessel ENA 2 carrying a cargo of sulphuric acid was damaged on its port side. Parts of the outer plating in the foreship area were deformed, water flooded in to the forward port wing tank. In addition the port Schottel drive in the aft area became inoperable as a result of the collision with PUDONG SENATOR. However, ENA 2 initially remained floating, continued under its own power without losing cargo into the Petroleumhafen and tied up with a slight list to port at the intended berth. The Waterway Police and two fireboats of the fire brigade hurried to the damaged vessel.

An officer from the Waterway Police Hamburg² stated in his report that he noticed " a strong smell of alcohol on the breath" of the Master. The latter had not been in a position to provide "comprehensible information" about the course of the accident.³ His considerable blood alcohol level was subsequently confirmed by the blood sample that was immediately ordered.

The fire brigade tried in vain to keep ENA 2 floating; its list to port increased further. At about 19:05 h ENA 2 capsized and floated keel upwards in the port basin. Sulphuric acid now escaped.

In the following days a salvage firm secured and subsequently uprighted ENA 2. Owing to the highly aggressive cargo and the risk of explosion resulting from chemical reactions and the associated formation of dangerous gases, extreme care had to be exercised in the recovery and salvage measures. The salvage organised under the direction of the Hamburg Fire Brigade with participation by the owner, the operator, the superior port office, the Waterway Police and various sectoral authorities, was finally successfully completed in the evening of 3 July 2004 with the uprighting of ENA 2 and restoration of its floating capability. In the meantime a large part of the cargo had found its way into the port water. The rapid dilution of the acid there meant that the major environmental pollution initially feared did not materialise.

¹ All times in the report are local time = Central European Summer Time = UTC + 2h.

² Hereinafter referred to as WSP.

³ In the WSP assignment report it is stated literally: "Comprehensible information was not possible."

Thanks to the prudent direction and coordination of the salvage measures by the Hamburg Fire Brigade and the constructive cooperation of all the above named decision makers involved and other parties, there were no personal injuries within the framework of the very dangerous securing and uprighting of ENA 2.

2 SCENE OF THE ACCIDENT

Nature of the incident: Very serious marine casualty
 Date: 28 June 2004
 Time: approx. 18:22 h
 Place: Port of Hamburg:
 Area in which Parkhafen opens into the main navigation
 channel Nordereibe (location of collision)
 Petroleumhafen (location at which ENA 2 capsized)
 Latitude/Longitude: ϕ 53°32.2'N λ 009°54.2'E (approximate location of collision)

Excerpt from sea chart 3268, BSH

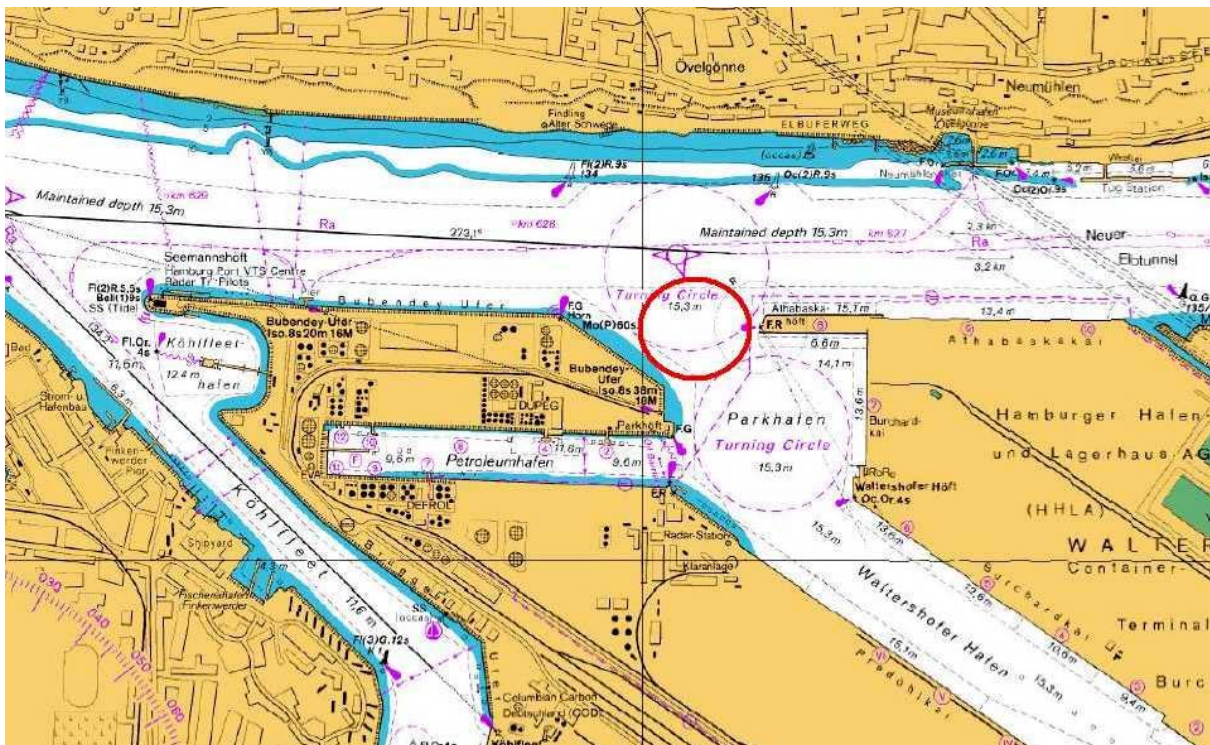


Figure 1: Scene of the accident

3 VESSEL PARTICULARS

3.1 Photo MV PUDONG SENATOR



Figure 2: MV PUDONG SENATOR

Directly after the collision with ENA 2 (Photo: Gyde Thönnessen)

3.2 Vessel particulars

Name of vessel:	PUDONG SENATOR
IMO number:	9141261
Type of vessel:	Container Vessel
Nationality/flag:	Federal Republic of Germany
Port of registry:	Rostock
Ship's call sign:	DQVI
Vessel operator:	Reederei F. Laeisz, Rostock
Year built:	1997
Building yard / building number:	Hyundai Heavy Industries Co., Ltd. / 1006
Classification society:	Germanischer Lloyd
Length overall:	294. 09 m
Width overall:	32. 20 m
Draft:	12. 55 m
Freeboard:	4. 385 m
Gross tonnage:	53,324 gt
Deadweight:	63,551 t
Engine rating:	41,040 kW
Main engine:	HHI Co., Ltd. Engine&Machinery Division/Type 9K90MC-C
Speed:	23.7 kn
Number of crew:	25 + 2 (port and Elbe pilot)

3.3 Photo MT ENA 2



Figure 3: MT ENA 2

shortly after the collision with PUDONG SENATOR (Photo: Gyde Thönnessen)

3.4 Vessel particulars

Name of vessel:	ENA 2
Official ship's number:	5101140
Type of vessel:	(Inland) Motor Tanker, type N open
Nationality/flag:	Federal Republic of Germany
Port of registry	Hamburg
Registration number	BSR No. 21088
Operator:	Hanseatische Tanklogistik HTL
Owner:	Norddeutsche Affinerie
Year built/year converted:	1972 / 1994
Building yard:	Brodogradiliste, Novi Sad, Yugoslavia
Conversion yard:	Hitzler Werft, Lauenburg, Germany
Ship's Certificate	No. HH 220, Central Ships' Inspection Commission No. H5058, Port Vehicle Certificate Superior Port Office Hamburg
Length overall:	62. 48 m
Width overall:	9. 52 m
Draft:	2. 62 m
Deadweight:	1000.197 t
Cargo tank volume:	4 x 125 m ³
Engine rating:	480 kW
Main engine:	2 x Schottel ruder propeller
Speed:	10 kn
Number of crew:	2

4 COURSE OF THE ACCIDENT

4.1 MT ENA 2

ENA 2 was built in 1972 as a non-self-propelled tank barge. In 1994 it was converted, equipped with two Schottel rudder propeller gears, a wheelhouse and all the necessary nautical installations, and since then has been able to run under its own power. To this end it was inspected by the Classification Society Germanische Lloyd, both as regards the navigational and technical equipment and as regards the safety of the inner tanks. The vessel was re-registered in the inland ship's register as a motor tanker, type N open, on 17 October 1994. On 25 September 2002 Germanische Lloyd inspected ENA 2 on behalf of the Inspectorate Commission Hamburg to extend the validity of the Ship's Certificate and as a result of the inspection the validity of the Certificate was extended up to 31 July 2007. The last annual survey prior to the accident was conducted in September 2003 and no restrictions or objections were ascertained by the class side.

ENA 2 was used primarily for transporting sulphuric acid in the Port of Hamburg. The acid is conveyed from Norddeutsche Affinerie⁴, where it is generated as a by-product of copper production, to the Petroleumhafen. There the acid is collected in large tanks and kept in intermediate storage before it is conveyed further via other transport media. In addition ENA 2 also transported sulphuric acid as far as Brunsbüttel, or delivered the cargo directly to seagoing vessels.

Together with its sister vessel ENA 1, four such trips were performed each day on average, carrying up to 960 t 96 % sulphuric acid in each case. According to the ADNR⁵, at 97 % this corresponded to the maximum admissible tank filling level. On average it took two to three hours to load the vessel at NA and the subsequent transport to the Petroleumhafen took about 60 minutes; discharge there took a further two to three hours on average.



Figure 4: Voyage route of ENA 2 in the Hamburg Docks

⁴ Hereinafter referred to briefly as NA.

⁵ Regulation on the conveyance of dangerous goods on the Rhine (ADNR), Chapter 3.2, Table C.

In the week before the accident the Master and deckhand were assigned to the early shift. On Monday, Tuesday, Thursday and Friday they worked from 06:00 h to 14:00 h during the day and on Wednesday and Saturday from 08:00 h to 17:00 h on ENA 1 or ENA 2. They had Sunday free. On the day of the accident (Monday, 28 June 2004) the Master and deckhand were to start their duty (late shift) on ENA 2 at 14:00 h.

According to the statement by the two crewmembers the empty ENA 2 was taken over at Holthusen kai. In view of the water level conditions the vessel had been berthed there and not at the premises of NA because the freeport bridge could not yet be passed. The Master and deckhand had been taken to the berth by the Inspector, driven using a vehicle belonging to the operator, and had gone on board at about 14:30 h.

After a brief hand-over at the wharf, the vessel had first been checked. Since everything had been in order and the water level conditions had changed in the meantime, the vessel had then steered towards the berth Tank 9 at the company grounds of NA. Loading of the vessel had started there at about 15:00 h. After completion of the loading work the vessel had left the berth at about 17:30 h with 960 t sulphuric acid on board.

4.2 MV PUDONG SENATOR

The container vessel PUDONG SENATOR built in 1997 runs into Hamburg regularly in a three-month rhythm on its round trips and moors at Waltershofer Hafen. The Classification Society is Germanische Lloyd. The class was renewed in 2002 and the most recent annual checks were carried out on 27 June 2004. The vessel had been regularly surveyed by Port State Control authorities throughout the world; it was never put on the chain. During its stay in port on 27 and 28 June 2004, PUDONG SENATOR was lying with its port side alongside at berth 5 and 6 of the Predöhl Wharf in the direction of traffic for running out. After completing the loading work at 17:50 h on 28 June 2004 the stations on board were manned and the aft tug CONSTANT was made fast; all lines were loosened at 18:06 h. At 18:07:40 h CONSTANT was informed that the voyage could start, which the tug confirmed.⁶

4.3 Development of the collision

In addition to the radar records of the VTS Hamburg Port Traffic⁷, the records of the electronic chart system⁸ of PUDONG SENATOR and the statements by witnesses, the evaluation of the radio communication documentation was of major importance for reconstructing the course of the accident. Since the communication between the participating vessels themselves and between the vessels and the VTS is considered in more detail below within the framework of analysing the marine accident (see Section 6 of this report), a general overview of the organisation and tasks of the VTS is set out below for better understanding (4.3.1). After this the rules for handling radio traffic in the Port of Hamburg (existing reporting obligations, radio channels to be used) are explained (4.3.2). The concrete course of the accident is then described with the aid of the above sources (4.3.3).

⁶ Source: Radio documentation VHF Channel 74 VTS Hamburg.

⁷ Hereinafter referred to briefly as VTS.

⁸ Installed Electronic Chart System (ECS): TRANSAS MARINE NAVI-SAILOR 2400.

4.3.1 Organisation and tasks of the VTS Hamburg

The VTS is one of three departments of the Navigational Centre of the Superior Port Authority of the Free and Hanseatic City of Hamburg; the further departments are the Port Operations Office and the Radar Control. The tasks of the Port Operations Office also include management of berths and tide windows. The Radar Control is manned in cases of reduced visibility or when specially requested by a sea-going vessel, by one to at most six port pilots and supports the pilots and vessel commands in navigating in the port area. Since visibility was very good at the time of the accident the Radar Control was not manned.

The VTS performs information, traffic surveillance and traffic regulation services with a view to guaranteeing the safety, ease and environmental compatibility of shipping traffic and to prevent dangers and environmental impairment emanating from shipping. Regularly one Master Mariner on Duty and one Navigator are commissioned with handling services in the VTS. These two Master Mariners have 14 radar stations available in the area of the Port of Hamburg for radar surveillance. Depending on the relevant traffic situation, the Master Mariners decide which radar images will be switched to the altogether four computer screens of the VTS. Priority is granted accordingly to the port area with the most critical traffic situation and/or the largest incidence of traffic.

4.3.2 Preliminary remarks on radio communication in the port of Hamburg

In accordance with § 8 of the Regulation on the Traffic in the Port of Hamburg and on other Waters (Port Traffic Regulation - German acronym HVO) the seagoing vessels and the inland vessels equipped with VHF designated by the Superior Port Office have to report positions in German when entering and departing and when shifting in the port. These reports with details of the name and direction of travel must be made on VHF channel 74⁹ and cover casting off in the Port of Hamburg, leaving a port basin or navigation channel, crossing a navigation channel, and passing fixed points within the Port of Hamburg. In addition seagoing vessels must report to the VTS on VHF channel 14¹⁰ when passing the Hamburg State boundary on entering and leaving and on making fast and casting off in the Port of Hamburg.

The Master Mariner on Duty and the navigational assistant monitor the two VHF working channels 14 and 74 in the VTS. As with the radar surveillance, the Master Mariners in the VTS must necessarily set priorities. Channel 74 is the working channel for all vessels moving in the port area, especially also for the large number of relatively small vessels and their communications with each other. Channel 14 on the other hand is used primarily by seagoing vessels entering and leaving and serves mainly for the targeted exchange of information between the VTS and the relevant vessel. Accordingly channel 14 has priority for the Master Mariners of the VTS when performing their tasks.

⁹ Radio channel intended for both vessel-to-vessel and for vessel-to-land communication; works in Simplex process, i.e. transmission and receiving on one and the same frequency.

¹⁰ Ship-to-land channel, works in Duplex procedure, i.e. transmitting and receiving on two different frequencies, the transmission frequency of the ship's radio station(s) corresponds to the receiving frequency of the coastal radio station and conversely. Accordingly direct ship-to-ship communication is not technically possible via this channel.

4.3.3 Collision development MT ENA 2 – MV PUDONG SENATOR

At **18:08:00 h**¹¹ PUDONG SENATOR reported on VHF channel 74 that it was casting off from Predöhl Wharf 5 and leaving.

The inland motor tanker ALMERODE was on its way from the Köhlbrand into the Norderelbe and onto the Parkhafen and into the Petroleumhafen. At **18:09:00 h** ALMERODE issued a corresponding announcement on channel 74. At this time it was running a few minutes before ENA 2.

At **18:14:00 h** the VTS called PUDONG SENATOR on channel 74 and informed it, *"Yes, if you start, everything free outside. Nothing coming up at the moment."* PUDONG SENATOR answered that it would then start. The Captain had understood that everything was free and that he was therefore permitted to run into the Elbe estuary waters. Later the Captain could no longer remember the precise wording of the permission, especially that the information "everything free" only related to the upcoming traffic. The casting off manoeuvre was carried out with the support of the aft tug CONSTANT using the bow thruster. Directly after the vessel was free from the large container vessel HANJIN BRUSSELS lying ahead, the main engine was set to "dead slow ahead" at **18:15:14 h**.

At **18:15:20 h** ALMERODE again reported on channel 74 that it was now running in from above into Parkhafen. Shortly after that at **18:15:50 h** ENA 2 gave the new tug pier as its current position on the same channel, stating its own vessel name, and also announced that it intended to run into the Parkhafen from above.

At **18:17:00 h** the Master of ENA 2 called ALMERODE *"ALMERODE, are you coming in there?"*, which the latter confirmed with the answer *"ALMERODE coming in and continuing to the Petroleumhafen"*. The radio traffic recording contains an announcement directly after this by the Master of ENA 2 *"Yes, ok. Me too, behind you."*

However, it should be noted that in both radio calls the Master of ENA 2 did not give his own vessel name when calling, neither for the question addressed to ALMERODE nor subsequently when he said that he was following ALMERODE.

After the assistant tug CONSTANT had supported PUDONG SENATOR in casting off, it was dismissed from the tug operation by the port pilot of the container vessel at **18:17:20 h** and instructed to run with the vessel and "make lee conditions"¹² for the change of pilot. Accordingly CONSTANT took up a position starboard aft of PUDONG SENATOR.

ALMERODE had crossed Parkhafen and reported at **18:18:00 h** on channel 74 that it was now running into the Petroleumhafen.

At **18:18:45 h** the main engine of PUDONG SENATOR was switched to "slow ahead" in order to ensure steerability in the prevailing west wind with forces of 6 to 7 Bft.

The Captain states that shortly after that he made out some motor barges coming from starboard. The Captain had evidently not heard the aforementioned announcements by ALMERODE and ENA 2 that were demonstrably issued, since in

¹¹ The times printed in bold face in this section originate from the radio records of the VHF channels 14 and 74 of VTS Hamburg Port Traffic and the manoeuvre recorders of PUDONG SENATOR, unless stated otherwise.

¹² The tug was to position itself in such a way that the pilot boat was in the wind lee so that this would facilitate the crossing over of the pilot.

his report submitted to the BSU he states that the subject vessels had not been announced via VHF.

Apart from ENA 2, whose name was still unknown to the Captain at this point, he states that the motor barges had changed their courses or had remained on clear-going courses. However, ENA 2 had steered a collision course and maintained this.¹³ Accordingly nor did the Captain hear the announcement by ENA 2 on channel 74 at **18:19:00 h** *"ENA 2 on the 136 from above into the Parkhafen, after this Petroleumhafen"* that must have occurred at exactly the same time as the optical perception of the tanker by the Captain.

The pilot's details surrounding the course of the accident in his report, especially on the time sequence, can only be partly brought to coincide with the actual (time-based) happenings.¹⁴ However, it should be noted that the events occurred altogether in a very narrow time corridor. There were only 14 minutes between casting off and the collision. In particular it should be taken into account that the casting off manoeuvre as such for a vessel of the size of PUDONG SENATOR required maximum concentration on the part of both the pilot and the Captain with the necessity of keeping clear of the container vessel HANJIN BRUSSELS at the berth ahead and the tightness of the navigation channel available. The subsequent memory capacity concerning the accident incident as well as the question as to what information was actually registered and taken into account at the time of the accident must be considered under this aspect.

By contrast with the Captain, the pilot of PUDONG SENATOR understood the announcement by the VTS, "everything free", including the subsequent restriction properly, since in his report he expressly points out that he had been informed by the VTS that the Elbe was free from below!

After the tug was cast off the pilot announced at **18:19:30 h on channel 74** that he would "shortly" be departing from the Parkhafen.

According to the information he supplied, the pilot did not hear the above-cited position reports of ENA 2 at **18:15:50 h** and **18:19:00 h** before this time, even though he stressed that he could hear channel 74 without restriction at any time. However, he had noted the aforementioned announcement by ALMERODE at **18:17 h** that it would be turning into Parkhafen and on to Petroleumhafen, including the following announcement by vessel travelling downstream, initially unknown to him, that it would follow ALMERODE. The pilot had subsequently identified ENA 2 through his binoculars, but did not initially address it directly. The reason for this was the warning he also heard at **18:19:10 h** on channel 74 that was evidently addressed to ENA 2 by a vessel unknown to him, *"big one coming out!"*. This warning was repeated at **18:19:50 h**. Whereas during the first warning neither a transmitter nor a receiver had been expressly stated, during the second call the Master of ENA 2 was contacted by his first name. However, once again no vessel names were transmitted.

The pilot further declared in his report that by way of precaution he had observed ENA 2 without interruption. It was only when he ascertained a standing bearing

¹³ In the comment of the draft of the present report the Master stressed as a supplement that the optical perception of ENA 2 was only possible at about **18.20 h**, since before this ENA 2 had been in the part of the Norderelbe hidden by the Athabaska wharf and the vessel made fast there. Moreover at this time ENA 2 had still been in the process of turning to port so that initially its collision course that became evident subsequently could not have been recognised.

¹⁴ Cf. in detail under point 6.2.2.

between the stems of the two vessels of 400 to 500 metres and no countermeasures by ENA 2 had been evident that he had addressed the tanker on channel 74 and asked what it planned to do. According to the radio records the call "ENA 2, *what's up then?*" was made at **18:21:40 h**.

The Captain of PUDONG SENATOR had also initially not estimated the approaching approximation of the two vessels as a particular danger situation. He states that the pilot had conducted radio traffic via VHF of which the details had not been comprehensible to him, the Captain, but the pilot had explained to him that he had called ENA 2 three times via VHF, but that the latter had not responded. Apart from the above cited call by the pilot at **18:21:40 h**, however, no further attempts to establish contact by PUDONG SENATOR can be noted from the radio record before or afterwards.¹⁵

In direct time-based connection with the call at **18:21:40 h** measures were taken actively on the bridge of PUDONG SENATOR to counteract the acute risk of collision now recognised. Several short sound signals were issued with the typhon. The engine was initially switched to "dead slow ahead" at **18:21:39 h** and then to "stop" at **18:21:59 h**.

Shortly after this the two vessels made contact in the forecastle area on the starboard side. According to the Captain, this could be perceived on the bridge, but could not be seen optically even from the starboard wing.

The damage configuration on ENA 2,¹⁶ the situation of the vessels in relation to each other before and in particular after the collision, and the testimony by the Master of the aft tug CONSTANT indicate that the port side of ENA 2 slipped along the starboard side of PUDONG SENATOR before the two vessels came free of each other again, lying parallel with each other with the same direction of travel (cf. Fig. 2).

The Master of ENA 2 pointed out in his written statement on the marine casualty written for the BSU that he orientates his approach manoeuvre towards Parkhafen to the relevant traffic and current conditions on the Elbe. On the day of the accident, shortly before reaching the entrance to Parkhafen he had steered towards the centre of the navigation channel, slowed down and started to turn into the Parkhafen. In view of the outgoing tide that offset him downstream on the Elbe, it had been necessary to start to turn in in good time. A further vessel had been running starboard ahead on his side of the navigation channel, but in the relevant section there had been no other vessels on the Elbe, in particular no oncoming traffic. The Master stressed that from his point of view it would have been possible to enter without any problem. Because of the good visibility he had not had the radar switched on. Since he had not received any answer to his announcements on channel 74, there had been nothing in the way of his course. Nor had the VTS contacted him.

When the Master had the tip of the Athabaskahöft athwart during his turning in manoeuvre on the Elbe, he had been able to see into the rear area of the Parkhafen

¹⁵ According to the comments on hand and in so far coinciding by the pilot and the Captain concerning the draft of the Investigation Report, the alleged three calls by the pilot had been a misunderstanding. Instead it was correct that there had been altogether three calls addressed to ENA 2, two by unknown vessels and one by the pilot himself.

¹⁶ For further details cf. Section 5.

from his wheelhouse and had now been able to make out the bow of the PUDONG SENATOR. He had immediately discontinued the entrance manoeuvre since he had recognised that the container vessel would not leave the necessary space for him in this respect. He had immediately turned "helm hard to starboard" with the two Schottel drives, increasing the speed of the two Schottel drives. In this way he had intended to absorb the turn to port of his vessel and turn ENA 2 hard to starboard. The aim had been not to cross the course of PUDONG SENATOR any more, but to turn away to starboard in front of the vessel.

However, shortly after this the Master realised that the starboard manoeuvre would no longer be able to prevent the collision and so had switched the Schottel drives to "full astern" in order to keep the foreship free of the container vessel. However, it had no longer been possible to avoid the collision since PUDONG SENATOR had continued with unaltered speed.

The concrete collision incident was not perceived immediately by the vessels in the vicinity or by the VTS, as is apparent from the radio records:

The aforementioned HANJIN BRUSSELS reported shortly before the collision at **18:20:40 h** that it proposed to cast off from the berth Predöhlkai 7 to leave and received the answer from the VTS, *"If you come out straight away, it looks good for you at the moment, nothing happening outside."*

The Elbe ferry REEPERBAHN, coming from Köhlfleet, was travelling upstream on the Elbe and passed the exit from Parkhafen at the time of the accident. At **18:22:30 h** the REEPERBAHN called, *"The vessel out of Parkhafen, the ferry REEPERBAHN is going right across to the North".*¹⁷ PUDONG SENATOR answered, *"The one coming out of Parkhafen is PUDONG SENATOR"* and then asked, *"Can you see ENA 2 on my stem?"* REEPERBAHN answered *"On the stem? I can't see anything there."*

The Master of the aft tug CONSTANT had observed the collision from the standby position, starboard aft of PUDONG SENATOR.

According to the information he supplied, PUDONG SENATOR had been roughly in the middle of the turning circle in Parkhafen when ENA 2 had entered the Parkhafen coming from the direction of Athabaskahöft from the Elbe with course towards the Bubendey shore. PUDONG SENATOR had already picked up speed. The Master of CONSTANT had noticed that ENA 2 tried to cross the course line of PUDONG SENATOR. Directly after this there had been a frontal collision with the forward third of the port side of ENA 2. The latter had folded towards the starboard side of the large vessel and then the port Schottel drive at the stern of ENA 2 had been deformed. Shortly before and during the collision the pilot had called ENA 2 and asked what it was doing there.¹⁸ After the collision ENA 2 had come free again within Parkhafen and had announced via channel 74 that it would run to the Petroleumhafen and make fast there. Since no emergency call had been issued, CONSTANT had passed ENA 2 and continued to run with PUDONG SENATOR as planned.

¹⁷ what is meant here is the Northern navigation channel side of the main navigation channel.

¹⁸ See the above-cited call at **18:21:40 h**.

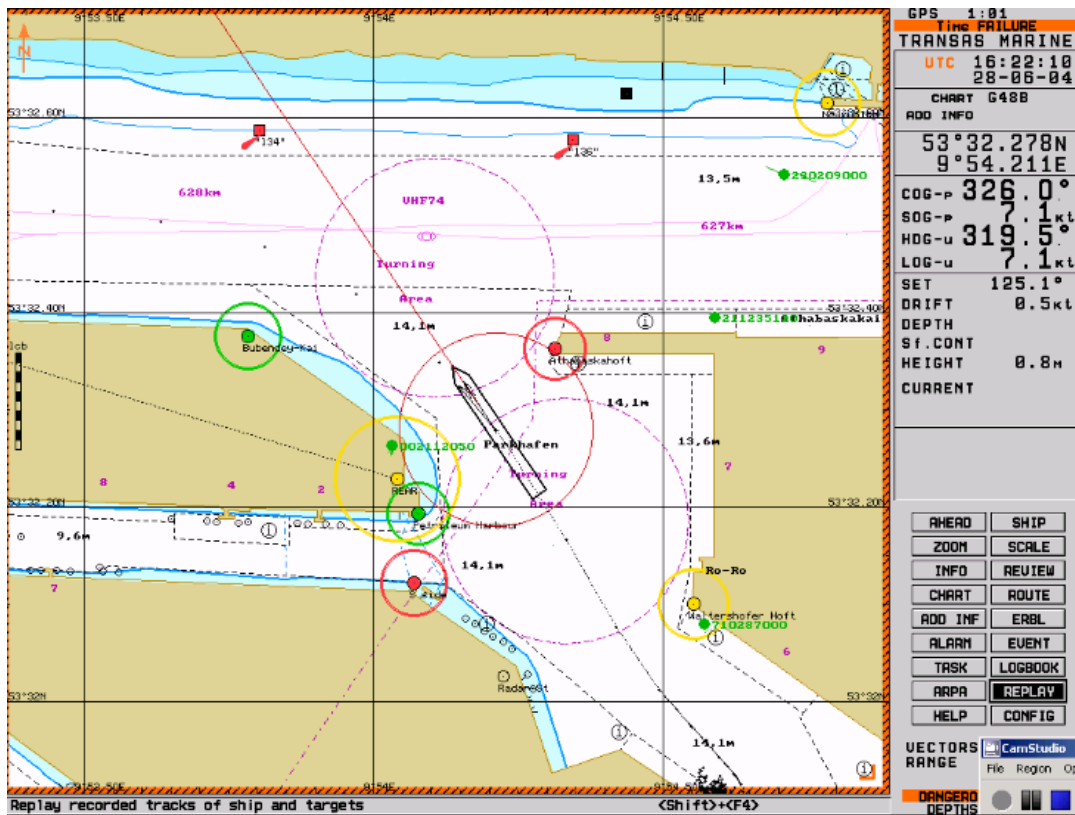


Figure 5: ECS of PUDONG SENATOR shortly before the collision

At **18:23:10 h** the port pilot of PUDONG SENATOR informed the VTS on channel 14 that ENA 2 had just run in front of their stem. In response to enquiries by the VTS, *"Did you have contact? Could you ascertain anything?"* the pilot answered, *"Yes, reportedly slight contact in the foreship, I can't see him any more"*. The VTS informed PUDONG SENATOR that it would look into the matter and instructed the vessel at **18:23:30 h** to first continue. After this the engine of PUDONG SENATOR was ordered to "dead slow ahead" and the vessel continued to turn out of the Parkhafen.

At **18:24:40 h** HANJIN BRUSSELS asked ENA 2 on channel 74 whether it was staying in the entrance. Die ENA 2 answered that it intended to run into the Petroleumhafen in order to clarify everything else there with the Waterway Police. At **18:25:00 h** the VTS called ENA 2, requesting it to call in on channel 14. ENA 2 countered that it first wanted to berth. The VTS permitted this, and at the same time asked the vessel to report on channel 14 after tying up.

At **18:26:50 h** PUDONG SENATOR again called VTS on channel 14 to announce that ENA 2 was still drifting in front of the Parkhafen. The VTS replied that it would continue to observe ENA 2 and informed PUDONG SENATOR at the same time about some smaller vessels of the Bubendey Shore. The port pilot answered that he was already on the Elbe, whereupon the VTS replied, *"Ah, sorry. I thought you were just still inside."* (Note: the Master Mariner on Duty in the VTS had probably confused PUDONG SENATOR briefly with the following HANJIN BRUSSELS, since at the time in question the latter was inside Parkhafen.) The VTS confirmed again that it had ENA 2 under control, whereupon PUDONG SENATOR finally continued its way downstream on the Elbe.

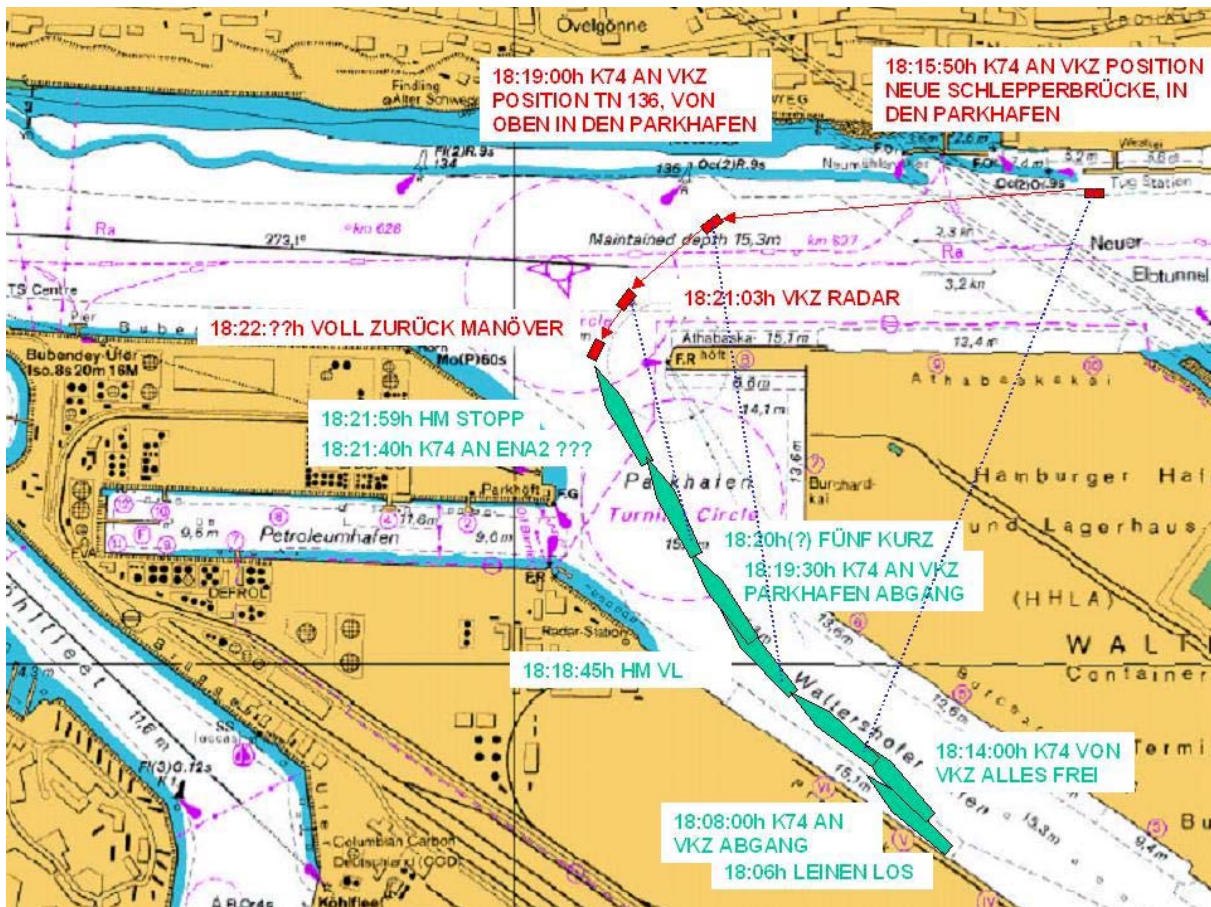


Figure 6: Overview of course of collision

At roughly the same time ENA 2 was called by two other vessels who asked what it was doing since it was turning backwards and forwards. ENA 2 confirmed in turn that it intended to turn into the Parkhafen and then to run into the Petroleumhafen.

In the meantime the Chief Officer on board the departing PUDONG SENATOR had been commissioned to assess the damage, but apart from paint abrasion nothing else had been ascertained. During the running check of the ballast water tanks on the starboard foreship, no changes had been evident.

An attempt was made to discover the extent of the damage on ENA 2 directly after the collision as well. For this purpose the deckhand had been instructed to check all the holds for any water intake and cargo spillage (acid). During this time the Master steered ENA 2 into the Parkhafen with the still operable starboard Schottel drive and then into the Petroleumhafen to the proposed berth.

4.4 Capsizing, cargo loss and salvage of ENA 2

At about **18:40 h** ENA 2 had made fast at Pier 1 in the Petroleumhafen with its starboard side alongside and initially with only a slight list to port. Directly after this the fire fighting boat OBERBAURAT SCHMIDT (LB 11) with three fire officers reached the damaged vessel and made fast aft alongside ENA 2 with two lines.

One officer crossed over to the tanker. There the deckhand was still engaged in checking the wing tanks for possible damage, having started to do this directly after the collision on the instruction of the Master; he had interrupted this work in the meantime due to the berthing manoeuvre. The Master of ENA 2 checked the wing tanks in the aft ship area for leaks after berthing and to this end opened the relevant entrance hatchways; he also checked the engine room. He was unable to ascertain any flooding in either case.

The fire officer accompanied the deckhand during the check of the entrance hatches to the wing tanks on the port side that were let into the side deck. Since the side deck was already 30 cm below water, they crossed the cargo tank deck to get to the foreship. After opening the forward-most entrance hatch to the wing tank on the port side the officer noticed noises of flow there and saw liquid in the hatchway. In the meantime at about **18:48 h** the fire fighting boat BRANDDIREKTOR KIPPING (LB 35) manned with nine firemen had reached ENA 2 and went alongside on a level with the open hatch entrance. The unit leader of fire fighting unit 35 assumed the command of the assignment. Two electrical immersion pumps were passed over to the officer acting on ENA 2 by LB 35 in response to his request. The immersion pumps were let down into the wing tank through the opened entrance hatch. Work commenced immediately on draining the tank chamber. According to the statement by the master of ENA 2, draining measures had not been started immediately after the collision by the vessel using its two firmly installed drainage pumps (location: port side deck midships and engine room). He justified this subsequently vis-à-vis the BSU by stating that directly after the collision it had not yet been clear at all whether there had in fact been any flooding or a leak in the acid tanks. After he had reached the berth and the leaky wing tank was located, the fire brigade had immediately started with its drainage measures. For the rest it would have been necessary to start a generator to operate the pump(s). In the meantime, however, the gate valve and shortly after that the switch of the large drainage pump on the port side side deck had already been under water.

At the same time as work started on bringing over the (external) drainage pumps, a further fire officer had crossed onto ENA 2 from the shore in order to determine material information about the cargo. At the same time as LB 35, two patrol boats of the Waterway Police (ELBE 20 and ELBE 39) arrived at the berth of ENA 2. Work commenced on police investigations. During initial questioning of the Master of ENA 2 by the Waterway Police for information purposes, one police officer ascertained the strong odour of alcohol on the Master's breath. The officer thereupon returned to the police boat in order to pick up the alcohol test device.



Figure 7: Entrance hatchway, wing tank

After the two immersion pumps had been started, further drainage measures were prepared from on board LB 35. However, these had to be discontinued because the list of ENA 2 became increasingly strong and was ultimately so great that the opening of the entrance hatch to the wing tank was flooded by port water. The assignment commander on board LB 35 recognised the acute danger of capsizing and immediately ordered evacuation of the vessel and withdrawal of the fireboats. The two firemen still on board subsequently stated that they had to call on the Master vigorously to leave ENA 2 together with them. Ultimately, however, the Master followed instructions and also proceeded to the ladder on the sheet piling of the wharf wall. This could be reached from the vessel via a gangway ladder. The Master managed to reach safety at the last moment with the assistance of the officer who had left the vessel over the sheet-piling ladder directly before him, before ENA 2 began to capsize. The fire assignment commanding officer subsequently estimated the time between the start of water flowing into the entrance hatch of the wing tank to complete capsizing at about 30 seconds.

The fire officers have stated that there had been no escape of acid up to the time ENA 2 capsized. Neither chemical reactions nor odours had been noted. Bubbles had only risen to the surface midships on the port side after the vessel had capsized completely. Now the typical sulphuric acid odour had spread too and dead fish had drifted upwards. Vigorous reactions of the water with the acid (known as "boiling water") had been evident in the area concerned. The gases released caused respiratory tract irritations in 11 persons, making medical treatment necessary. During subsequent investigation of the capsized ENA 2 by divers it was ascertained that of the altogether four hatches of the two forward cargo tanks, one tank hatch was open. All the hatches of the aft cargo tanks (see below Figure 8 No. 1 and 4) were properly closed. It remained unclarified, especially due to the not very productive testimony, whether the tank hatches had only opened after capsizing or

whether they were opened within the framework of ascertaining the damage after the collision and not closed again. It is also conceivable that the hatch covers in question had not been properly bolted already prior to the collision. The latter assumption contradicts the statement by the Master and the deckhand of ENA 2, however, as both stressed that bolting was expressly specified by the operator and was therefore regular practice. Moreover the fact that the hatches of the two aft tanks were all properly barred initially indicates that the forward hatches were still closed, at least during the passage.

Since the two forward tanks thus provided relatively large exit apertures for the acid, it can be assumed that the cargo in them (approx. 480 tonnes) escaped within a brief period after capsizing, or was mixed very strongly with river water inside the tank. The acid in the two aft tanks could only escape via the ventilation sockets and mix with river water, however. The complete exit cross section of the altogether four ventilation sockets (cf. Figure 8 No. 2) was approx. 100 cm². This corresponds to about 1.4 % of the altogether four hatch openings of the two aft tanks. Accordingly the product must have escaped steadily over a period of several days from the time of capsizing.

After the capsizing of ENA 2 priority was given to safe salvage of the inland motor tanker that was floating keel upwards by the overall assignment command of the fire brigade coordinating the salvage measures and all other parties involved (Waterway Police, Superior Port Office, salvage firm, owner and operator of ENA 2, environmental authority). The floating crane ENAK was requested from Bremerhaven to perform the salvage and arrived late in the evening of 29 June 2004.

On assessing the danger, two main risks had to be weighed against one another, on the one hand the spillage of further cargo with the chemical reactions to be expected and the associated possible harm for health and the environment, and on the other hand the explosive hydrogen-air mixture forming in the tank atmosphere. The acid on board was the so-called "clean" sulphuric acid, in particular without any arsenic components. Accordingly, even if relatively large quantities escaped there was no toxic danger, but a strong danger of burning irritation. The risk assessment revealed that the far more serious consequences could be expected from an explosion. As a result of chemical reactions, hydrogen had been released in the cargo tanks. Mixing of the hydrogen with oxygen led to gas bubbles being formed inside the cargo tanks, the exact size and composition of which was neither known, nor could it be estimated. At any rate the possibility that the hydrogen concentration necessary for forming a highly explosive gas mixture might be within the relative range of between 4 and 75% could not be ruled out.

Further risks were seen to be breaking up of the vessel during turning due to structural weaknesses and promoted by corrosion¹⁹ and the possible leakage of fuel²⁰ from the fuel tanks and the bilges. As a preventive measure oil barriers were brought out by the oil combat vessel WILM and the fire fighting boats. It was possible to eliminate the explosive gas bubbles that had formed in the cargo tanks by blowing nitrogen in, that displaced the gas containing hydrogen from the tanks.

¹⁹ When the originally highly concentrated sulphuric acid is mixed with port water, a sulphuric acid liquid results that has corrosive properties at a concentration of less than approx. 75%.

²⁰ At the time of the accident there was about 3 t gas-oil on board ENA 2.

With the evening high tide at about 18:00 h on 3 July 2004 the damaged vessel - in which freedom from gas had been ensured in the meantime - was turned in controlled fashion with the assistance of the two floating cranes ENAK and WAL.

After the vessel was uprighted there was still liquid containing sulphuric acid in the aft cargo tanks and in the wing tanks of ENA 2, altogether about 130 t liquid with about 8 to 10 t sulphuric acid in it. This sulphuric acid mixture was pumped out and the tanks were subsequently flushed and ventilated in order to make them free of gas. Furthermore all the lubricating oil and fuel tanks were pumped empty and subsequently sealed.

At about 10:00 h on 4 July 2004 the salvage company returned ENA 2 to the owner in floating condition; the vessel was oil-free and gas-free and a gas-free certificate was issued. In view of the sulphuric acid liquid ascertained in the wing tanks too outside the cargo tanks, it was decided to tow ENA 2 into the Muggenburger Canal and rinse out the hull since the contaminated water resulting could be disposed of as waste properly there. On 7 July 2004 the damaged vessel was towed to the Grube Yard in Moorfleet and made dry there.



Figure 8: Tank apertures ENA 2²¹

1. **Inspection hatches**: one per cargo tank, no regular entrance into the tank, specified as second tank aperture when work is in progress in the tank; are otherwise used for sampling and/or checking the filling level; are not to be closed during travel, but otherwise always during loading and unloading (according to a circular letter from the operator to all the crews).
2. **Ventilator with moisture filter**:²² two per cargo tank; only venting and bleeding possibility during loading and unloading, not lockable, permanently open, sulphuric acid could escape here from ENA 2 after complete capsizing.
3. **Sounding pipes**: one per cargo tank, always closed during loading and unloading, are opened after completion of loading, the tank content is sounded there with the sounding rod inserted.
4. **Hatch entrances**: one per cargo tank, with a ladder for entering the tank; are always to be kept closed during loading and unloading and during travel (according to a circular letter from the operator to all crews); are opened in the port for sampling and to check the filling level; one entrance each to the forward tank was open when the ENA 2 capsized completely according to the statement by the diver.
5. **Loading and discharge facilities**: one unit arranged midships for all four tanks, loading at NA (with shore pumps) and unloading in the Petroleumhafen with one Deep Well Pump each (blue) per cargo tank; via a pipe system designed as manifold on board; unloading in Brunsbüttel or directly to seagoing ships is carried out via hose connections port and starboard (cf. also Figure 9 bottom).
6. **Wing tank entrance**: two per wing tank, with ladder for entering the tank; these tanks serve for vessel stability and insulate the cargo tanks from the outer plating; one wing tank is as long as a cargo tank stretching up to midships below the cargo tank; no transverse bulkheads, no compensation with the opposite wing tank.

²¹ Photo section shows the rear part of ENA 2 after uprighting the capsized vessel; the forward part of the vessel not in the picture is also equipped with the same tank openings.

²² The moisture filter of the ventilator on the port side is missing (probably ripped out during salvage).



Figure 9: Loading/discharge facilities ENA 2²³

5 SUMMARY OF THE DAMAGE

5.1 Damage to MV PUDONG SENATOR

The collision could hardly be perceived from the bridge of PUDONG SENATOR. Even from the forecastle it was not possible to observe the actual collision since this occurred in the dead angle of the foreship. No persons on board the container vessel sustained injury.

The Elbe pilot departing at 21:35 h had noticed two slight dents on the starboard side of the foreship in the area of the waterline and just above it. At about the same time, just before Brunsbüttel, the Waterway Police instructed PUDONG SENATOR to have the class confirmed in Rotterdam as next port of destination. The Waterway Police also ran along the starboard side of the container vessel at 21:40 h. Apart from paint abrasion no further damage was discovered. On 30 June 2004 PUDONG SENATOR was surveyed by Germanischer Lloyd. The two dents in the area of the starboard wing tank No. 1 between frames 291 and 297 were confirmed and measured as 1600 x 700 x 25 mm and 1400 x 800 x 25 mm. In addition deformations of frames 354, 358 and 362 port were ascertained in the fore peak tank.²⁴ The damage is to be repaired permanently at the latest by renewal of class in June 2007.

5.2 Damage to MT ENA 2

The inland motor tanker ENA 2 collided with the foreship of the container vessel PUDONG SENATOR at its own port stem. The crew of ENA 2 did not sustain any personal injury. As a consequence of the collision the smaller vessel was pushed around, as a result of which the port aft vessel of ENA 2 collided with the sidewall of

²³ Photo taken after salvage of ENA 2; on the left-hand half of the picture (= port side of ENA 2) the salvage pontoon can be seen.

²⁴ These deformations are not connected with the collision.

the container vessel. The acid transporter was pulled along briefly by the large vessel and about two minutes later both vessels had come free of each other again.

Directly after the collision the drive house of the port Schottel rudder propeller was deformed on ENA 2 and several cracks and deformations occurred in the port foreship, but the cargo tanks remained undamaged. The Master managed to run into the Petroleumhafen under his own power. Indirectly as a result of the collision and the water flooding into the wing tank caused by this, ENA 2 capsized at its berth and was additionally heavily damaged.

Due to a chemical reaction between a part of the acid cargo and the port water during capsizing, eleven persons in the assignment forces and the surrounding port establishments sustained irritations. One injured person remained in hospital over night for observation, but all the other injured persons were discharged again after ambulatory treatment. In the evening of 2 July and in the morning of 3 July 2004 both staff of a surrounding port establishment and residents north of the Elbe perceived unpleasant odours. Seven staff members of the port establishment were examined briefly in hospital, but no poisoning was ascertained. Tracing troops of Police and the fire brigade examined the odour nuisance reported and were able to detect uncritical quantities of hydrogen sulphide in the atmosphere. Due to the prevailing wind direction, however, ENA 2 could be virtually ruled out as possible emitter. In the past odour nuisance had already been reported when the wind was blowing in this direction. Possible causing parties were a series of port establishments in the Port of Hamburg, but none could be clearly identified.

The salvage divers found the entrance hatches at the forward cargo tank starboard half open and at the forward cargo tank port completely open. In addition the aft cargo tanks of the vessel were open upwards via the airing and bleeding sockets. Nearly all the cargo of 960 t sulphuric acid had run out of ENA 2 that was floating keel upwards. Thanks to the buffer effect of the port water, however, no further violent chemical reactions resulted. The sulphuric acid did not contain any toxic components and thanks to the tidal exchange of water in the Elbe the acid was, moreover, quickly diluted to a harmless concentration. Environmental damage only occurred in a locally limited area in the Petroleumhafen in the form of fish dying. In the further area of the River Elbe no environmental damage was recorded. The damaged vessel did not lose any fuel or any other oily substances or residues.

In addition to the property damage caused directly by the collision, ENA 2 suffered further damage due to the capsizing. The port wing tanks, the engine room and the deck superstructures had been flooded with a liquid that contained some sulphuric acid. After capsizing, sulphuric acid liquid also formed in the cargo tanks. Beyond the water damage, this caused damage due to the corrosive properties of this liquid. Furthermore economic damage was sustained due to the position-dependent activation of the 1000 m-wide barred radius, which led to restrictions and downtime in the adjacent basin and for surrounding port establishments



Figure 10: Deformed port Schottel drive housing



Figure 11: Bridge of ENA 2



Figure 12: Deformation and cracking in the outer plating of ENA 2



Figure 13: Schottel rudder propeller

6 ANALYSIS

The analysis of the marine casualty first of all involves a detailed consideration of the traffic-law specifications applicable for the area of the Port of Hamburg and relevant for the accident, and their application to the concrete accident constellation (6.1).

Building on this, a summarising assessment of the findings achieved is provided in Section 6.2. This investigates the question as to whether and to what extent the infringements against prevailing traffic regulations ascertained caused the collision of the two vessels, and what other factors brought about the collision. Within the framework of the accident analysis we have deliberately only marginally considered the problem complex of whether the subsequent capsizing of ENA 2 that managed to reach the proposed berth in Petroleumhafen under its own power despite the collision could have been avoided (6.3). The reason is that for this it would have been necessary to consider the stability issues of ENA 2 much more deeply. However, since ENA 2 is an inland vessel, the legally defined investigation mandate and scope of BSU are restricted to this extent.

6.1 Transport-law specifications

6.1.1 Applicable law

The Port Traffic and Shipping Law of the Free and Hanseatic City of Hamburg takes priority in the area of the River Elbe within the State boundaries of Hamburg.²⁵

As a supplement both the national (Federal German) and the international shipping regulations are to be applied via § 21 Para. 1 No. 2 Port Traffic and Navigation Law²⁶ in conjunction with § 1 Para. 1 Port Traffic Regulations (HVO)²⁷, whereby the more specific regulation applies in each case. Accordingly the Seeschiffahrtsstraßen-Ordnung (SeeSchStrO – German Collision Regulations) and the International Regulations for Preventing Collisions at Sea²⁸ of 1972 are to be consulted for assessing the collision to be investigated here under traffic law conditions in as far as the Hamburg HVO does not contain any deviating regulations.

6.1.2 Right of way rules

The collision location was located at the transition from Parkhafen into the Norderelbe, roughly on the imaginary line between the two light beacons on the mole heads of Athabaskahöft and Bubendey Shore and thus in the mouth area where the secondary navigation channel Parkhafen opens into the main navigation channel Norderelbe, in accordance with § 4 Para. 1 HVO.

²⁵ Here: Port Traffic and Navigation Law, Regulation over traffic in the Hamburg Port and on other waters (Port Traffic Regulations), Port Vehicle Regulation, Regulation over qualifying certificates to leading port vehicles (Port Patent Regulation), Port Safety Regulation (HSVO).

²⁶ Directive authorisation, especially for regulating traffic. In the following we have waived stating the authorisation standard in each case to make the report more easily readable.

²⁷ Reference standard, in the following is considered to be in so far dispensable and has also been left out to promote better readability of the remarks.

²⁸ Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREGs).



Figure 14: Navigation channel limit

The fact that under § 1 Para. 1 HVO in conjunction with § 25 Para. 1 SeeSchStrO right of way regulations deviating from Rule 9 Letters b to d and Rules 15 and 18 Letters a to c COLREGs apply in the navigation channels of the Port of Hamburg is particularly important for assessing the right of way situation prevailing at the collision location.

Here it should be pointed out in particular that Rule 15 COLREGs, according to which in the case of two power-driven vessels which are crossing the vessel which has the other on her own starboard side shall keep out of the way, is over-ridden here.

6.1.2.1 Right of way of ENA 2 under § 25 Para. 2 SeeSchStrO?

According to § 25 Para. 2 SeeSchStrO, the vessels following the course of the navigation channel have right of way over the vessels running into or crossing the navigation channel, in so far over-riding the COLREGs. In § 20 Para. 3 No. 1 HVO it is specified as a **supplement (!)** to this regulation that vessels using the main navigation channel have priority over vessels coming out of secondary navigation channels.

ENA 2 was initially "using" the main navigation channel. However, it is questionable whether it was possible to assume "use" in the meaning of § 20 Para. 3 No. 1 HVO and a right of way based on this in conjunction with § 25 Para. 2 SeeSchStrO vis-à-vis PUDONG SENATOR that was indubitably coming out of the secondary navigation channel even when ENA 2 had started to turn in to the Parkhafen. At any rate, ENA 2 was now no longer following the course of the (main) navigation channel.

However, since § 20 Para. 3 No. 1 HVO is expressly a *supplementary* regulation that only refers to § 25 Para. 2 SeeSchStrO, which in turn only regulates the right of way of the vessels following the course of the navigation channel, it is to be assumed that "use" of the navigation channel in the meaning of § 20 Para. 3 No. 1 HVO can only be affirmed as long as a vessel follows the course of the navigation channel.

Accordingly ENA 2 no longer had a right of way to be based on § 20 Para. 3 No. 1 HVO in conjunction with § 25 Para. 2 SeeSchStrO when it turned into the Parkhafen, leaving the course of the navigation channel.

(Note: The thesis put forward in various comments on the draft of the present report and co-supported, § 20 Para. 3 No. 1 HVO represents a special ruling excluding § 25 Para. 2 SeeSchStrO and completely displacing the content of the regulation of § 25 Para. 2 and 4 SeeSchStrO in the entrance area of main and subsidiary navigation channels cannot be followed by the BSU. The clear wording of the introductory sentence of § 20 Para. 3 HVO speaks against this legal interpretation: "As a supplement to § 25 Para 2 of the Seeschiffahrtsstraßen-Ordnung the following rules apply for right of way..." The direction in § 25 Para. 4 SeeSchStrO with the right of way of vessels in the navigation channel set out there vis-à-vis those running into this navigation channel is on the other hand particularly not referred to in § 20 Para. 3 HVO.

The argument put forward that the collision (might) not have occurred in the main navigation channel Norderelbe at all, but instead in the secondary navigation channel Parkhafen, from which in turn a right of way of PUDONG SENATOR would result under § 25 Para. 2 No. 1 SeeSchStrO, must ultimately be rejected. It is basically correct there is a right of way within a secondary navigation channel in the Port of Hamburg via § 1 Para. 1 No. 1, § 4 Para. 1 No. 2 and Para. 2 HVO in conjunction with § 25 Para. 2 and Para. 4 SeeSchStrO for vessels in the (secondary navigation channel) vis-à-vis vessels running into this (secondary) navigation channel. However, the accident occurred here in the mouth area between a main and a secondary navigation channel. It is extremely difficult to reconstruct on what side of the boundary between the said navigation channels the point of collision of the two vessels was ultimately precisely located. However, the answer to this question is not crucial. It is evident from § 20 Para. 3 No. 1 HVO that the standard formulator in the Port of Hamburg intends to privilege the traffic using the main navigation channel vis-à-vis traffic coming out of the secondary navigation channel. Admittedly it is set out above that under § 20 Para. 3 No. 1 HVO in direct application to the marine casualty subject to investigation here, no right of way can be derived in favour of ENA 2 that was no longer following the course of the main navigation channel. However, this does not alter the fact that at any rate privileging of ENA 2 originally following the main navigation channel has a post-effect within the mouth area between the main and secondary navigation channel, at least partially (post-action sector). Interpreting this in the contrary fashion would lead to the existing rights of way being able to "change round" directly on an (imaginary) boundary line that is practically impossible to locate. This would not be compatible with practicable and safe traffic management in the boundary area between main and secondary navigation channels. Consequently the mouth area between the main and secondary navigation channel is to be classified as a post-action sector so that in so far ENA 2 is still to be considered (fictitiously) as travelling in the main navigation channel and PUDONG SENATOR as a vessel running into the main navigation channel.)

6.1.2.2 Right of way of ENA 2 under § 25 Para. 4 SeeSchStrO?

Under § 25 Para. 4 SeeSchStrO, vessels *in the navigation channel*²⁹ have right of way, irrespective of whether they are following the course of the navigation channel, over vessels running into this navigation channel from a tributary or navigation channel opening into it.

As was already the case above under the term "use", the question again arises as to whether ENA 2 was "in the navigation channel" in the meaning of § 25 Para. 4 SeeSchStrO and could derive a right of way for itself from this. It is difficult to answer this question initially because unlike the group of addressees of § 25 Para. 2 SeeSchStrO that is clearly determined by the formulation "vessels following the course of the navigation channel", the designation "in the navigation channel" is very broad and therefore appears to need interpretation in the overall context of the subject paragraph 4. Although the party issuing the regulation attempted to specify the formulation "in the navigation channel" more precisely by the subsequent clause "irrespective of whether they follow the course of the navigation channel", an interpretation of the regulation looking at this wording alone would not go far enough.

²⁹ Note: this also includes the post-action sector defined above.

HVO too does not contain any further aid for interpretation, since unlike Para 2 of § 25 SeeSchStrO that is expressly supplemented by § 20 Para. 3 No. 1 HVO and has thus been adapted to the conditions in the Port of Hamburg, there is no supplementary explanation in concrete terms for paragraph 4 within the HVO. An unrestricted right of way granted for vessels *in the navigation channel* irrespective of the nature and manner of *how* they move in this would however, contradict the meaning and purpose of § 25 Para. 4 SeeSchStrO. This regulation, that in turn represents a specialisation of Rule 9 COLREGs in conjunction with § 2 Para. 1 No. 1 SeeSchStrO serves to facilitate the fluidity of through-going traffic, especially in the interest of shipping dependent on tides.³⁰ However, it would contradict achievement of the said target if *all* vessel movements *in* the navigation channel were privileged without exception. All vessels that want to enter or leave this navigation channel must be enabled to assess the *entire* traffic happenings in the subject section reliably. Only then can they carry out their manoeuvres in accordance with regulations, maintaining any rights of way of other vessels.

(Note: The view expressed in a lawyer's comment on the draft of the subject report that § 25 Para. 4 SeeSchStrO could basically not be applied to the present encounter situation has a legal fault. The non-applicability of the said standard was justified as follows in the written statement:

§ 25 Para. 4 presupposes an encounter situation in which a vessel is within a navigation channel and another vessel is running into this navigation channel. Both ENA 2 and PUDONG SENATOR would have been in the same navigation channel however. This would result from § 4 Para. 2 HVO. It was set out there that all traffic ways and areas within the Port of Hamburg are navigation channels within the meaning of the Seeschiffahrtsstraßen-Ordnung. Thus both the Elbe and Parkhafen are one (and the same) navigation channel in the meaning of the Seeschiffahrtsstraßen-Ordnung. In the case of the collision to be investigated it was therefore not an encounter situation at all between a vessel within the navigation channel and a vessel running into this navigation channel.

The cause of the argumentation shown (and ultimately erroneous) is evidently a misapprehension of the ruling contained in § 4 Para. 2 HVO. There it is stated literally, "All traffic ways and areas are considered as navigation channels in the meaning of the Seeschiffahrtsstraßen-Ordnung." However, this formulation expressly does not state "...traffic ways and areas are considered as one and the same navigation channel ...". Such a narrowing understanding cannot be derived from this standard by any interpretation either. On the contrary, in both HVO and the SeeSchStrO the term navigation channel is admittedly used on the one hand as a summarising overall term, but on the other hand this basically presupposes that there are different navigation channels alongside one another. This is evident beyond doubt from the said formulations in the HVO and the SeeSchStrO.)

It is therefore crucial for answering the question as to whether the Master of ENA 2 could claim right of way under § 25 Para. 4 SeeSchStrO whether he in turn behaved in accordance with the standards in the meaning of the relevant provisions of the HVO and the SeeSchStrO.

Before this is checked, however, it must first be clarified whether any right of way might not have been ruled out in any case by other priority regulations.

³⁰ Cf. Graf/Steinicke, SeeSchStrO, S. 79.

6.1.2.2.1 Right of way of PUDONG SENATOR as right of way vessel?

One crucial restriction of § 25 Para. 4 SeeSchStrO in the area of the Port of Hamburg arises in particular from § 20 Para. 2 HVO. According to this provision all vessels travelling must give way to a right of way vessel.

According to § 2 No. 9 HVO, right of way vessels are vessels that are forced to use the deepest part of the traffic routes and areas because of their draft, their length or other properties. They are considered to be vessels restricted in their ability to manoeuvre in the meaning of Rule 3 Letter g COLREGs .

The term right of way vessel is defined with essentially the same content in § 2 Para. 1 No. 13 SeeSchStrO. Furthermore, in conjunction with § 60 SeeSchStrO as an alternative to the above-cited requirement, there is a possibility for the locally competent Regional Waterways and Shipping Directorate to publicise dimensions justifying the right of way property of a vessel, but only for the area of the Federal waterways. The Regional Waterways and Shipping Directorate Northwest has made use of this option for the River Weser. For the rest, Regional Waterways and Shipping Directorate Nord and Regional Waterways and Shipping Directorate Northwest have directed a separate reporting obligation to the relevant VTS for those claiming the right of way. So far no further concrete details have been set out defining the prerequisites that must be fulfilled for a vessel to be a right of way vessel.

Accordingly the initially cited general definition applies for the situation under review here in the Port of Hamburg according to which it is to be decided whether a vessel is forced to use the deepest part of the traffic ways and areas due to certain properties.

However, unlike the main navigation channel of the Norderelbe, there is no designated deepest part of the traffic route in the Parkhafen and in the area where it opens into the main navigation channel. Consequently use of the "deepest part of the traffic route" necessitated due to size and any right of way in the meaning of § 20 Para. 2 HVO building up (solely) on this for a large container vessel like PUDONG SENATOR is not conceivable without more ado.

Conversely, however, by linking § 2 No. 9 HVO with Rule 3 Letter g COLREGs an unrestricted connection is expressly produced between the manoeuvring impediment of a vessel and its (possible) classification as right of way vessel. Both vessel categories are made equal with each other in the way of statutory fiction.

The expression "vessel constrained by her draught" in the COLREGs in turn covers vessels that by the nature of their use are restricted in their ability to manoeuvre in the manner that would have been prescribed and are therefore unable to evade other vessels.

The non-final listing in Rule 3 Letter g COLREGs indicates the following vessels by way of example - those that

- are laying out sea markers, underwater cable or pipes
- are dredging, conducting research, measuring or underwater work,
- are carrying out supply manoeuvres
- are clearing mines
- are considerably impeded from deviating from their course during towing operations.

By contrast the manoeuvring impediment of a right of way vessel derives primarily from its dimensions in relation to the space available in the navigation channel, but in accordance with § 2 No. 9 HVO can expressly also be based on other properties that are not defined more closely.

As a result of the size and associated restricted manoeuvrability in relation to the existing manoeuvring space that is additionally impaired by aspects such as in particular susceptibility to side winds and impeded visibility due to container loads on deck, a large container vessel may be just as substantially impeded from deviating from course after leaving its berth in the Port of Hamburg as, for instance, a vessel and its attachments during a towing operation.³¹

In view of the specific geographical circumstances and the strongly restricted manoeuvring options already indicated, it was therefore practically not possible for PUDONG SENATOR to stop inside the opening area from the secondary navigation channel Parkhafen into the main navigation Norderelbe, or to take any other kind of evasion manoeuvre in favour of ENA 2.

The hypothetical option of short-term anchoring for which PUDONG SENATOR must always be constantly ready in the navigation channel according to § 21 Para. 3 SeeSchStrO does not alter this at all. Such an emergency manoeuvre (!) must always be considered as "ultima ratio" because of the risks involved, in particular the substantial endangering of the seaman charged with carrying out the manoeuvre on the forecastle³² and can accordingly only be carried out on the basis of weighing up the dangers. However, it is unsuitable as a regular "stopping manoeuvre" in order to observe a general waiting obligation and/or a right of way.

However, waiting by stopping/astern manoeuvres in the exit area from the Parkhafen would have led to an unjustifiable loss of steerability and hence to inestimable risks such as, for instance, the risk of collision with the Athabaskakai. The prevailing wind from WNW that occasionally reached gust strengths of 6 to 7 Beft³³ considerably reinforced the risk of drifting in such a case.

Thus basically PUDONG SENATOR satisfied the (factual!) prerequisites for claiming a right of way.

However, it is problematic that the visual signals specified in accordance with § 12 Para. 3 HVO had not been set on board the container vessel. Since a right-of-way vessel was equated with a manoeuvre-impeded vessel (cf. § 2 No. 9 HVO), it was formally necessary for PUDONG SENATOR to carry the signals specified in accordance with Rule 27 Letter b COLREGs. In such cases the appropriate signals to be carried in the port of Hamburg in accordance with § 12 Para. 3 HVO by direction of the VTS or - in cases of right-of-way - the port pilot have not only a declaratory, but also a constitutive effect, since only when it is announced to other traffic that a right-of-way is called for is it possible for the other vessels to observe and respect this right.

The Superior Port Authority does not consider it practicable to have a fundamental instruction with a regulatory content stating, for example, that vessels from a certain

³¹ Cf. Rule 3 Letter g Section (vi) COLREGs.

³² If the anchor really did catch at a speed over ground of 7 kn, the sudden strong stress and strain would virtually unavoidably lead to rupture/breakage of the chain and/or bracing facility.

³³ Source: Official expertise by Germany's National Meteorological Service (DWD) on behalf of the BSU.

size upwards or of a certain type are to be classified as right-of-way vessels and that it should be made mandatory for such vessels to carry the appropriate signals. Instead, in response to an enquiry by the BSU, the authority stated that on the contrary new unclear aspects in the assessment of right-of-way situations would arise from such specifications. Under certain circumstances corresponding rules would lead to a proliferation of right-of-way vessels in individual port sections. The question as to right-of-way would then not be facilitated, but instead additionally complicated. The granting of right-of-way by smaller vessels with better manoeuvring qualities to larger vessels with restricted manoeuvring qualities was moreover generally recognised, common and proven practice in the Port of Hamburg, even if this was not explicitly set out in the Port Traffic and Navigation Law for the port of Hamburg.

In its comments to the BSU the Bundesverband der See- und Hafenslotsen (BSHL – Federal association of sea and port pilots) also vigorously warned against the negative consequences of "inflationary" expansion of right-of-way powers.

- As an intermediate result it remains to be recorded that PUDONG SENATOR would basically have had a right of way. The non-carrying of the appropriate Signals and waiving of the associated announcement via Channel 74 formally restricts the legal position of PUDONG SENATOR connected with the right-of-way substantially, however. This applies initially independently of the question to be considered in more detail below as to whether the Master of ENA 2 could have perceived the signals in question from his position (low eye height, visibility restricted by handling equipment etc. on Athabaskakai) on the course he had selected in time at all and would have been able to react to these. Accordingly the right-of-way of ENA 2 that could be formally justified at least with extensive interpretation of § 25 Para. 4 SeeSchStrO is not critically ousted (solely by the fact that PUDONG SENATOR satisfied the prerequisites for declaring itself a right-of-way vessel in the segment relevant for the accident).

6.1.2.2.2 Restriction of § 25 Para. 4 SeeSchStrO by valid travel rules

In accordance with §§ 1 Para. 4, 22 SeeSchStrO in conjunction with Rule 9 Letter a COLREGs there is fundamentally a precept of travelling on the right in the navigation channel. This obligation is established and set out in concrete terms by § 20 Para. 1 HVO for the area of the port of Hamburg too: *"As far as possible vessels shall keep to the right side of the navigation channel on all traffic routes and areas and move in such a way that they do not use the traffic ways more and longer than necessary. The use of the left side of the navigation channel is admissible for vessels transferring pilots, when manoeuvring with large vessels, and otherwise only on short section between neighbouring port basins, entrances or berths, and subject to the provision that endangering of through-going shipping can be ruled out."* The directions build on § 5 Port Traffic and Navigation Law and § 3 Para. 1 SeeSchStrO³⁴ that obligate *all* traffic participants to ensure safety and ease of traffic as basic rules for behaviour in traffic. Accordingly damaging, endangerment or impediments or nuisance more than avoidable under the circumstances are prohibited.

³⁴ In conjunction with § 1 Para. 1 No. 1 HVO.

The above standards must thus be taken into account within the framework of interpreting and applying § 25 Para. 4 SeeSchStrO. Consequently a vessel can only claim the subject right-of-way unrestrictedly as long and in as far as it observes these rules "in the navigation channel".

The evaluation of the radar records of the VTS, the descriptions of the course of the travel of ENA 2 by the witnesses, and not least the collision location and collision angle document, however, that ENA 2 contravened the specified rules of travel on approaching the Parkhafen.

When a vessel comes from the Norderelbe, the rules stated above show that a manoeuvre for crossing the main navigation channel and subsequently running in to the secondary navigation channel of the Parkhafen must be designed in such a way that the vessel crosses as close as possible at right angles to the direction of the main navigation channel and at a position that allows subsequent entry into the right-hand side of the navigation channel of the secondary navigation channel. To this end ENA 2 should have continued up to approximately Buoy 134 on the northern side of the navigation channel of the Norderelbe. Apart from the fact that only in this way could he have satisfied the requirements of leaving the main navigation channel swiftly, if he had continued up to Buoy 134 the Master of ENA 2 would also have had a sufficient view into the Parkhafen and the traffic coming from there that was not yet possible at Buoy 136.

6.1.2.3 Intermediate result on the question of regulating the right of way

In view of the legal and actual aspects to be taken into account, it is not easily possible to reduce the analysis of the accident to the question, "who had right of way?" and to answer this in the spirit of clear allocation of responsibility³⁵ for the collision to PUDONG SENATOR or to ENA 2.

Consideration of the legal specifications for regulating the right of way in the port of Hamburg has shown that when these are applied, it is necessary to consider a complex interlinkage of various standards. Furthermore, the collision location lies precisely at the boundary between a main navigation channel and a secondary navigation channel, which made it more difficult to clarify the question of right-of-way, but only at first glance, however. Furthermore habits under customary law that take the practical requirements of smooth traffic processing in the port into account on the one hand and written law on the other, only coincide to a certain extent.

The legal assessments of the concrete traffic situation by the lawyer representatives of the "participants"³⁶ involved in the accident as well as by the Waterway Police Hamburg submitted to the BSU partly diverge substantially from the assessment of the legal situation by the BSU presented in the draft of this investigation report. All critical objections have been examined intensively. Since the arguments put forward

³⁵ See note on page 2.

³⁶ In the Seeamt (Marine Board of Inquiry) proceedings that are to be strictly separated from the activity of the BSU and whose task is to ascertain individual faulty seamanship behaviour and where appropriate to sanction this, the term "participant" has a legally defined meaning (cf. § 22 Para. 3 SUG). In BSU reports on the other hand, formulations such as "non-participating" or "participating" are not technical, i.e. they are to be understood literally and are therefore not necessarily identical with the diction of the Seeamt.

were not convincing, however, the BSU stands completely by its assessment of the right-of-way situation described above.³⁷

6.1.3 Vessel Traffic Services

Since the collision occurred in the area of the traffic to be supervised by the VTS of the port of Hamburg, the rights and obligations crucial for traffic steering are also to be explained below.

§ 8 Para. 1 HVO governs general reporting obligations and Para. 2 (in conjunction with §§ 30 and 58 SeeSchStrO) those extended for certain vessels for the area of the port of Hamburg. § 30 SeeSchStrO determines special travel restrictions for tankers and push and tow combinations that convey specially determined gaseous goods, liquid chemicals or liquid products as bulk products.

Neither PUDONG SENATOR nor ENA 2 were subject to special travel restrictions; both vessels simply had to satisfy the general reporting obligations to the VTS. For ENA 2 these were position announcements stating the type of vessel, name and direction of travel on VHF Channel 74 on passing Norderelbebrücken, Amerikahöft, Überseebrücke, Vorhafen and Buoy 135/KS1, and position reports on the same channel when casting off, before leaving a port basin or navigation channel, and before crossing a navigation channel.

PUDONG SENATOR as a sea-going vessel had to issue announcements on VHF Channel 14 on casting off directly before departing, stating name, draft and port of destination. On Channel 74 the vessel was required to issue position reports at casting off, before leaving the port basin, on passing the Parkhafen and leaving the secondary navigation channel.

The evaluation of the radio records has revealed that both vessels issued all the specified reports, but only the announcement of the type of vessel on Channel 74 was omitted in each case.

With resolution A.857(20) the International Maritime Organisation issued directives for vessel traffic services.³⁸ These distinguish between three possible tasks of a VTS, information service,³⁹ assistance service⁴⁰ and organisation service,⁴¹ whereby the nominated body in a contracting state is responsible for specifying the nature and scope of the tasks of a vessel traffic services centre.

The responsibility for the ports in the Federal German waterways rests with the relevant Federal States. The responsible (nominated) body for the port of Hamburg is the Hamburgische Superior Port Authority. The nature and extent of the services of the VTS Hamburg Port Traffic are set out in the "Service Instructions for the Operation of the Nautical Centre of the Superior Port Authority".

³⁷ The crucial objections were treated in the report above in the relevant connection in each case. It should be pointed out that the Superior Port Authority (representative of the standard-maker!) had no objection to the legal assessment of the right-of-way situation by the BSU.

³⁸ IMO Resolution A.857(20) „Guidelines for Vessel Traffic Services“.

³⁹ Information service: "a service to ensure that essential information becomes available in time for on-board navigational decision-making“.

⁴⁰ Navigational assistance service: "a service to assist on-board navigational decision-making and to monitor its effects“.

⁴¹ Traffic organization service: "a service to prevent the development of dangerous maritime traffic situations and to provide for the safe and efficient movement of vessel traffic within the VTS area“.

According to § 1 of these Service Instructions⁴² the Navigational Centre has to perform tasks of information, traffic monitoring and traffic organisation for the port of Hamburg. In §§ 26 to 28 the tasks information, assistance and organisation are described in more detail by analogy with the aforementioned IMO Resolution. In addition, in the definitions under § 3 of the Service Instructions a distinction is made between "continuous observation/analysis" and "uninterrupted observation/analysis". According to the relevant legal definitions, "continuous" means "in such time intervals that permit a general overview of the situation in the district". By contrast, "uninterrupted" is supposed to mean "the sustained observation recognised as necessary from case to case in order to be able to encounter an approaching danger in time with the means available".

According to § 26 the traffic information consists of "individual information items that are issued to shipping via the known working channels as required or on request".

Navigational assistance services in accordance with § 27 "are notes and warnings to shipping and recommendations within the framework of ship advisory services". The notes and warnings are intended to direct the attention of the traffic participants to possibly dangerous circumstances.

Traffic organisation under § 28, finally, "comprises direct shipping-police directions from case to case and issued wherever supporting measures are not sufficient". It should be noted here that in areas in which manoeuvring of ships can no longer be analysed as regards the desired success, the VTS may not intervene in the travel conduct of the vessels. However, warnings to the vessel commands concerned are expressly not covered by this restriction according to § 28.

According to § 25 Para. 2 of the Service Instructions, information, assistance and organisation are in a phased relationship to each other, whereby the next higher measure is to be taken when the set goal could not be achieved by the measure preceding this. Para. 3 further explains that the master mariners of the VTS have to set priorities in as far as an assessment of the situation shows several danger situations at the same time.

According to the information supplied by the Hamburger Superior Port Authority, approximately 39,000 sea-going vessel movements are noted each year in the area of the port of Hamburg. In addition to the general information on the traffic situation, the master mariners serving in the VTS accordingly restricts themselves to assisting sea-going vessels. This support for outgoing and incoming vessels is provided on VHF Channel 14 in such a way that entries and departures of large vessels are planned and coordinated depending on tidal windows, berths and possible mutual encounters to be taken into account. The master mariners of the VTS use continuous observation and analysis of radar images and radio communication on Channel 74 for this purpose.

Traffic information on other vessels, especially port vessels and inland vessels, is regularly obtained by sea-going vessels and their pilots on board by listening to Channel 74, whereby the VTS does not edit the announcements made by these vessels any further. Conversely, the port vessels and inland vessels obtain their traffic information about other vessels, including information about sea-going vessels, only via the specified reports on Channel 74. In this respect the VTS solely represents an information service for this group of vessels. The vessel commands or pilots are to make agreements on traffic between individual vessels, as well as

⁴² See also § 55a SeeSchStrO.

between sea-going ships and port vessels or inland vessels directly between each other on Channel 74 or on individually agreed working channels.

Comprehensive traffic assistance extending beyond traffic information and the restricted traffic assistance for sea-going vessels concerning all or individual vessels by the VTS in the port of Hamburg is only provided in exceptional situations, such as extremely poor visibility, when up to six port pilots man the radar station at the Navigational Centre and assist shipping, at the individual request of a vessel, whereby a port pilot then looks after this vessel alone from the Radar Central Station in the Navigational Centre, or when the master mariners of the VTS recognise a dangerous situation and take measures at their discretion. In these situations the "uninterrupted observation/analysis" described above becomes relevant too.

Further traffic organisation extending beyond this calling on masters of vessels to do, tolerate or omit certain actions by means of shipping and/or Waterway Police Directions only occurs when the traffic assistance measures alone are not sufficient.

6.1.4 Legal blood alcohol limit

After ENA 2 had tied up, the officers of the Waterway Police ascertained a strong smell of alcohol on the Master's breath and ordered a blood sample to be taken. After the collision the sample showed a blood alcohol concentration (BAC) of 2.1 ‰, from which a concentration of 2.2 ‰ at the time of the accident can be calculated. According to § 3 Para. 4 SeeSchStrO, anyone with a blood alcohol concentration of 0.8 promille or more or an alcohol quantity in his/her body that leads to such a blood alcohol concentration may neither command a vessel nor determine its course or speed independently.⁴³

This provision takes into account the fact that as a result of the effects of the alcohol the subjective performance feeling and readiness to take risks are demonstrably increased. On the other hand, attentiveness, ability to grasp essentials, concentration, ability to adapt, skill and reactions are decreased.

The distinction developed for motor vehicle drivers by court decisions regarding the question of punishability of driving under the influence of alcohol between absolute unsuitability for driving (fixed promille boundary value as an indisputable indication in this respect) and relative unsuitability for driving (BAC below an absolute boundary value plus deficiency symptoms) is basically important in the shipping sector too. However, no fixed promille boundary value has evolved here yet. The legal specifications fluctuate between an application by analogy with the rules for motor vehicle drivers (boundary value 1.1 ‰) on the one hand and 2.5 ‰ on the other hand.⁴⁴

Within the framework of the assessment and evaluation of the accident occurrence by the BSU,⁴⁵ which is expressly not of a penal nature, the BAC value ascertained for the Master of ENA 2 has at least an indicative value. His blood alcohol content that at any rate was in the border area of absolute unsuitability for commanding and the resulting restriction of attentiveness, reaction capacity and ability to assess and

⁴³ The case under investigation here triggered a political discussion aiming to reduce the promille level. Both a complete ban on alcohol (cf. corresponding law initiative of the Free and Hanseatic City of Hamburg in the German Federal Council) and a reduction of the promille limit to the value 0.5 are being discussed.

⁴⁴ Cf. here the remarks and evidence in the Penal Code, Tröndle/Fischer, § 316 Marginal Note 6.

⁴⁵ Cf. Reference on Page 2 of the Report

foresee his own and other vessel's movements had a crucial influence on shaping the course of the accident.

(Note: The objection raised by the lawyer disputing the causal influence of the substantial blood alcohol content of the Master on the accident occurrence changes nothing in the above assessment. The corresponding allegation was justified by the fact that the Master did after all succeed in manoeuvring the severely damaged ENA 2 with only one remaining Schottel drive to a safe berth after the collision and go alongside properly there. However, this argumentation does not take into account the phenomenon⁴⁶ of the sobering up effect known from general life experience and also backed up scientifically. This effect demonstrably leads to deficiency symptoms resulting from alcohol being suppressed at short notice by the occurrence of special circumstances, such as for example acute danger to life. The Master of ENA 2 was also suddenly in a situation that threatened his life shortly after the collision with PUDONG SENATOR. Accordingly there is a plausible explanation for the subsequent passage to the berth and the concentrated berthing manoeuvre without it being necessary to seriously doubt the causality of the considerable blood alcohol content for the occurrence of the accident.

As a marginal note attention is drawn to the fact that the argumentation in question is not very conclusive itself. It is vigorously claimed that the blood alcohol concentration of 2.2 promille (!) had no influence at all on the command behaviour of the Master of ENA 2. If one follows this assessment that evidently ignores a plausible sobering up effect, this would necessarily mean that the Master must have been particularly used to imbibing relatively large quantities of alcohol. However, this in turn would be in blatant contradiction to the careful selection of the Master claimed in the said written pleading by the operator of ENA 2 and the statement that no alcohol-related irregularities had been observed by the employer within the framework of continuous, almost daily, internal direction and supervision of the "tested, experienced and responsible Master"⁴⁷ over a period of several years.)

6.2 Summarising assessment of the collision development

Most of the trips made by ENA 2 were shuttle trips between Norddeutsche Affinerie and Petroleumhafen. The Master and deckhand had been employed by the previous management and since the firm had been taken over by the present management, on ENA 2 and its sister vessel ENA 1. Both the vessel with its manoeuvring qualities and special structural features as well as the route travelled and the transport regulations in the port of Hamburg were known.

Crossing of the main navigation channel between Buoy 136 and Buoy 134 with subsequent passage through the Parkhafen had to be appraised as a particularly critical section of the journey because of the traffic prevailing in both the main navigation channel and running out of Waltershofer Hafen, especially since visibility from the wheelhouse of ENA 2 was distinctly restricted because of the low eye level. (Figure 15 shows clearly how strongly Athabaskakai impeded the view to Parkhafen.) It was important to pay special attention to VHF radio traffic already before reaching Buoy 136, as well as to ensure that there was a proper lookout. If the radar system on board ENA 2 had been used, the opening area of the secondary navigation channel Parkhafen into the main navigation channel Norderelbe could have been observed for outcoming vessels at an early stage, as this only became optically visible at a very late stage.

⁴⁶ Source: Information from Prof. Dr. K. Püschel; Institute of Legal Medicine, University Clinic Hamburg-Eppendorf, Managing Director

⁴⁷ Original quotation



Figure 15: ENA 2 on the day of the accident turning into Parkhafen

(Photo: Reinhard Foerster)

PUDONG SENATOR called at the port of Hamburg regularly at three-monthly intervals and tied up in Waltershofer Hafen. The vessel operator regularly assigned the crew to this vessel, especially the vessel command. The vessel command headed by the experienced Captain thus knew the manoeuvring qualities of the vessel and the special features of the port as well. The vessel command was advised by an experienced port pilot.

The casting-off manoeuvre and subsequent entry into the main navigation channel of the Elbe required particular concentration on the part of PUDONG SENATOR, especially when wind and current conditions were unfavourable. Here too the restricted visibility to the main navigation channel of the Norderelbe in the direction of the Bubendey Shore due to trees (downstream on the Elbe) as well as in the direction of Athabaskakai (= upstream on the Elbe) due to port/container handling equipment and other vessels berthed there also required special attentiveness to VHF radio traffic and provision of the proper lookout.



Figure 16: View from the bridge window of PUDONG SENATOR⁴⁸

⁴⁸ PUDONG SENATOR during the next run through the port (09/2004) lying at Predöhlkai: left part of picture Bubendey Shore, right part Athabaskakai; on the day of the accident a container vessel lying at Athabaskakai additionally prevented visibility (cf. here Figure 15, foreground)

The picture series below (Figure 17) produced the next time PUDONG SENATOR ran through the port on 18 September 2004 and taken from the starboard wing, shows by way of example how a vessel of a size comparable with ENA 2 proceeding through Parkhafen in the direction of Norderelbe (upstream on the Elbe) "disappears" behind the Athabaskakai, even when no larger vessel has berthed there.

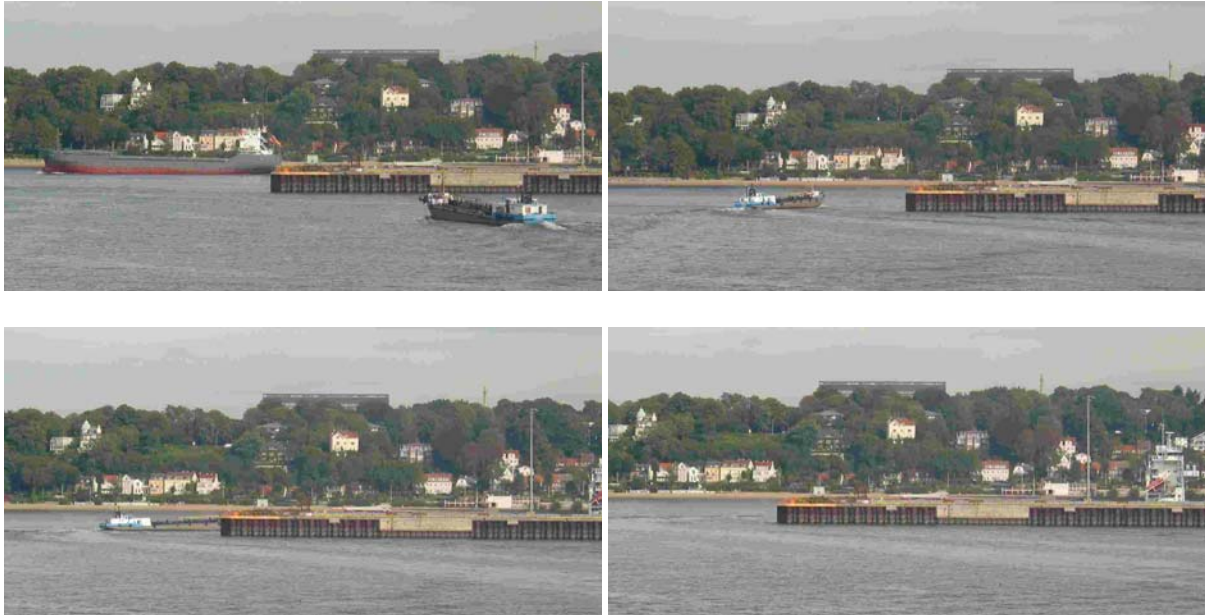


Abbildung 17: Athabaskakai wharf as optical barrier...

6.2.1 Course of the voyage of ENA 2 up to the collision

Disregarding the valid rules for traffic (cf. Section 6.1.2.2.2 above) according to which a navigation channel should be crossed at right angles as far as possible and otherwise the right-hand side of the navigation channel is to be used, the Master of ENA 2 steered towards the opening area of Parkhafen already shortly after passing the Tug Station Neumühlen at 18:16 h.

Leaving the northern side of the navigation channel already well before reaching Buoy 136 and approaching the entrance area of Parkhafen-Norderelbe in the middle between the mole heads at Athabaskahöft and Bubendey Shore with announced outgoing traffic from Parkhafen was dangerous above all because the Master of ENA 2 could not see into Parkhafen at all at this time as he lacked any radar image and had a low eye level. Even vessels not involved recognised the approaching danger of collision, as is clearly documented by the frequent warning ignored by the Master of ENA 2 via Channel 74, "A big one coming out".

Taking into account the fact that PUDONG SENATOR was in fact bound to use the middle of the navigation channel due to its restricted manoeuvring capability, not only did this increase the probability of a collision, but also it considerably reduced the time available to take effective countermeasures.

There should in any case have been an early agreement with the departing container vessel on the VHF working channel for example about passing green to green,⁴⁹ in order to inform all participants (vessel command, pilot, VTS) as well as the other traffic of the exceptional (!) deviation from the specified rules of traffic in time. However, not only were the necessary agreements lacking, but there was not even a special traffic situation that would have justified deviation from the traffic rules to be basically observed in the manner planned by ENA 2. At any rate there are no indications that the traffic situation at the time of the accident necessitated ENA 2 approaching Parkhafen on its elected course. The argumentation of the Master of ENA 2 in his written comment to the BSU changes nothing here. Although he draws attention to the fact that due to the outgoing tide that had offset him downstream on the Elbe it was necessary to turn into Parkhafen in good time, this alone does not justify the fact that as the Master of ENA 2 concedes, he initially approached Parkhafen "blindly".⁵⁰

ENA 2 with the two Schottel rudder propellers arranged port and starboard aft had two particularly comfortable drive and steering systems, so that despite the outgoing tide it would have been unproblematic to start the turning manoeuvre later.⁵¹ Furthermore, even if he refrained from using the radar, he could have assigned the deckhand and lookout to relieve the burden on the Master by observing the traffic situation.

The statement by the Master of ENA 2 that he had not received any reply to his VHF calls on Channel 74 from other vessels, which was why he assumed that there was nothing to prevent his course, is not convincing.

Factually, the recorded radio traffic contradicts this. Directly after his announcement "ENA 2 at the 136 from above into Parkhafen, then Petroleumhafen" was immediately followed by the warning from an unknown vessel, "A big one coming out!". Just 20 seconds after this PUDONG SENATOR itself announced, "shortly to leave Parkhafen, departure of PUDONG SENATOR". Again, shortly after this, the warning of the big vessel approaching was repeated, and although this time too ENA 2 was not called expressly, at least the first name of its Master was called. Accordingly he can hardly claim that he did not feel that he was being addressed all the time.

However, the argumentation of the Master's conclusion quoted above is based on a critical error. Even if one assumes that he did not hear the warnings and departure announcement of PUDONG SENATOR, or at least did not need to interpret this as a contradiction to his planned route, the Master then also ignores the fact that his announcement, "ENA 2 at the 136 from above, into Parkhafen, then Petroleumhafen"

⁴⁹ This means passing starboard to starboard, by contrast with the fundamentally specified passage port to port.

⁵⁰ The Master states literally: "*When I started the turning in manoeuvre on the Elbe, the tip of the Athabaskahöft was abeam and I could see into the rear part of Parkhafen from my wheelhouse, I saw the bow of a large container vessel coming out.*"

⁵¹ In a comment by a lawyer on the draft of this report this statement was doubted partly with a reference to a scientific essay by Urban (cf. Sources). It should be noted here that the subject paper was dealing with Azipod drives but does not contain any statements on the manoeuvrability of vessels with Schottel rudder propellers. The exceptionally advantageous manoeuvring properties due to the rudder propellers installed is also backed up by the fact that ENA 2 itself was still sufficiently manoeuvrable after losing 50 per cent (!) of the drive and steering power available (loss of the port propeller).

was formulated in much too general terms to necessarily trigger an immediate "Protest". The way in which ENA 2 would leave the main navigation channel was not evident from this announcement. Solely on the basis of the assumed assumption that there were no crucial (protest) reactions to his announcement that he would enter Parkhafen, the Master of ENA 2 could not conclude that he had "a clear channel".

Nor could the Master of ENA 2 claim that unrestricted right of way existed in any case when he turned into Parkhafen at an early stage:

His view expressed to the BSU regarding the question as to the general right-of-way situation on entering Parkhafen that the right-of-way ruling in the port of Hamburg depended on whether he was using a main or secondary navigation channel and that accordingly he as user of the main navigation channel had right of way before vessels coming out of a secondary navigation channel documents his lack of understanding of the existing regulations.

The legal opinion expressed initially contradicts the principle set out above according to which the appropriate right of way presupposes that the traffic rules are observed.⁵²

It is also not realised that the basic rule declared to be generally valid does not apply specifically for right-of-way vessels in accordance with § 20 Para. 2 HVO. It has already been ascertained that PUDONG SENATOR only satisfied the factual prerequisites for claiming a right of way, but it did not show the formally necessary signals.⁵³ However, this in no way alters the fact that even if the container vessel had been carrying the specified signals, due to the restricted visibility described, ENA 2 would not have been able to perceive the - at the latest then - resulting suspension of its claimed right of way at the time the vessel started to turn in.

Furthermore the rigorous insistence of the Master of ENA 2 on his right of way ignores the customary habits in the port of Hamburg, even if one were to consider that he fulfilled the formal prerequisites for this. As a result of § 5 Port Traffic and Navigation Law and § 3 SeeSchStrO in conjunction with § 1 Para. 1 No. 1 HVO, it is generally recognised daily practice - that is particularly indispensable for smooth flow of traffic - that in the interest of safety and ease of traffic small and easily manoeuvrable (port) vessels refrain from case to case on insisting on formal legal positions in encounters with large (sea-going) vessels with restricted moveability. Thus even if it is assumed that ENA 2 had a formal right of way, the uncompromising insistence on this would in any case have represented an abuse of the law. Accordingly, because of all the above aspects the Master of ENA 2 could not assume that he had right of way whatever happened.

The statement by the Master of ENA 2 that he broke off his entry manoeuvre immediately when he saw the bow of PUDONG SENATOR coming out of Parkhafen and immediately turned "hard to starboard" with his two Schottel propellers must also be critically questioned.

The radar records of the VTS that allowed a reconstruction of the course of the accident, as well as the statements by various witnesses, do not support this claim.

On the contrary, the subject radar images (cf. below Fig. 18 to 21) show that at 18.21 h ENA 2 was evidently clear of the eastern molehead of Parkhafen (Athabaskakai)

⁵² Cf. above point 6.1.2.2.2.

⁵³ Cf. above point. 6.1.2.2.1.

and must have had unimpeded visibility of outgoing traffic, even from the aft wheelhouse. The Master further concedes himself that immediately after seeing PUDONG SENATOR optically, he realised that the container vessel would not leave him any space for his intended manoeuvre. At this time the distance between the two vessels was still more than 2 cables,⁵⁴ however, so that ENA 2 could still have changed course to port and pass the entrance area close to Athabaskakai enabling a green to green passage with PUDONG SENATOR and could have notified the vessel of this via VHF Channel 74.

Even if one assumes in favour of ENA 2 that this vessel had a formal right of way, or at least believed that his legal position was such, Rule 17 Letter c COLREGs to be observed in this situation would not have been against such a procedure.

(Note: The question as to whether there is any scope at all for application of Rules 16 and 17 COLREGs in the navigation channel despite § 25 Para. 1 SeeSchStrO (in conjunction with § 1 Para. 1 HVO) and the non-validity of Rule 15 COLREGs stated there must be answered in the affirmative. Admittedly it could be said against the applicability of Rule 17 that the rights of way and waiting obligations directed in the special rulings § 25 Para. 2 and 4 for navigation channels might override the general obligations to take evasive action or maintain a course.⁵⁵ However, the clear wording of § 25 Para. 1 SeeSchStrO comes out in favour of the applicability of the subject rule since it is expressly stated that Rules 15 and 18, in other words specifically not Rules 15 to 18 are over-ridden by the following paragraphs of the regulation. Furthermore, there is no evident cogent reason for requiring a complete (!) overriding of Rule 17 COLREGs by § 25 Para. 2 and 4 SeeSchStrO. The pair of concepts "stand-on vessel/give-way-vessel" within the COLREGs corresponds in the scope of application of § 25 SeeSchStrO to the pair of concepts "right-of-way vessel/waiting vessel". Ultimately both sets of terms serve the same purpose, namely to allow a clear definition and thus legal distinction between vessels to which priority should be granted in traffic and those who have to observe such a right. However, once such a classification has been made, it must be ensured that this persists. The principle of trust requires this. Rule 17 COLREGs expressly embodies the principle described in the Collision Prevention Regulations. Nothing else can apply for the navigation channel in the scope of validity of the Seeschiffahrtsstraßen-Ordnung. The standard content of Rule 17 COLREGs is accordingly to be interpreted in the light of § 25 Para. 2 and 4 SeeSchStrO in the area of national navigation channels to mean that the vessel with right of way

- 1. must not do anything that could cast doubt on its right,**
- 2. is obliged to take a last-moment-manoevre as soon as it becomes clear that the risk of collision cannot be eliminated solely by measures of the "opponent",**
- 3. may not change course to port by comparison with the "opponent" to avoid a collision in as far as circumstances permit this.)⁵⁶**

Although Rule 17 Letter c specifies that in the case of crossing courses the stand-on vessel may not change its course to port by comparison with a vessel on its port side as far as circumstances allow, the ban on changing course to port applies expressly only "as far as the circumstances allow".

However, this condition was not satisfied. ENA 2 was only about 2 cbl away from PUDONG SENATOR when the latter became visible for it. In view of the relatively high approach speed of the two vessels it was extremely questionable whether ENA 2 could in fact have actually averted the threatening collision by a resolute "hard -to-starboard manoeuvre". The Master of ENA 2 might possibly have shared this

⁵⁴ 2 cbl = 370 m.

⁵⁵ Fundamentally represented in this way by Graf/Steinicke, SeeSchStrO, P. 79.

⁵⁶ Graf/Steinicke also comes to the conclusion that Rule 17 COLREGs is ultimately applicable (by analogy) in the area of the navigation channel, although with a different justification; cf. Comment op.ct.

assessment, since as already indicated above, he evidently did not initiate a resolute "hard-to-starboard manoeuvre" - at any rate not immediately. His claim that he did so as quoted above is contradicted by the radar records documenting the course of ENA 2 (see Figures 18 to 21 below). No radical course alteration is noticeable. The deckhand on board ENA 2 did not confirm the change of course to starboard either. He stated that during the accident occurrence he had been in the old bridge, the messroom of the vessel, and had been able to see ahead and to the side from there since the (new) bridge had been raised. Apart from the high engine speed he had not noticed anything prior to the collision. The statement by the Master of the aft Tug CONSTANT that he had observed ENA 2 trying to cross the bow of PUDONG SENATOR at high speed also contradicts the thesis of an early "hard-to-starboard manoeuvre" on board ENA 2. The statements by the pilot and Captain of PUDONG SENATOR indicate that instead ENA 2 initially maintained its elected course persistently, even after the container vessel came into sight. Both stated that ENA 2 did not initiate any change of course. The allegedly initiated "hard-to-starboard manoeuvre" would moreover in any case have necessarily led to a significant turning movement that would have been recognisable in the radar records of the VTS and also for the other participants/witnesses. This assumption can be justified on the one hand by the fact that ENA 2 had two fast-reacting Schottel rudder propellers that at least theoretically would allow the vessel to turn on the spot or to cross with full thrust.⁵⁷ Furthermore, the outgoing tide that was in full flow at this time would have additionally supported a turn to starboard initiated for ENA 2.



Figure 18: Radar image of the VTS at 18:20:10 h

⁵⁷ Cf. Scharnow (Ed.) Seemannschaft 3, Schiff und Manöver, P. 342 f., Product brochure Schottel Rudder Propeller (including the many applications set out there for vessels with particularly high manoeuvrability requirements).

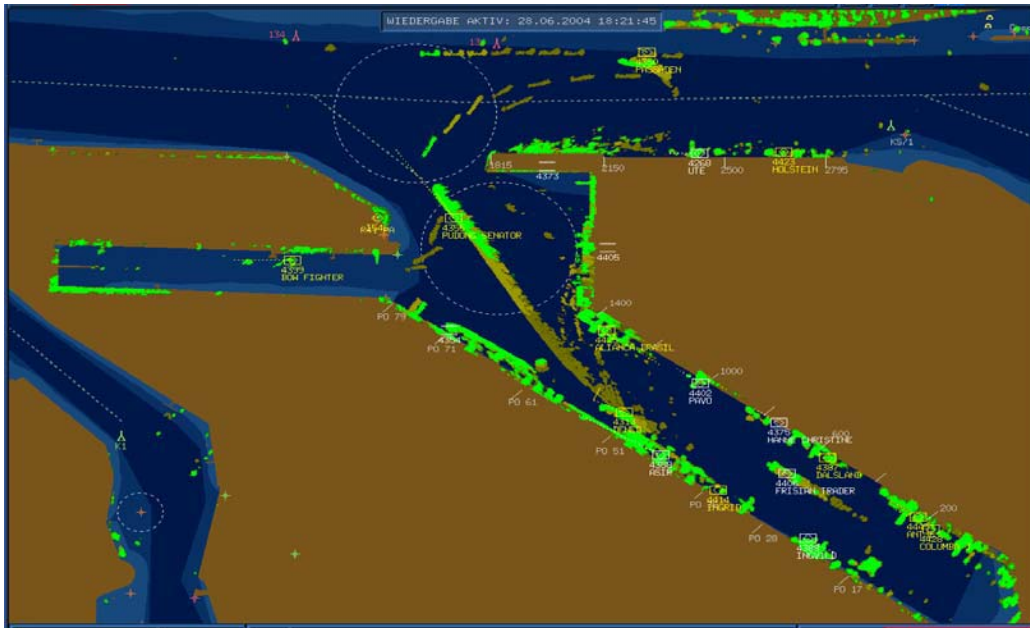


Figure 21: Radar image of the VTS at 18:21:45 h

Note.: The objection raised within the context of a lawyer's comment on the draft of the present report that the radar images of the VTS would not support the course of ENA 2 ascertained by the BSU, but instead on the contrary clearly confirmed the collision prevention measures claimed by their Master, is not convincing.

On the basis of two radar images an attempt was made to prove that the early hard-to-starboard manoeuvre alleged by the Master of ENA 2 was in fact carried out. To this end the "course lines" of the advance echo of 18:20:39 h and the radar echo of 18:21:03 h were each extended in the radar display of 18:21:03 h (cf. Figure 22). The angle determined between the diverging lines of about 4° that occurred within a short space of 24 seconds was intended to serve as an irrefutable document ... for the hard-to-starboard rudder manoeuvre initiated.

As regards this approach it must first be stated that the value determined is in any case subject to imprecision due to the quality of the relevant echoes. Furthermore a possible short-term course change of such a minor size need not at all have been caused by a hard-to-starboard manoeuvre. Instead, if this was not a minor course correction, it may well have been a natural course fluctuation (over ground) occurring depending on the influence of currents and wind, even if the course through the water is steered without any change. Furthermore, in view of the considerable blood alcohol content of the Master a possible "weaving course" is by no means an improbable possible reason for the alleged proven turn to starboard.

However, in particular the subsequent radar image record of 18:21:57 h and the position of ENA 2 in the navigation channel documented therein make it clear once again that no early hard-to-starboard manoeuvre was carried out. In order to back this up additionally the BSU has by way of exception adopted the dubious approach described above and compared the "course line" of the advance echo of 18:20:39 h with that of the radar echo of 18:21:57 h (cf. Figure 23). The display makes it clear once again that the alleged early hard-to-starboard manoeuvre by the Master of ENA 2 cannot be backed up at all by the radar records of the VTS.

The alleged early emergency stop manoeuvre initiated is not confirmed by the radar records secured either, by contrast with the claims put forward in the same written pleading by the lawyer. Here too reference is made to the imprecision due to the system and display that basically prevent reliable ascertainment of speed based on radar images alone. Apart from this, it is admittedly correct that the distance traversed by ENA 2 between the individual radar echoes does show a reduction in speed of ENA 2 if one includes the different time intervals of the successive images correctly. However, it should be taken into account here that the Master admitted himself that he reduced the speed of ENA 2 (as planned) in the course of carrying out the turning-in manoeuvre. In addition the current-related support of forward travel over ground

Patroleumhafen. Accordingly its Master could not claim an unrestricted right of way.

- In any case, insisting on any right of way would have been an abuse of law. Port and small vessels are obliged to navigate with particular consideration to large sea-going vessels in the interest of the needs of practice to achieve the smoothest possible traffic in port. This requirement is not only customary law in the port of Hamburg, but furthermore is also in line with the general principles of good seamanship and is flanked by § 5 of the Port Traffic and Navigation Law.
- The measures claimed by the Master of ENA 2 to avert the collision are not confirmed by the radar records and the statements by other participants and witnesses. In particular, however, his estimation that after PUDONG SENATOR came into view he immediately did everything to avoid the collision is not objectively plausible.
- The prima facie evidence that the considerable blood alcohol content of the Master and his associated unsuitability to command were the main cause of the development of the collision was not shaken by the sources of information analysed by the BSU, but instead additionally confirmed. The navigation behaviour of the Master of ENA 2 can only be explained plausibly by considerably reduced powers of concentration and reaction. His mis-estimations of the right of way as set out might have promoted the accident occurrence. However, it appears more likely that this primarily represents a subsequent attempt to pass off responsibility for the collision.

6.2.2 Course of the voyage of PUDONG SENATOR up to the collision

In view of its dimensions, PUDONG SENATOR had to use the middle of the navigation channel at the opening of Parkhafen into the Norderelbe. The pilot should have instructed the vessel to draw attention to a formal claim of right of way by setting the appropriate signals. However, the investigation comes to the conclusion that it is most improbable that such a measure together with an appropriate announcement on Channel 74 would ultimately have prevented the collision.

With the prevailing wind conditions and manoeuvre qualities, in particular the susceptibility to wind of the deck container cargo, it appears that the increase in speed of PUDONG SENATOR from "dead slow ahead" to "slow ahead" at 18:18:45 h did not contradict the requirement under Rule 6 COLREGs to maintain a safe speed.

(Note: It is evident from the manoeuvre documents⁵⁸ for PUDONG SENATOR available to the BSU that the minimum speed for maintaining a course is 6.2 knots (but with the propeller stopped). However, according to the express warning, this information only applies as long as the wind speeds are less than 10 knots (in other words at most force 3 Bft) and does not take into account any current influences. According to the official expert opinion by the Germany's National Meteorological Service (DWD), at the time of the accident there was a mean windforce of 5 Bft. There were occasional gusts of force 7 Bft. The effect of such unforeseeable gusts becomes particularly clear when one takes into account that the wind pressure acting on the

⁵⁸ Here in particular wheelhouse poster and pilot card.

large sail area of a fully loaded container vessel increases with the square of the wind speed. This means that a wind speed of between 5 and 7 Bft increases by about 65 per cent in non-linear form, but the wind pressure at the same time increases by nearly 300 per cent. Increasing the rate of speed from Dead Slow Ahead, that theoretically (!) allows a maximum speed of 7.9 kn, to Slow Ahead ($v_{\max} = 11.4$ kn), which does not lead to a sudden but instead to a gradual increase in speed⁵⁹, was therefore necessary due to the prevailing weather conditions in order to maintain the steerability of PUDONG SENATOR.⁶⁰)

When the risk of collision became evident on the bridge of PUDONG SENATOR, the machine was set back to "Dead Slow Ahead" at 18:21:39 h and shortly after that to "Stop" at 18:21:59 h and the sound signal in accordance with Rule 34 Letter d COLREGs was issued with the typhon. It is questionable whether complete stopping of the container vessel (by reversing and/or emergency anchor manoeuvre) at a time at which there could no longer be any doubt even objectively about ENA 2's intention of wanting to cross the course line of PUDONG SENATOR could have prevented the collision. Even assuming that an emergency stop manoeuvre (by changing over the engine telegraph to full astern) had been initiated about one minute earlier, the stopping distance of PUDONG SENATOR at the speed of approx. 5 knots being travelled at this time would hardly have sufficed to prevent the collision. In so far it should also be taken into account that considering the navigating characteristics of ENA 2 such a deceleration in the speed of PUDONG SENATOR might under certain circumstances even have been counter-productive. It cannot be ruled out that the (first) collision contact between the two vessels might then not have occurred in the foreship area of ENA 2, but instead further aft. A collision between the bow of PUDONG SENATOR and the midship area or aft ship of ENA 2 might possibly have led to much more dramatic consequences of the accident.⁶¹ As already explained above, furthermore an emergency stop manoeuvre also involved the risk of drifting almost unmanoeuvrable in the Parkhafen, which in view of the prevailing wind conditions could also have led to a collision with the Athabaskakai wharf.

During the final phase prior to the collision, the vessel command and the pilot of PUDONG SENATOR did not make any avoidable faults that were causal for the accident. However, their preceding communication behaviour must be subjected to a critical assessment. The approaching danger situation was initially underestimated.

The 3rd Officer who was responsible on the forecastle for the casting off manoeuvre was additionally allocated the task of lookout. In this capacity during the casting off manoeuvre he observed in particular that there was safe passage on the port side of the HANJIN BRUSSELS moored at the berth in front of PUDONG SENATOR. Initially the manoeuvring space available was very slight. On the other hand observation of the area where Parkhafen opens into the Elbe navigation channel was not the focus of his lookout activities. Furthermore, the Captain on the bridge of PUDONG SENATOR understood the remark by the VTS at **18:14:00 h**, "*Yes, if you start,*

⁵⁹ It is evident from the stored data of the ECS that after casting off PUDONG SENATOR reached a maximum speed of 7.1 knots.

⁶⁰ Cf. also Scharnow (ed.), Seemannschaft 3, Schiff und Manöver, p. 185 ff.

⁶¹ Note: The fictitious progress of events last set out is expressly not connected with a general recommendation to increase speed in order to pass a possible scene of accident before a threatening collision. It is only intended to make clear that the objection raised by the lawyer that PUDONG SENATOR could have prevented the accident in any case by stopping in Parkhafen did not take sufficient account of the faulty and unforeseeable navigational behaviour of ENA 2.

everything free outside. Nothing coming up at the moment." to mean that everything was free, in other words that no shipping traffic restricting the casting off was to be expected from the direction of Athabaskakai.

Although such an understanding of this announcement does not correspond with the wording, since after all it is only confirmed that there was no upcoming traffic, despite this it is certainly possible to understand from the subject notification that as seen by the VTS there was altogether nothing against PUDONG SENATOR running into the main navigation channel. However, even if one follows the interpretation by the Captain of PUDONG SENATOR and interprets the subject notification by the VTS as approval for running into the Elbe pilotage waters, this does not necessarily represent an unshakable confidence circumstance of having factually "a clear run" for turning into the main navigation channel.

In particular the announcements of ENA 2 on VHF channel 74 at **18:15:50 h** "*ENA 2 new Schlepperbrücke, from above into Parkhafen*" and at **18:19:00 h** "*ENA 2 at the 136, from above into Parkhafen, then Petroleumhafen*" should have led to considering the possibility of an approaching danger situation in the course of the forthcoming turning-in manoeuvre. It should be taken into account here also that the *optical perception* of ENA 2 and its risky course must have been possible for the pilot and the command of PUDONG SENATOR at even an earlier time than was conversely possible for the Master of ENA 2. This conclusion results from the greatly differing eye levels and visibility angles from the bridges of the two vessels as regards the opposite vessel and the fact that in addition the radar set was being used on the bridge of PUDONG SENATOR.

Moreover the pilot of the container vessel concedes literally his report , "*...at a level with Athabaska 8⁶² I was able to see a vessel travelling downstream (on the Elbe) that was following the aforementioned vessel (ALMERODE, the author). This vessel stated via VHF channel 74 in so many words that it would follow the inland vessel travelling ahead. I was able to identify the name through my binoculars as ENA 2.*"

According to the radio records the last mentioned radio message was sent by ENA 2 at **18:17:00 h** without stating its own name on VHF channel 74 with the content, "*Yes, ok. Me too, behind you*".

After this it is stated in the report, "*I kept ENA 2 in view without interruption, but did not contact the vessel directly via VHF channel 74 initially because at this time another vessel was addressing ENA 2 via VHF channel 74 and explained in other words, "look out, there's a big one coming out of Parkhafen!" Because of this radio message I omitted to repeat this message by radio.*"

This can thus only mean the message from an unknown vessel on channel 74 at **18:19:10 h** "*There's a big one coming out!*" or its repetition, "*X. there's a big one just coming out*" at **18:19:50 h**.⁶³

If one follows the remarks of the pilot quoted, the logical conclusion is that he must have identified ENA 2 already at **18:17 h**. In his comment on the draft of this

⁶² here the outermost (most western) berth at Athabaskakai is meant; cf. marked area in Fig. 16.

⁶³ Whereas the first warning did not expressly state either the transmitter or the receiver, in the second call the Master of ENA 2 was addressed with his first name. However, no vessel names were stated again.

investigation report however, he stresses that he could only see ENA 2 optically after **18:20:10 h**. The reason for this was the container vessel moored at the berth Athabaska 8 that initially barred the view of the eastern area of the Elbe navigation channel and the approaching ENA 2.⁶⁴ The radar records of the VTS would additionally confirm this statement.⁶⁵

Despite this, the accuracy of the time stated for the last-mentioned perceptions in the pilot's report and in the said comment must be at least partly doubted. This results from the following considerations.

In his report the pilot stated on the one hand that he had reported the position and planned departure of PUDONG SENATOR from Parkhafen on channel 74 and *shortly after this* had heard the message from a barge that announced that it would turn into Parkhafen and on into Petroleumhafen. He also states that he had heard the message of a further vessel that had declared in other words that it would follow the aforesaid vessel. However, it emerges from the records of the radio traffic on channel 74 that the announcements by the two vessels heard by the pilot which must have been the aforementioned announcements by ALMERODE and ENA 2 had already been transmitted at **18:17:00 h**. The vessel's own departure announcement was demonstrably issued at **18:19:30 h** and thus not before but instead indubitably only after the said announcements by the barges.

The pilot's statement that he had only perceived ENA 2 optically after **18:20:10 h** is also contradictory for another reason. After all, he concedes that he had initially not contacted *ENA 2 that was in sight* directly because this vessel had already been warned by an unknown vessel. However, as set out above, these warnings were issued at **18:19:10 h** and **18:19:50 h**.

It is therefore evident from the time sequence of the announcements documented by the radio records that ENA 2 must have been visible from the bridge of PUDONG SENATOR at the latest as of the time of the second warning, in other words as of **18:19:50 h**.

Moreover it is also certain that the intention of ENA 2 to enter Parkhafen had been known on the bridge of PUDONG SENATOR already since approx. **18:17 h** and that ENA 2 must also have been identified optically as of **18:19:50 h**. At this time at the latest it must have been clear that the barge tanker was evidently turning towards Parkhafen and was dangerous for PUDONG SENATOR, or could at least become dangerous.

It was already ascertained above that ENA 2 evidently ignored the warnings addressed to it by a third party and continued on its course unchanged towards Parkhafen. Despite this, reckoned from the second warning, it was almost two minutes before the pilot of PUDONG SENATOR called ENA 2 directly at **18:21:40 h** to ask, "*ENA 2, what's the matter?*" Although it has been repeatedly pointed out in this investigation report that the practical possibilities for PUDONG SENATOR of actively preventing the approaching collision were extremely restricted if not totally excluded, valuable time during which the tanker might possibly have been convinced of the necessary passage green to green was lost by the only very late direct contact with ENA 2.

⁶⁴ Cf. here Figures 15, 16 and 17, top in Section 6.2.

⁶⁵ Cf. here in particular Figure 18 top in Section 6.2.1.

- The setting of the specified signal as right of way vessel and the corresponding report to shipping on channel 74 would have formally strengthened PUDONG SENATOR's legal position within the framework of the turning into the main navigation channel. However, this omission was not causal for the accident.
- The decision on the bridge of PUDONG SENATOR not to call ENA 2 at an early stage on channel 74 and initiate a direct traffic agreement must be assessed as promoting the accident. Once again, however, it is questionable whether such an attempt to establish contact would in fact have avoided the accident, since ENA 2 was not deterred from intending to cross the course line of the container vessel by warnings from a third party or by PUDONG SENATOR coming into sight.
- The difficult relationship between the legal specifications in the mouth area of the channel on the one hand and the practical requirements and circumstances to be observed on the other hand and the excessively long confidence in the fact that the smaller (port) vessel would take evasive action in accordance with the custom in the Port of Hamburg might have contributed to the delay in using radio telephone traffic and in so far promoted the collision.

6.2.3 Assessment of the activity of the VTS

The Master Mariner on Duty and the nautical assistant of the VTS answered the specified announcements by PUDONG SENATOR on VHF channels 14 and 74 with the return message concerning the traffic situation, but restricted themselves to stating that there was no upcoming traffic.

The VTS did not confirm the position announcements of ENA 2 on channel 74 separately. According to the information supplied by the Superior Port Authority the position announcements and other information disseminated via this channel comprise information that a vessel addresses to all other traffic participants. Return messages to such radio messages or confirmations of the relevant messages by the VTS were basically not provided for. At **18:14 h** the VTS notified PUDONG SENATOR in the message already quoted several times above on channel 74 that *"...if you start, everything free outside. Nothing coming up at the moment."* At this time ENA 2 had not yet passed the tug station Neumühlen. The traffic situation regarding ENA 2 and PUDONG SENATOR appeared to be developing as a routine encounter situation without any particular danger potential. Accordingly the Master Mariners of the VTS were not observing the further approach of the two vessels with top priority. At **18:20:40 h** HANJIN BRUSSELS, a further container vessel, reported that it was about to depart from Predöhlkai on Channel 74, whereupon the answer from the VTS was here too, *"If you come out straight away, it all looks good for you at the moment. Nothing happening outside."* The two warning calls by the unknown vessel at **18:19:10 h** and **18:19:50 h** issued in the meantime that a big one was coming out evidently did not influence the assessment of the situation. In so far, however, it should be stressed once again that the two messages did not contain either a "transmitter" or a "receiver" who could be clearly allocated. It is possible that this was a reason why the Master Mariner in the VTS did not address enhanced attention to the opening area of Parkhafen into the Norderelbe.

The radar display of the radar station Parkhafen showed ENA 2 north of the mole head Athabaskahöft at this time. Although the tanker barge was thus on the wrong side of the navigation channel for entering Parkhafen, a passage green to green with the outgoing PUDONG SENATOR appeared to be possible at this time, which may have been a further and crucial reason why the VTS still did not classify the forthcoming encounter situation as dangerous.



Figure 24: Radar image of the VTS at 18:20:39 h

Within the framework of the general analysis of the situation by the VTS the subject vessel movements were evidently not being observed with particular priority since it was trusted that the smaller vessel would give way to the larger vessel in good time in accordance with the customary habits in the Port of Hamburg. That is why no direct call was made to PUDONG SENATOR and/or ENA 2 to clarify whether an appropriate agreement on traffic had in fact been made.

In particular, a traffic assisting measure in the meaning of § 27 of the service instructions of the Superior Port Authority concerning the operation of the Nautical Centre that could have consisted of a hint and/or warning to ENA 2 and PUDONG SENATOR was waived.

According to § 25 Para 2 of the said service instructions, the warnings/hints to the two vessels would have had to be transmitted in such good time that they could take the necessary measures to avert dangers by agreeing appropriate navigational behaviour directly with each other. According to § 3 Para 1 of the service instructions, danger in this sense of the word is the possibility of the occurrence of damage in the foreseeable future evident if happenings progress unimpeded. Impairment of the safety and ease of traffic or impairment of the port as a traffic route must be sufficiently probable.

It is difficult in the aftermath to assess as of what time the possibility of damage occurring in the meaning of the cited regulations should have been sufficiently probable for the Master Mariners in the VTS in the situation under review. This applies all the more when one considers the plausible confidence of the Master

Mariner on Duty that such a routine encounter situation would basically proceed unproblematically.

However, on the basis of the radar records of the relevant channel opening area, especially as of about **18:20:40 h** (cf. Figure 24 above), it should have become clear that a dangerous approach was directly forthcoming between a large container vessel running out and a small vessel running in and crossing in the opening area of Parkhafen. HOWEVER, it is questionable whether the traffic assistance measure in the meaning of § 27 of the aforementioned service instruction that would be indicated now at the latest could have actually prevented the collision, in other words whether it could have been carried out in good time in accordance with the aforementioned § 25 Para 2 of the service instructions.

It should also be taken into account that the two Master Mariners of the VTS have to monitor and organise shipping traffic in the entire port area and in addition to constant radar-supported observation of various vessel movements in the different port areas they must also act as coastal radio station Hamburg Port Traffic with the associated monitoring and processing of radio traffic.

- The message by the Master Mariner on Duty that "everything was clear" might have strengthened the confidence on the bridge of PUDONG SENATOR that there was nothing to stop them turning into the main navigation channel. However, it is also clear that at least the pilot was aware that this announcement only related to the upcoming traffic.
- The omitted warning of the forthcoming dangerous approach between ENA 2 and PUDONG SENATOR that was probably due to confidence that the two vessels would regulate this routine situation with each other without any problem under the very good visibility conditions promoted the collision occurrence.
- In view of the manning available a objectively desirable greater concentration of the Master Mariner on Duty on danger-incipient approach situations like the subject situation stands against the practical need to set priorities when monitoring and steering traffic.
- In any case there are substantial doubts as to whether a traffic assistance measure (hint/warning) by the VTS at the time the danger situation became evident would in fact have been able to prevent the collision.

6.2.4 Alcohol at the workplace (marginal condition)

The strict internal ban on alcohol within Norddeutsche Affinerie (NA) and the corresponding regulations in the contract of employment between the operating company Hanseatischen Transport Logistik (HTL) and the Master of ENA 2 were unable to prevent the occurrence of the accident incident.

The conclusion to be drawn in the draft of this investigation report by the BSU that there must have been omissions in implementing the existing specifications that were in turn contributory to the accident occurrence was vigorously rejected by both the owner of ENA 2 (NA) and its operator (HTL) in their comments.

In its comment NA initially referred to § 7 No. 7 of its valid work regulation and the ban on working with a blood alcohol content specified in this.

According to the information supplied by NA the said regulation states literally: *"Experience has shown that consumption of alcohol is frequently the cause of serious work accidents. According to the regulations of the Employers' Accident Association (UVV) staff may not put themselves - by consuming alcohol - in a condition in which they can endanger themselves or others. There is an absolute ban on alcohol for certain activities (in particular commanding of vessels, cranes, etc.)."*

This ban on alcohol relating to the entire Hamburg Plant and the Group subsidiaries was reportedly enforced consistently in all parts of the organisation by the works' security of NA and the Health Protection Department.

Employees who showed indications of blood alcohol content in the works' grounds were reportedly immediately subjected to a breath test and in the event that a blood alcohol content was ascertained had to leave the works' grounds promptly. Further consequences were taken.

NA further stressed that it had no legal rights to tackle this. The Master of ENA 2 had not been an employee of NA, but instead like the deckhand employed was an employee of the operating company HTL. NA was "merely" the owner of the vessel. As proven by the Bareboat-Charter Contract of 12 December 2003 between HTL and NA the responsibility for transporting acids rested solely with HTL. NA had convinced itself comprehensively before this of the reliability of the contracting partner HTL. In view of this constellation it was not possible under labour law to exercise any influence on the ship's crew.⁶⁶

However, there were no actual possibilities of influencing the crew provided by HTL and their behaviour either. The actual circumstances at the acid loading station ("Säureverladung Elbe") were not such that any alcoholised condition of the Masters of the acid vessels could be perceived. The acid loading station was outside the company grounds of NA on the Norderelbe. Loading was always carried out in accordance with the same procedure. The acid vessel tied up at the intended facilities. Then the ship's crew swivelled a loading arm to the loading station that was connected by the NA staff member on duty via a quick acting coupling to the acid pipeline. Before the start of the loading operation the boatsman (deckhand) generally climbed over a ladder to the loading station and handed the NA staff member the ADNR checklist that had been completed by the Master prior to this. The NA staff member would supplement and countersign this. The loading operation would then start. The Master would only leave his cabin / bridge briefly to connect and disconnect the loading arm. After completing the roughly two-hour loading operation, the acid vessel would leave the loading station to start the transport of the sulphuric acid. The bridge of the vessel was about 20 to 30 m away from the loading station. The NA staff member had to monitor the loading operation from the shore side. For safety reasons he was not allowed to leave the loading station and, for example, enter the vessel. He had to secure the loading station so that in the event of any difficulties arising the loading operation could be stopped at any time. Due to the said circumstances the NA staff member would only see the Master of the acid vessel briefly if at all.

⁶⁶ Note: The BSU has never said that the NA has the possibility to exercise any influence on the ship's crew under labour law.

On the day of the accident the loading operation had proceeded in the way described. The NA staff members on duty had monitored the loading operation from the shore side. There had only been direct contact with the deckhand when he handed over the ADNR checklist for countersigning. The Master himself had briefly approached one of the two NA staff members when connecting the loading arm at a distance of approx. 10 meters and was otherwise about 20 to 30 metres away on board, on the bridge and for part of the time below deck. On the occasion of the always only brief sighting, the two staff members of NA had not been able to perceive any irregular behaviour or alcoholic influence on the part of the Master. The berthing and casting off had also been totally without any irregularities.

Moreover NA did not have any legal possibilities of accessing the crew of ENA 2, nor had they been able to notice any alcoholic influence affecting the Master of ENA 2 in actual fact on the day of the accident.

The lawyer representing the operator, ENA 2, also rejected any (organisationally connected) co-responsibility for the journey under the influence of alcohol of the Master of ENA 2.

Reference is made to the statements by witnesses to the Waterway Police who had been in contact with or seen the Master on the day of the accident before he reached ENA 2 and later on board the vessel. All the witnesses had stated without restriction that the behaviour of the Master had been completely normal and in no way irregular. None of the witnesses questioned had ascertained any odour of alcohol, alcohol-related deficiency symptoms or other faulty behaviour modes indicating alcohol on the part of the Master. Nobody had suspected alcohol.

Furthermore it was not known when and where the Master had consumed alcohol. However, it is conceivable that he had already been drinking before coming on board, but it was also possible that he only consumed the alcohol on board, for example in the form of beverages with a high percentage alcohol content.

At any rate it was possible that the Master could bring alcohol on board unnoticed. There were no legal possibilities for such excluding physical checks, especially since there was no alcohol-related irregular behaviour on the part of the tested Master who was considered to be very responsible and particularly committed in safety matters.

Furthermore, the strict ban on alcohol had been expressly included in the contract of employment as with all HTL staff and had also been stressed orally when the contract was signed. The Master had been under constant observation during the day at irregular intervals, like all Masters. He could therefore not be confident that possible consumption of alcohol would remain undiscovered.

Finally reference is made to the fact that all staff members of HTL are repeatedly familiarised with safety matters in refresher and upgrading courses and that the subject of alcohol at the workplace was discussed at such times.

If one considers the arguments put forward by NA and HTL, it appears that there are in fact no chargeable omissions regarding the alcohol policy of the two enterprises. However, the contradiction outlined already above between the allegation that the considerable blood alcohol content of the Master of ENA 2 was in no way causal for the accident, that could only be justified with extremely worrying drinking habits and a resulting alcohol habituation, and the vigorous reference to the functioning control mechanisms and the special awareness of responsibility of the Master has not been resolved.

A further contradiction also remained unclarified. Both NA and HTL stress credibly that any infringements regarding alcohol that are ascertained in the company grounds and on the acid vessels lead to strict consequences for the persons affected and that the appropriate consequences had also been made very clear to the Master of ENA 2. In the written pleading of HTL it is stated literally here: "*... He (the Master) knew from his interview that this (consumption of alcohol at the workplace) would lead to immediate dismissal with the consequence that he would not obtain any comparable position any more in the Port of Hamburg.*" Furthermore HTL made it clear that the Master of ENA 2 (also) had been exposed to constant and unforeseeable checks.

Despite this, the Master had evidently completely ignored the clear warnings and the risk of being found out. His evident refractoriness to the livelihood-threatening (!) consequences of being found out infringing the alcohol ban documented by this can therefore only be described with difficulty as a once only and careless infringement of the existing duties of an otherwise committed and responsible staff member.

The Master and the deckhand were to start their work on the day of the accident at about **14:00 h** in the company grounds of Norddeutschen Affinerie (NA). Since ENA 2 was still in the waiting position at Holthusenkaai, the Master and deckhand were taken to the berth by car by an inspector of the operating company and went on board at about **14:30 h**. After shifting to NA and loading there, the vessel left its regular berth at about **17:30 h**. After the collision officers of the Waterway Police went on board and noticed a substantial odour of alcohol on the breath of the Master of ENA 2; the blood sample ordered showed a blood alcohol concentration of 2.2 ‰ reckoned back to the time of the accident. It still appears not very credible that the alcohol consumption necessary for this only took place after the vessel cast off for the Petroleumhafen. Instead it is to be assumed that the Master either already started his work under the influence of alcohol, or that he consumed large quantities of alcohol during the three hours before leaving the loading station. In both cases it is difficult to believe that the strong alcoholising of the Master was not noticed by any of the staff.

As regards the statements by witnesses that no such perceptions were expressly made, it is to be taken into account that at any rate at the loading station the NA staff evidently admitted themselves that they did not have the necessary close and direct contact with the Master to perceive anything reliably. However, the credibility of the statements by persons who were actually in the vicinity of the Master prior to the accident must be considered critically. In so far it is to be taken into account that with a subsequent admission of possible moments of suspicion about alcoholisation of the Master, the relevant witness would necessarily bear not merely moral co-responsibility for the subsequent accident occurrence.

Finally it should also be pointed out that the daily practice described by the NA side according to which there was no personal contact between the Masters of the acid vessels and the loading staff, especially when the ADNR checklist is handed over, appears problematic. The carrier thus does not make use of the most effective option for monitoring the person who is subsequently fully responsible for safe transport of the extremely dangerous cargo, in the interest of all participants.

- The BSU attaches value to the finding that it could not be clarified in what period and with what beverages (quantity, promille content) the Master of ENA 2 achieved the demonstrated blood alcohol content. However, it is improbable that the alcohol consumption necessary for this only took place after casting off from the NA berth.
- Greater attentiveness and even stronger awareness-raising for the risks of alcoholised staff, especially those entrusted with handling and responsible transport of dangerous cargoes might under certain circumstances have been able to prevent the trip under the influence of alcohol.
- Despite the hard consequences known to all staff members in the event of alcohol contraventions, the existing control and monitoring system of the owner and operator of ENA 2 was not sufficient to prevent the journey leading to the collision or to frighten the Master off his alcohol consumption. However, it should also be taken into account here that a 100 % control network and an always successful prevention of trips under the influence of alcohol cannot be achieved by any traffic medium with the current state of the art.

6.3 Capsizing of ENA 2 in the Petroleumhafen

It has already been pointed out that the final causes leading to capsizing of ENA 2 at the berth were not a subject of the investigation, since the questions of stability of an inland vessel that would then have been the focus of attention do not belong to the statutory scope of investigation of the BSU.

Accordingly the following remarks are restricted to an overview of the information / comments on the capsizing incident that have become known to the BSU within the framework of the investigation of the marine casualty and that indicate open discrepancies. In order to avoid repetitions, reference is made to Sections 1, 4.1, 4.4 and 5.2 of this investigation report.

The Master and deckhand of ENA 2 have reported in agreement that directly after the collision the deckhand was charged with ascertaining the damage. However, the comments of the Master and the deckhand regarding the execution of this order deviate substantially from each other.

According to the information supplied by the Master, the deckhand initially reported that he had not ascertained any water flooding in the engine room. The Master states further in his comment for the BSU: "*... Then the deckhand checked the wing passages, in other words the air tanks at the sides of the vessel. In the meantime the deckhand P. had to help me berth however. Then he ascertained that water was running into the wing passage / air tank at the side on the port side at the front. At this time the fire brigade made fast next to us. ...*"

By contrast the deckhand replied to the question of the Waterway Police what he had been doing before ENA 2 made fast at the berth as follows: "*I ran forward and opened the wing tank⁶⁷ port at the front. Then I saw that water was running in there.*"

⁶⁷ Wing tank = side tank.

then I told the Master this. I then closed the wing tank again with a toggle. I then waited midships until the vessel had reached bridge 1.⁶⁸"

In response to the question as to whether he had checked the cargo tanks for any cargo loss (after making fast), the deckhand replied to the Waterway Police: *"No, I didn't. M.⁷¹ checked the aft cargo tank on the port side at the tank dome. Then he closed the toggle again."*

In response to the question as to which other tanks were checked, the deckhand added: *"M. checked the wing tanks aft and the engine room too. I don't know how he checked the engine room. However, he said, "The engine room is dry." I checked the forward wing tank at the entrance hatches."*

A comparison of the statements by the deckhand and the Master regarding the question as to the time at which the leak in the forward port wing tank was ascertained show major discrepancies. It follows from the comment by the Master that the water intake in the forward wing tank, port, was reportedly only ascertained by the deckhand after making fast. However, the deckhand himself states that he had located and reported the subject leak already shortly after the collision and before tying up in the Petroleumhafen.

Priority is to be accorded to this description of the happenings. On the one hand it is objectively hardly plausible that the deckhand only went up to the port foreship that had been evidently and primarily affected by the collision about 18 minutes after the collision to check this for damage. Furthermore there is no evident plausible reason why the deckhand should have answered the corresponding and clearly formulated question of the Waterway Police wrongly. Instead the suspicion arises that the Master of ENA 2 is trying to justify his omission to take measures against the leak at an early stage by claiming that the leak in the forward port wing tank was only located at a much later point in time. In his comment, he himself stresses in response to the question as to the use of the shipside drainage pumps⁷² that these were no longer used (after tying up and locating the ingress of water) because the fire brigade had already had its own pumps. Moreover one of the generators would then first have had to be started. The gate valve and shortly after this the switch of the drainage pump at the wing passage on the port side had "already been under water then".

However, accessibility to the draining facilities was not yet restricted prior to making fast. In this connection it is instead important that the deckhand who was the only crewmember on board along with the Master steering the vessel and accordingly could have been called in to start up and set the draining equipment correctly did not even know that this existed. This is documented by his following reply to the question as to whether shipside leak prevention measures were initiated after the collision:

⁶⁸ Bridge 1 = proposed berth in Petroleumhafen.

⁶⁹ Wing tank = side tank.

⁷⁰ Pier 1 = intended berth in Petroleumhafen.

⁷¹ The Master is meant here.

⁷² Note: On ENA 2 there is a large drainage pump installed midships on the port wing passage. It is operated via an electric switch fitted there and the gate valve for the relevant holds and outlet. Power current is necessary for operation so that initially one of the two ship's generators has to be started for this. There is a second drainage pump that also requires power current in the engine room, from where it is operated.

"No. I didn't know that there was a drainage pump on board. When we needed to we drained using an immersion pump."

Irrespective of the question as to whether early shipside drainage measures might ultimately have in fact prevented capsizing of ENA 2 or not, that is neither covered by the investigation mandate of the BSU nor to be commented on, it remains to be noted that:

- The leak in the forward port wing tank had already been located before ENA 2 tied up in the Petroleumhafen.
- There were technical prerequisites for shipside draining measures on board in the form of two firmly installed drainage pumps.
- The tug CONSTANT could for instance have been asked for assistance after the collision in the form of handing over immersion pumps.
- The Master refrained from starting shipside drainage measures.
- The deckhand did not have the necessary knowledge to start up the firmly installed drainage pumps on the vessel.

7 SAFETY RECOMMENDATIONS

7.1 Alcohol at the workplace

Norddeutsche Affinerie as producer and shipper of the sulphuric acid and as owner and **Hanseatische Transportlogistik** as operator are advised to review the implementation of their high internal safety standards regarding the ban of activities under the influence of alcohol for any possible weaknesses.

It must be made clear to **staff of all port and operator firms** repeatedly that colleagues under the influence of alcohol and especially on board vessels endanger not only themselves but above all other persons and the environment substantially. In the case of contraventions uncompromising measures must therefore be taken in order to prevent the exercise of further activities by colleagues under the influence of alcohol.

7.2 Legal blood alcohol limit in shipping traffic

The BSU is not involved in the political discussion that flared up as a result of the collision between ENA 2 and PUDONG SENATOR concerning an amendment of the legal blood alcohol content within the Seeschiffsstraßen-Ordnung (cf. § 3 Para. 4 SeeSchStrO).

However, **owners** and **operators** of vessels are called upon to review the possibility of a complete ban on alcohol seriously, at least for staff on watch duty, irrespective of the results of any modifications of the legal specifications.

Captains, officers, engineers and all **other crewmembers** are advised to deal responsibly with alcohol consumption on board by themselves and others, independently of current and future legal and company regulations.

7.3 Proper look-out

The **Superior Port Authority of the Free and Hanseatic City of Hamburg** and the competent responsible **authorities** in the other **German ports** are advised to review whether under certain circumstances it should be made mandatory to provide a look out for small and port vessels in the port, possibly depending on their cargo and bridge height, within the context of the HVO or the relevant regulations.

The large number of ship movements in ports, the endangerment of these vessels by a low eye level in combination with poorer recognisability on the part of large vessels and the only restrictedly possible traffic assistance by the VTS are facts that speak out in favour of the necessity of relieving the burden on the Master within the framework of his traffic observation.

The recommendation of making the use of radar facilities on board obligatory aims at the same target.

7.4 Movement rules

All **owners** and **operators of port vessels and inland vessels** are advised to expressly draw the attention of their Masters to observation of the movement rules in accordance with the port traffic regulations Hamburg and of other relevant ports and the SeeSchStrO. If it is necessary to deviate from these movement rules due to the traffic situation from case to case, this is to be reported unmistakably via the VHF work channels provided for this purpose. In addition, if necessary, clear individual traffic agreements are to be made with other vessels.

7.5 Right of way

Vessel commands and **port pilots** of large vessels are advised to consider the use of right of way connected with the showing of signals for vessels restricted in their ability to manoeuvre in accordance with the COLREGs (in the Port of Hamburg in conjunction with § 12 Para 3 HVO) seriously, **when and in so far as**

- navigation against the general rules is urgently necessary because, for example, a waiting / evasion obligation cannot be sufficiently fulfilled due to special morphological features and/or weather conditions (strong wind pressure),
- there is a threat of insoluble contradiction between the factual requirement and features on the one hand and the right of way regulations on the other hand **and**
- individual agreements to be made with priority are not promising.

7.6 Right of way ruling

The marine accident examined here has shown that under certain circumstances there is only conditional agreement between the right of way rules arising from § 5 Port Traffic and Navigation Law (parallel standard: § 3 Para 1 SeeSchStrO, general need to show consideration) and rights and obligations of vessel commands partly embodied in customary law. The **regulation makers** of the **government** (Federal Ministry of Transport, Building and Housing) and the **states** (for example the Senate of the Free and Hanseatic City of Hamburg) responsible for regulating traffic on waterways and in ports are advised to review in their relevant areas of competence in cooperation with the **Traffic and Pilotage Water Centres** and the **Pilot Associations** and **Water Police** whether and to what extent written law and customary habits are in fact in harmony in practice.

Should these examinations reveal that practical rectifications and individual agreements or (under very narrow conditions!) the claiming of a right of way (cf. 7.5 above) to create reliable legal framework conditions for vessel commands and pilots do not suffice in individual cases, the adaptation of existing right of way rules and/or traffic steering elements to practical requirements and circumstances is advisable locally.

7.7 Land radar advice

Vessel commands **and** port pilots are further advised to review the use of land radar advice depending on the situation⁷³ in addition to advisory services by the port pilot on board.

⁷³ Note: In the subject case there was no appropriate requirement.

7.8 Use of VHF radio telephone

Vessel commands and port pilots are advised to carry out direct ship-to-ship traffic agreements at an early stage and unambiguously via the communication channel provided for this (in the Port of Hamburg VHF channel 74).

Pilots are advised to familiarise vessel commands with the way in which VTS support traffic and where appropriate to "translate" customary "port vocabulary" (e.g. "Everything free from below") in cases where misunderstandings might otherwise be possible.

7.9 Radio discipline

Vessel commands and port pilots are urgently called upon to observe the radio discipline set out in the relevant telecommunications regulations. Refraining from stating one's own name or addressing another vessel without expressly calling it may partly conform with practice, especially in port radio traffic. However, the accident has shown once again that radio messages and warnings that cannot be easily be allocated may mean an accident risk that should not be underestimated.

7.10 Manning of the VTS in the Port of Hamburg

The Superior Port Authority of the Free and Hanseatic City of Hamburg is advised to review at regular intervals the appropriateness of only staffing the VTS with one Master Mariner on Duty and one nautical assistant in view of the growing number of ship movements in the Port of Hamburg and the increasing measure of responsibility.

7.11 Leakage stability of the inland motor tankers

The **Centralised Ship's Inspectorate Commission (ZSUK)** and the **Classification Society** are advised to review whether their admission / test criteria for the (leak) stability of inland water craft, especially of tank vessels of category type N open have in fact been observed by ENA 1 and ENA 2. If this was the case, it should be reviewed whether the crucial building regulations should be modified with a view to improving the leak stability.

8 SOURCES

- Written witness statements/comments/reports/correspondence:
 - Captain MV PUDONG SENATOR
 - 3rd Nautical Officer in charge of the watch MV PUDONG SENATOR
 - Port pilot MV PUDONG SENATOR
 - Master MT ENA 2
 - Deckhand MT ENA 2
 - Master of assistant tug CONSTANT
 - Reederei F. Laeisz GmbH, Rostock (vessel operator PUDONG SENATOR)
 - Hanseatische Tanklogistik GmbH, Hamburg (operator ENA 2)
 - Press centre Norddeutsche Affinerie AG, Hamburg (owner ENA 2)

- Written comments on the draft of the report
 - Owner ENA 2
 - Operator ENA 2
 - Vessel operator PUDONG SENATOR
 - Captain PUDONG SENATOR
 - Port pilot MV PUDONG SENATOR
 - Port Pilot Association Hamburg
 - Water Police Hamburg
 - Superior Port Authority Hamburg
 - Fire Brigade Hamburg
 - German Federation of Sea and Port Pilots (BSHL)

- Records by the VTS Hamburg:
 - Radio traffic VHF channel 74 and channel 14
 - Radar recordings

- Written documents/shipside records MV PUDONG SENATOR
 - Print-out manoeuvre data recorder
 - Wheelhouse poster; pilot card
 - ECS data

- Official expert opinion by the DWD on the weather conditions on 28 June 2004 between 18:00 h and 19:00 h CEST in the area of the Port of Hamburg

- Investigations/records by the Water Police Hamburg

- Hearing at the BSU
(Port Captain, Master Mariner on Duty, Leader of the Port Pilot Association Hamburg)

- Fire Brigade Hamburg
(Witness statements by crewmembers of the fire fighting boats)

- Literature etc.:
 - Graf, Kurt; Steinicke Dr. Dietrich (ed.); Seeschiffahrtsstraßen-Ordnung, Kommentierte Textausgabe, Verlag Busse + Seewald GmbH, Herford 1998
 - Tröndle, Herbert; Strafgesetzbuch und Nebengesetze, 50th edition, Verlag C.H. Beck, Munich 2001
 - Urban, Axel; "Manövrieren von Schiffen mit Azipod-Antrieben", almanac of the Schiffbautechnischen Gesellschaft, 2000, S. 212 ff.
 - Product brochure Schottel rudder propeller (www.schottel.de)
 - Scharnow, Ulrich (ed.); Seemannschaft 3, Schiff und Manöver, U., transpress-Verlag Berlin 1987

9 ANNEX: STANDARDS CITED IN THE REPORT

The most important legal regulations significant for the investigation are reproduced in excerpts below. The sequence of the laws/regulations is in line with the legal principle "lex specialis derogat legi generali"⁷⁴ to be observed during application.

Port Traffic and Navigation Law (of the Free and Hanseatic City of Hamburg) of 3 July (GVBl. p. 177) with amendment of 19 January 1981 (GVBl. p. 9), of 10 December 1996 (GVBl. p. 307) and of 8 August 2001 (HmbGVBl. p. 251, 257)

§ 1 Validity area

- (1) The regulations of this law and the statutory orders issued due to this law apply in Hamburg port. As far as nothing different one is certain, they apply in addition in the peripheral areas: on the Alster and their channels and fleets underneath the hare mountain bridge, on the Bille and their channels below the Billeschoepfwerkes, on the Dove Elbe (district mountain village), the Gose Elbe, the new air-lock ditch, the air-lock ditch up to the Serrahnwehr and in the ports Oortkaten and Zollenspieker.

....

§ 5 General behavior

Everyone has itself in such a way to hold back in the area of application of this law that nobody endangers, is damaged or more, than unavoidable after the circumstances, obstructed or troubled.

§ 21 Authorizations

- (1) the senate is authorized, over into that §§ 15 and 19 A to issue intended statutory orders outside for the execution of this law statutory orders,
1. over on and notices of departure as well as police examinations of vehicles, crews and passengers;
 2. over the traffic regulation on waters as well as over the use of the bridge passages, air-locks and barriers by the navigation;

...

Regulation over traffic in the Hamburg Port and on other waters (Port Traffic Regulations; HVO) of 12 July 1979 (HmbGVBl. 1979, p. 227), last amended by the Regulation of 15.3.2005 (HmbGVBl. 2005, p. 71)

§ 1 Applicable legislation

- (1) As far as this regulation does not contain deviating regulations, find in its respective version according to application:
1. the sea-going vessel travel road order in the version from 22 October 1998 (federal law gazette 1998 I page 3210, 1999 I page 193),
 2. the regulation to the international rules changed from 1972 to preventing of collisions on lake from 13 July 1977 (federal law gazette I page 813), last in 7 December 1994 (federal law gazette I pages 3744, 3750) including the international rules from 1972 to preventing of collisions on lake (collision preventing rules - KVR - federal law gazette 1976 II page 1023), or the legislation stepping to their place. With application of these regulations port vehicles are considered as inland waterway crafts.

...

⁷⁴ The particular law displaces the general law.

§ 2 Definitions for vehicles and other Flotation chamber

In this regulation are

1. Vehicles:
Sea and inland waterway crafts, port vehicles, sport vehicles and ferries as well as swimming devices;
2. Port vehicles:
Vehicles, which are intended exclusively for the use in the validity area of port traffic and navigation law;
- ...
9. Privileged ships:
Vehicles, which are forced because of their depth, its length or other characteristics to take the deepest part up of the traffic routes and surfaces; they are considered as manoeuvrierbehinderte vehicles in the sense of rule 3 letter g of the KVR;

§ 4 Traffic routes and surfaces

- (1) In this regulation the following organization of the traffic routes and surfaces applies:
 1. Main navigation channel:
Under and Norderelbe north from Tinsdal to Oortkaten with exception of the water surfaces the line of the Sandtorhoeft along the pontoon and landing plants up to the southeast corner equipment dock Altona;
 2. Secondary navigation channel:
Koehlfleet, Finkenwerder outer port, park port, Koehlbrand, Suederelbe, Kuhwerder outer port and southern heron stairs from the air-lock to the Rethe Hubbruecke with exception of the inland waterway craft couch places at the Ewersween;
 3. Other traffic surfaces:
All other watercourses and surfaces, harbor basins and channels.
- (2) All traffic routes and surfaces are considered as driving water in the sense of the sea-going vessel travel route order.

§ 8 Navigation-police messages

- (1) By the responsible authority marked the sea-going vessels and with Ukw of equipped inland waterway crafts (including dragging and thrust federations) have when the in and running out as well as when getting in the port under indication of the name for delivering the size and the travel way position signals in German language. These vehicles have to announce a passing of the national border to Tinsdal and Oortkaten as well as the on and placing at Hamburg haven Traffic in and outgoing in Hamburg port.
- (2) Vehicles in the sense of the § 30 paragraph 1 of the sea-going vessel travel route order may do that Hamburg port only under of the responsible authority for the respective motor vehicle type admit made navigation-police conditions to drive on. 2 These vehicles are two hours before running out or getting with in § 58 paragraph 1 number 1 of the sea-going vessel travel route order to announce data mentioned at the responsible authority in writing.

§ 12 General information

- ...
- (3) In the KVR prescribed marker for not maneuverable and maneuver-handicapped vehicles may be only led, if it were arranged for safety reasons by the responsible authority; if it concerns a privileged ship, the marker may be led also on arrangement of the port pilots. This does not apply, if and as long as maneuverability occurs impairing event while driving.
- ...

§ 20 General driving rules

- (1) Vehicles have to hold and in such a way drive the right side of the driving water to possibility all traffic routes and surfaces that they do not take the traffic routes to no more up and longer than necessarily. The use of the left driving water side is
1. for vehicles in the pilot shifting service,
 2. when maneuvering with large ships,
 3. in the rest of only on short distances between neighbouring harbor basins, entries or couch places

and under the condition permissible that the endangerment of the continuous navigation can be excluded.

- (2) all vehicles - including the unusual dragging and thrust federations -, in travel, must evade to the privileged ships.

- (3) in addition one too § 25 paragraph 2 of the sea-going vessel travel route order apply to the right of way the following regulations:

1. Vehicles, which use the main navigation channel, have priority before the vehicles coming from secondary navigation channel or other traffic surfaces,
2. Vehicles, which use a secondary navigation channel, have priority before the out other traffic surfaces coming vehicles,
3. Vehicles on other traffic surfaces are alternaterequiring, if and the one vehicle at their starboard side it crosses their course in such a way that the danger of a collision exists.

Seeschiffahrtsstraßen-Ordnung (SeeSchStrO) of 3 May 1971 (BGBl. I p. 641)

Newly worded by the publication of 22 October 1998 (BGBl. I p. 3209), last amended by Art. 3 V of 18 February 2004 (BGBl. I p. 300)

§ 1 Scope

...

- (4) The international rules of 1972 for prevention of collisions at sea - collision prevention rules (annex to § 1 of the regulation on the international rules of 1972 for prevention of collision at sea of 13 June 1977 - (BGBl. I p. 813), last amended by Article 4 No. 6 of the regulation of 7 December 1994 (BGBl. I p. 3744), apply within the scope of this regulation in the version valid for the Federal Republic of Germany unless expressly determined otherwise in this regulation.

§ 2 Definition of terms

- (1) The definition of terms under rules 3, 21 and 32 of the collision prevention rules apply for this regulation; furthermore in the meaning of this regulation:

1. Navigation channel

The parts of water areas bounded or characterised by signals B.11 and B.13 of annex 1 or, in so far as this is not the case, on inland water ways determined for through-going shipping; the navigation channels are considered to be narrow navigation channels in the meaning of the collision prevention rules;

...

13. Right of way of vessels

- a) Vessels with the exception of those on the Kiel Canal that exceed the dimensions announced for a seagoing waterway under § 60 Para 1 or that are forced because of their draft, their length or other properties to use the deepest part of the navigation channel,
- b) Vessels in the area of water areas between the sea boundary in the meaning of § 1 Para 1 sentence 2 No. 1 and 2 and the sea boundary of the coastal sea that satisfy the preconditions published under § 60 Para 1;

these are considered to be manoeuvre-impeded vessels in the meaning of Rule 3 Letter g of the Collision Prevention Rules;

.....

§ 3 Basic rules for behaviour in traffic

- (1) Each traffic participant must behave in such a way that safety and ease of traffic is ensured and so that no other party is damaged, endangered or impeded or bothered more than is unavoidably necessary under the circumstances. In particular he shall observe the rules of care and caution required by customary seamanship or particular circumstances of the case. The command of a vessel equipped with a VHF radio telephone system is obliged to listen to the traffic information and supporting measures issued in German and on request in English by a VTS, following the regulations of behaviour in traffic, and to take the relevant traffic situation into account promptly in accordance with the conditions.
- (2) Taking into account the special circumstances, all necessary measures must be taken to avert an immediate threat of danger if this necessitates deviating from the regulations of this regulation.
- (3) Anyone impeded in safe command of a vessel due to physical or mental deficiencies or alcoholic consumption or consumption of other stimulants may not command a vessel or independently determine its course or speed. This applies for use of a water motorcycle or a kite and sail surfboard accordingly.
- (4) Anyone with a blood alcohol concentration of 0.8 or more promille or an alcohol quantity in his/her body leading to such a blood alcohol concentration may not command a vessel or determine its course or speed independently. This also applies for use of a water motorcycle or a kite and sail surfboard accordingly.

§ 25 Right of way of shipping in the navigation channel

- (1) The regulations contained in the following paragraphs apply for vessels in the navigation channel in deviation from Rule 9 Letters b to d and Rules 15 and 18 Letters a to c of the collision prevention rules.
- (2) In the navigation channel, vessels following the course of the navigation channel, irrespective of whether they can only move safely within the navigation channel, have right of way over vessels who
 1. run into the navigation channel,
 2. cross the navigation channel,
 3. turn in the navigation channel,
 4. are leaving their anchorage or berths.
- (3) In as far as sailing vessels do not follow the direction of a navigation channel clearly, they shall behave vis-à-vis each other in accordance with the collision prevention rules if they do not endanger or impede vessels entitled to right of way as a result.
- (4) Irrespective of whether they are following the course of a navigation channel or not, vessels in the navigation channel have right of way over vessels running into this navigation channel from a branching or incoming navigation channel.
- (5) If vessels approach a narrow point that does not provide definitely sufficient space for them to pass at the same time, or a part of the navigation channel marked with the signal A.2 in annex I from both sides, then the right of way belongs...
- (6) A vessel that must grant right of way must show in good time by its navigational behaviour that it will wait. It may only continue its voyage when it can see clearly that shipping will not be impaired.

§ 60 Authorisation to issue shipping police announcements and legal regulations

- (1) The Water and Shipping Directorates Nord and Northwest are empowered to issue the publications provided for in the above regulations if and in as far as this is necessary to avert dangers for the safety and ease of traffic. The announcements are to be published in the Federal Gazette.
- (2) The Water and Shipping Directorates Nord and Northwest are empowered to decree legal regulations on the bounding of military and civil practice and barred areas and the resulting behaviour of vessels.
- (3) The Water and Shipping Directorates Nord and Northwest are authorised to issue instructions of a temporary nature with a scope of validity of at most three years via legal regulations that become necessary on special occasions for the safety and ease of traffic on seagoing waterways. The directions can in particular be occasioned by work on a waterway, public events or the waterway conditions. Sentence 1 is also to be applied for regulations that are necessary in order to take shipping police measures until this regulation is altered or for test purposes.

International Rules of 1972 for Prevention of Collisions at Sea (- COLREGs -)

Rule 6 – Safe Speed

Every vessel shall at all times proceed at a safe speed so that she can take proper and effective action to avoid collision and be stopped within a distance appropriate to the prevailing circumstances and conditions.

In determining a safe speed the following factors shall be among those taken into account:

- (a) By all vessels:
 - (i) the state of visibility;
 - (ii) the traffic density including concentrations of fishing vessels or other vessels,
 - (iii) the manoeuvrability of the vessel with special reference to stopping distance and turning ability in the prevailing conditions;
 - (iv) at night the presence of background light such as from shore lights or from back scatter of her own lights;
 - (v) the state of wind, sea and current, and the proximity of navigational hazards;
 - (vi) the draught in relation to the available depth of water.
- (b) Additionally, by vessels with operational radar;
 - (i) the characteristics, efficiency and limitations of the radar equipment;
 - (ii) any constraints imposed by the radar range scale in use;
 - (iii) the effect on radar detection of the sea state, weather and other sources of interference;
 - (iv) the possibility that small vessels, ice and other floating objects, may not be detected by radar at an adequate range;
 - (v) the number, location and movement of vessels detected by radar;
 - (vi) the more exact assessment of the visibility that may be possible when radar is used to determine the range of vessels or other objects in the vicinity.

Rule 9 – Narrow Channel

- (a) A vessel proceeding along the course of a narrow channel or fairway shall keep as near to the outer limit of the channel or fairway which lies on her starboard side as is safe and practicable.
- (b) A vessel of less than 20 metres in length or a sailing vessel shall not impede the passage of a vessel which can safely navigate only within a narrow channel or fairway.
- (c) A vessel engaged in fishing shall not impede the passage of any other vessel navigating within a narrow channel or fairway.

- (d) A vessel shall not cross a narrow channel or fairway if such crossing impedes the passage of a vessel which can safely navigate only within such channel or fairway. The latter vessel may use the sound signal prescribes in Rule 34(d) if in doubt as to the intention of the crossing vessel.
- (e) (i) In a narrow channel or fairway when overtaking can take place only if the vessel to be overtaken has to take action to permit safe passing, the vessel intending to overtake indicate her intention by sounding the appropriate signal prescribes in Rule 34(c)(i). The vessel to be overtaken shall, if in agreement, sound the appropriate signal Prescribed in Rule 34(c)(ii) and take steps to permit safe passing. If in doubt she may sound the signals prescribed in Rule 34(d).
- (ii) This Rule does not relieve the overtaking vessel of her obligation under Rule 13.
- (f) A vessel nearing a bend or an area of a narrow channel or fairway where other vessels may be obscured by any intervening obstruction shall navigate with particular alertness and caution and shall sound the appropriate signal prescribed in Rule 34(e).
- (g) Any vessel shall, if the circumstances of the case admit, avoid anchoring in a narrow channel.

Rule 15 – Crossing Situation

When two power-driven vessels are crossing so as to involve risk of a collision, the vessel which has the other on her own starboard side shall keep out of the way and shall, if the circumstances of the case admit, avoid crossing ahead of the other vessel.

Rule 17 – Action by Stand-on Vessel

- a) (i) Where on of the two vessels is to keep out of the way the other shall keep her course and speed.
- (ii) The latter vessel may however take action to avoid collision by her manoeuvre alone, as soon as it becomes apparent to her that the vessel required to keep out of the way is not taking appropriate action in compliance with these Rules.
- (b) When, from any cause, the vessel required to keep her course and speed finds herself so close that collision cannot be avoided by the action of the give-way vessel alone, she shall take such action as will best aid to avoid collision.
- (c) A power-driven vessel which takes action in a crossing situation in accordance with subparagraph (a)(ii) of this Rule to avoid collision with another power-driven vessel shall, if the circumstances of the case admit, not alter course to port for a vessel on her own port side.
- (d) This Rule does not relieve the give-way vessel of her obligation to keep out of the way.

Rule 18 Responsibilities between vessels

Except where Rules 9, 10 and 13 otherwise require:

- (a) A power-driven vessel underway shall keep out of the way of:
 - (i) a vessel not under command;
 - (ii) a vessel restricted in her ability to manoeuvre;
 - (iii) a vessel engaged in fishing;
 - (iv) a sailing vessel.
- (b) A sailing vessel underway shall keep out of the way of:
 - (i) a vessel not under command;
 - (ii) a vessel restricted in her ability to manoeuvre;
 - (iii) a vessel engaged in fishing.
- (c) A vessel engaged in fishing when underway shall, so far as possible, keep out of the way of:
 - (i) a vessel not under command;
 - (ii) a vessel restricted in her ability to manoeuvre.

- (d)
 - (i) Any vessel other than a vessel not under command or a vessel restricted in her ability to manoeuvre shall, if the circumstances of the case admit, avoid impeding the safe passage of a vessel constrained by her draught, exhibiting the signals in Rule 28.
 - (ii) A vessel constrained by her draught shall navigate with particular caution having full regard to her special condition.

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