

**Theme study into fire safety onboard inland
navigation passenger ships**

The Hague, June 2008

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N.B:

This report is published in the Dutch and English languages.

In the event of conflict in interpretation, the Dutch text will be deemed binding.

CONSIDERATION

On the 18th of August 2001, a fire broke out onboard a passenger ship on the Amsterdam-Rhine Canal. There were 12 passengers and 16 crew members onboard the 89-year-old ship, which had been converted to a passenger ship. The accident mainly caused a substantial degree of material damage. 4 passengers sustained minor injuries during the evacuation. The relatively good outcome was more a result of fortuitous circumstances than the effect of the safety provisions and procedures. The small number of passengers onboard simplified the evacuation. If the ship had been at full capacity with 82 passengers, the evacuation would have been considerably more difficult. As a result of the investigation conducted by the Dutch Safety Board into this specific incident, which uncovered suspected structural safety issues, a theme study into fires onboard passenger ships was launched.

The results of the theme study, which was based on research into incidents and visits onboard operational inland passenger ships, gave rise to concerns within the Dutch Safety Board with regard to fire safety onboard these types of ships. Passenger ships generally carry relatively large numbers of often vulnerable and less able-bodied passengers. In the event of a fire, these passengers are not able to reach safety on their own and are dependent upon assistance from others. If it is subsequently necessary to evacuate the ship, the limitations imposed by the water make this a risky and difficult procedure. In the event of fires onboard passenger ships in particular, account must be taken of severe complications as a result of the advanced age of (a number of) the passengers. In this situation it is also unrealistic to rely on the rapid arrival of external assistance. The onboard fire safety procedures must be adequate. The study revealed that the owners, skippers and crews of passenger ships are not sufficiently aware of the potentially limited ability of passengers to cope in this type of situation. In this sector, the emphasis is on ensuring that passengers enjoy a pleasant and comfortable stay whilst onboard. This often means that not enough attention is paid to fire safety. In view of the major potential risks, the Dutch Safety Board considers it necessary to explicitly highlight the structural safety issues in respect of fire safety within this specific sector.

The requirements in the field of safety on and around passenger ships have been set out in various laws and regulations. Whereas on the one hand, safety issues for the employer in relation to employees is governed by the Working Conditions Act, on the other hand, responsibility for fire safety, fire fighting and safety procedures on passenger ships and the care of passengers onboard is laid down in maritime legislation. In view of the international nature of passenger transport, the regulations for the inspection of vessels for the Rhine Navigation (ROSR) and the Rhine navigation traffic regulations (RPR) are particularly relevant.

The abovementioned statutory regulations assign the owner of the ship, the skipper and the employer of the ship's crew their own specific tasks and responsibilities. It goes without saying that there are risks associated with carrying large numbers of passengers. The three parties referred to above can be expected to take personal responsibility with regard to the management of risks onboard the ship. Indeed, the concept of individual responsibility for risk management is a recurrent theme in the applicable legislation. Examples include the obligation for the owner/skipper to have introduced safety procedures incorporated in the ROSR; the requirement stipulated in the RPR that the ships must be appropriately designed and equipped to ensure the safety of those onboard; the requirement, also set out in the RPR, that the skipper must be a "good seaman"; and the Occupational Health and Safety Hazard identification (RI&E) and analysis obligation imposed on the employer for the purpose of ensuring the safety of his or her employees under the Working Conditions Act. The investigation however revealed that, with a few exceptions, skippers and owners of passenger ships devote little attention to fire safety and to the specific issues surrounding the evacuation of passengers in general, and less able-bodied passengers in particular.

Certificate of Inspection

Before a (passenger) ship is permitted to set sail, both the ship and the organisation must have met with a number of requirements. The requirements relate not only to the technical features of a ship, which are dependent upon its age, but also the onboard safety procedures, which are entirely unrelated to the age of the ship. If these requirements have been met, the Transport and Water Management Inspectorate will issue a Certificate of Inspection (COI). The IVW carries out inspections prior to granting a COI when a ship is first put into commission and on renewal of the certificate. This assessment does not, however, provide a full picture: the inspections do not extend to cover the entire ship. The specific details of the inspections depend on the chosen points for attention, as well as the personal interpretation of these of the individual inspector and owner in question. There are no uniform standards for the inspections. There is therefore a risk that the

inspector will fail to observe that the ship does not meet the applicable requirements. This is all the more serious considering that in many cases; the inspections appear to focus exclusively on the applicable technical requirements, whilst the equally valid requirements in relation to safety procedures often remain somewhat neglected. In spite of this, the COI is viewed by owners and skippers of passenger ships as proof that all requirements, including those in relation to the organisational aspects of safety, have been met. The crucial aspect of risk management is therefore being neglected.

Transitional arrangement and fulfilment of individual responsibility

European Directive 2006/87/EC lays down technical regulations for inland waterway ships, which they must meet in order to be eligible for a certificate. This Directive also incorporates the transitional provisions in respect of ships that have already been put into commission. These regulations and the transitional arrangements are included in the ROSR.

The transitional arrangements are linked to the year in which the ship was constructed. As a result, the technical fire safety requirements can vary. Provided that old ships have not been radically altered, they do not have to meet the requirements in relation to fire prevention that, for instance, new ships are required to meet.

The transitional arrangement for old ships, which grants certain ships a long-term exemption from requirements to introduce the necessary fire safety provisions, makes it even more important that the non-technical requirements, such as safety procedures, are fulfilled. After all, owners and skippers of ships that fall under the transitional arrangement can be expected to take supporting measures in order to offset the increased risk associated with the transitional provisions as far as possible. In this situation, the reduced focus on safety procedures brought to light by the investigation is therefore even less advisable: there is every reason to ensure that particular attention is paid to this issue on an ongoing basis.

The operational requirements that can be imposed on safety procedures for dealing with fires onboard ships are the management of the tasks described in provisions such as those of the ROSR. These include aspects such as training, the provision of instructions and drills in relation to raising the alarm, fire fighting, the provision of assistance and evacuation. In addition to preparing for an emergency situation, care must be taken to ensure that escape routes are maintained and remain fully accessible and unobstructed. There must also be (sufficiently large) areas in which passengers can assemble. Adequate arrangements must also be in place with regard to the maintenance of fire prevention and fire fighting equipment, and the correct storage of flammable materials and (flammable) waste.

Examples

The conclusion that individual responsibility is only being taken to a limited extent is supported by a number of examples that were uncovered during the course of the investigation.

- a) The information uncovered during the theme study showed that in the event of an emergency, passenger ships are not always moored to the shore or alongside the quay in good time, which can severely complicate the evacuation of passengers. When sailing on the open water, it is often impossible for ships to moor, and even on rivers, it is not always possible to moor (in good time) as a result of shallows and wharf and quay structures. It appears that this risk is often not recognised.
- b) The theme study also revealed that there are no adequate assembly points for passengers' onboard inland passenger ships, where they can safely gather for a period of time in the event of a fire. This is primarily due to the lay-out, design and structure of the ships. If a safe assembly point is absent an evacuation from an unmoored ship is the most realistic option in the event of a fire. It appears that in drawing up evacuation plans, insufficient account is taken of the problems associated with this type of evacuation as a result of the reduced mobility of a percentage of the passengers. This is particularly relevant in the case of passenger ships with overnight accommodation, where problems of this type are rarely anticipated.
- c) Onboard hotel passenger ships (with the exception of day cruise ships), life jackets are usually stored in the crew and passenger cabins. Life jackets are not stored in a central location at assembly points (as required in the case of sea-going ships). Problems will occur if, in the event of an emergency (evacuation), crew members and passengers first need to collect these jackets from their cabins. This could lead to a loss of valuable time and reduce the chance that individuals will actually be able to get to a life jacket in time in the event of

an evacuation: certainly if it is not possible to reach the cabins due to the presence of fire and smoke.

- d) Group life-saving equipment, such as life rafts, is only prescribed for zone 2 waters (open water). Lower classified inland waterways can however also be very wide and sometimes inaccessible to the emergency services, which means that in practice the situation is not very different from that which applies in the case of the official zone 2 waters. Group life-saving equipment is, however, not required in the case of ships sailing on lower classified inland waterways, and the potential problems to which this could give rise in the event of an emergency are also not recognised.

Investigation

For the purpose of the investigation, ten dossiers on passenger ships on which a fire actually broke out were examined in order to identify the common features. In addition, around forty randomly selected passenger ships were inspected to determine the situation with regard to fire safety.

The findings of the investigation revealed that skippers and owners are not sufficiently aware of the dangers associated with smoke in the event of fires. The greatest danger in the event of a fire is often presented not by the fire itself, but by the accompanying smoke. This is what claims the most victims. Smoke contains a variety of toxic fumes, such as carbon monoxide. This gas has an intoxicating effect, which can lead to loss of consciousness and potentially death. The smoke produced in the event of a fire can penetrate all areas of the ship and can severely complicate the evacuation of the passengers and crew. It is also impossible to locate the seat of the fire and to fight the fire without a compressed-air mask in the event of severe smoke production.

Furthermore, the same shortcomings were established time and again, which means that it is possible to assert that there are a number of structural safety issues in the case of the transport of passengers on inland waterways.

1. This concerns shortcomings in the design of the ships, particularly failure to meet the requirements in relation to compartmentalisation, the incorrect installation/implementation of cable transits and pipes, the interior of rooms and choice of materials.
2. Failure to provide personnel with (sufficient) training.
3. Lack of precautionary measures, such as evacuation possibilities and provisions in the event of a fire.

The problems identified will arise in the event of a fire or evacuation, and are likely to lead to escalation in the case of the evacuation of passengers, who are usually of a more advanced age and/or less able-bodied. These passengers often suffer from physical limitations (to a greater or lesser extent).

Supervision and fire safety

The Transport and Water Management Inspectorate (IVW) is the official supervisory authority for the shipping industry. The IVW carries out inspections prior to granting a COI when a ship is first put into operational service and on renewal of the certificate. When a ship is first put into operational service, the IVW is the authority that is explicitly charged with assessing fire safety. On shore, fire safety assessments are carried out by the fire department within the context of the granting of planning permission and, in the case of structures that will provide accommodation for large numbers of individuals, an occupancy permit.

The IVW operates on the basis of the requirements laid down in legislation in respect of inland navigation and conducts inspections of newly constructed ships, as well as four-yearly inspections on renewal of the Certificate of Inspection (COI). In its response to the draft report, the IVW does not describe the situation with regard to fire safety onboard passenger ships as a cause for concern.

The theme study carried out by the Dutch Safety Board has demonstrated that the supervision by the IVW of compliance with fire safety requirements onboard passenger ships can, in general terms, be characterised as too limited. The fire department's expertise in the field of fire prevention, for instance, is not being used by the IVW, or is only being used to a very limited extent.

It is the Dutch Safety Board's opinion that the most obvious and appropriate course of action would be for the IVW to make more effective use of the expertise of the fire department. Incidentally, the

Dutch Safety Board's concerns apply not only to passenger ships, i.e. hotel ships, but also to day cruise ships, which are used for parties and house parties.

An additional advantage of involving the fire department in these inspections is that the knowledge gained could prove useful in fire fighting or the provision of assistance by the professional emergency services.

Finally, in addition to the IVW, the Health and Safety Inspectorate (AI) also plays a role in the supervision of inland navigation. With a view to protecting their employees, skippers/owners are expected to carry out, or arrange to have carried out, Occupational Health and Safety Hazard identification and analyses (RI&E), and to make improvements in anticipation of potential risks. However, apart from targeted projects, the AI only verifies whether or not this requirement to carry out RI&E's under the Working Conditions Act has been met on a reactive basis, i.e. as a result of a major accident and/or scheduled inspection.

Conclusions

The theme study has revealed that, in general terms, there is a major difference when it comes to fire safety provisions between passenger ships that fall under the old arrangement including the transitional arrangement, and those passenger ships that meet the latest regulations in respect of navigation on the Rhine. As a rule, fire safety onboard ships constructed in accordance with the old regulations is sub-standard, as due to the date of construction, the owners of the ship are not required to take all of the statutory safety measures. This affects a few hundred ships out of the total fleet of almost 1.000 passenger ships. These old ships pass the safety inspections as a result of the transitional arrangement, even if they do not necessarily meet the statutory fire safety requirements imposed on new ships. As a result, passenger ships with sub-optimal or relatively poor safety provisions are in operation. Furthermore, the ships also generally have poor safety procedures.

On important points, the situation onboard passenger ships shows similarities with the issues described in the report published by the Dutch Safety Board in September 2006 on the fire in the Schiphol detention centre. A substantial number of the ships are designed in a way that constitutes a fire risk and feature inadequate or inconsistently implemented compartmentalisation, the structure of which incorporates materials that are not fire-resistant and/or fire-retardant. In this context, passengers are largely dependent on the crew, who are not sufficiently prepared and/or trained in fire safety to be able to cope adequately in the event of a fire.

In its response to the draft report, the Netherlands Rhine and Inland Shipowners' Association (CBRB) claimed that certain conclusions drawn in the report were outdated. The members of the CBRB operate more than 200 passenger ships: one fifth of the total fleet of passenger ships in the Netherlands. This shows that not all owners/skippers have joined sector organisations. This is why, although the recommendations are directed at the sector organisations for practical reasons, those owners and skippers who are not members of one of these organisations also need to act on the conclusions reached and recommendations made in this report.

Finally, it has been established that a percentage of the tour operators are indeed aware of the risks and impose requirements on the operators of hotel ships, regarding such matters as the organisation of evacuation drills. The Dutch Safety Board regards this as a positive development and believes that the tour operators, sector organisations and insurance providers in particular can play a role in encouraging new initiatives for the purpose of improving safety.

In the federal state of Mecklenburg-Western Pomerania in Germany, for instance, a quality mark has been developed for passenger ships which provides consumers with an idea of the level of quality and safety of a ship.

Recommendations

On the basis of the theme study into fire safety onboard inland passenger ships, the Dutch Safety Board has drawn up the following recommendations.

1. The Dutch Safety Board advises the Netherlands Rhine and Inland Shipowners' Association and the Royal Schuttevaer to:
 - a. improve (fire) safety onboard passenger ships in order to ensure that the crew and passengers are able to cope without the assistance of the emergency services in the event of an incident, and
 - b. introduce a certified quality/safety mark¹ that provides tour operators and passengers in particular with an insight into the current level of onboard (fire) safety provisions and safety procedures.

2. The Dutch Safety Board advises the Minister of Transport, Public Works and Water Management to:
 - a. develop uniform criteria relating to such aspects as safety procedures to be applied during inspections performed within the context of the granting of a Certificate of Inspection to passenger ships, and
 - b. incorporate, in consultation with the Netherlands Association of Fire and Disaster Control Services, a fire safety assessment as a permanent component of these standard criteria.

The Hague, June 2008

Pieter van Vollenhoven
Chairman of the Dutch Safety Board



M. Visser
General Secretary



¹ Comparable with the Dutch Coach Business Quality Mark Board [*Stichting keurmerk touringcarbedrijf*] or the German safety certificate introduced in the federal state of Mecklenburg-Western Pomerania.

LIST OF ABBREVIATIONS

AMBV	Order in Council
ANVR	Dutch Association of Travel Agents and Tour Operators
Working Conditions Act	Working Conditions Act 1995
BHV	company emergency response provision
BSB	Inland Waterways Ships Decree
BSW	Inland Waterways Ships Act
CBRB	Netherlands Rhine and Inland Shipowners' Association
CCR	Central Commission for Navigation on the Rhine
COI	Certificate of Inspection
DG-TREN	Directorate-General for Energy and Transport of the European Commission
Efectis	Efectis Nederland B.V. is a privatised division of TNO. All activities carried out by TNO's Centre for Fire Safety were transferred to Efectis on 1 July 2006.
IVW	Transport and Water Management Inspectorate
KNRM	Royal Netherlands Sea Rescue Institution
NKIP	Netherlands Certification Institute for Recreational Craft
RI&E	Occupational Health and Safety Hazard identification and analysis
ROSR	Regulations for the inspection of ships for the Rhine Navigation
SVW	Shipping Traffic Act
TNO	Netherlands Organisation for Applied Scientific Research
VNSI	Netherlands Shipbuilding Industry Association
TÜV	<i>Technische Überwachungs Verein</i> (quality mark)

Definitions (source: ROSR)

Persons with reduced mobility

'Persons who experience specific difficulties when using public transport, such as the elderly, the disabled, individuals with a sensory handicap, wheelchair users, pregnant women and individuals accompanying small children'.

Passenger ship

'A day cruise ship hotel ship constructed or designed for the transport of more than twelve passengers'.

Day cruise ship (round trip)

'A passenger ship that does not feature cabins for the overnight accommodation of passengers'.

Hotel ship

'A passenger ship that features cabins for passengers'.

Assembly zones

'Specially protected zones of the ship in which individuals are required to gather in the event of danger'.

Evacuation areas

'Part of the ship's assembly zones from which individuals can be evacuated'.

1 INTRODUCTION

1.1 GENERAL

On the 18th of August 2001, a fire broke out in the Amsterdam-Rhine Canal in the region of the Muiderbrug in Weesp on a hotel ship that was sailing from Amsterdam to Cologne. The fire, which started in the engine room, rapidly spread across the entire rear section of the lower deck, where the crew's cabins were situated. The fire subsequently spread to the middle deck, where the passengers' cabins were situated. The 12 passengers and 16 crew members who were onboard the ship at the time of the fire were able to evacuate in good time. 2 passengers and 2 crew members sustained minor injuries. The stern was completely burnt out.

Initial investigations on the basis of the Dutch Safety Board's accident database revealed that the fire onboard this passenger ship was not an isolated incident within the context of the transport of passengers on inland waterways. Prior to the fire, two fires on passenger ships had been reported to the Dutch Safety Board and subsequently investigated during the period 1999-2001. It is true to say that in these incidents, fortuitous circumstances, such as the fact that there were few passengers onboard and the presence of other ships in the vicinity, meant that the fires solely resulted in material damage. However, the findings from the investigations conducted by the Dutch Safety Board into the fires on other passenger ships gave sufficient cause to suspect structural safety issues in the field of fire safety.

The Dutch Safety Board deemed the risk onboard these ships to be such that it commissioned a theme study. The study focused specifically on fire safety onboard inland passenger ships (hotel ships, day cruise ships and ferries) during the period 1999-2004. Fires have also broken out onboard Dutch passenger ships in subsequent years, however as these incidents occurred abroad and due to the fact that it was necessary to establish a final date for practical reasons, a number of incidents were not investigated by the Dutch Safety Board.



Figure 1: On the right of the photo, the burning passenger ship. On the left, a ship of the Amsterdam Port Authority, also a fire-extinguishing ship (source unknown).

A number of relevant parties are responsible for fire safety onboard passenger ships. For instance the 'carrier' is responsible for ensuring the safe transport of the passengers, whilst the government, as the authority with ultimate responsibility for the overall system, is responsible for maintaining safety by means of legislation, regulations and supervision.

In order to find answers to the questions posed, the following aspects were assessed during this special investigation:

- Shipbuilding requirements, construction
- Fire protection, fire fighting and fire safety
- Training provided to the crew/personnel
- The evacuation and behaviour of passengers
- Government supervision
- National and international legislation

1.2 READING GUIDE

Chapter 2 describes the facts and circumstances in relation to fire safety in the ten incidents that were investigated. A summary is also provided of the findings made during additional inspections conducted onboard forty passenger ships. Chapter 2 provides a general outline of the scope and characteristics of the inland waterway passenger transport sector.

This is followed by a description in Chapter 3 of the assessment framework applied to the results of the investigation. Chapter 4 provides an overview of the parties involved and their respective responsibilities. Chapter 5 describes the investigation findings and analyses.

Chapter 6 lists the main conclusions reached on the basis of both the investigations into the circumstances onboard ten ships on which a fire occurred and the additional inspections.

Finally, Chapter 7 of the report presents the recommendations drawn up with the aim of contributing towards increasing (fire) safety onboard passenger ships.

2 FACTS AND CIRCUMSTANCES

2.1 INVESTIGATION INTO THE CIRCUMSTANCES

As part of this theme study, research was carried out into 10 fires that broke out onboard passenger ships sailing on Dutch rivers and waters during the period from September 1999 to August 2004. This chapter presents the general findings made during the investigations into these fires. See Annex 3 for information on each of the incidents.

On the instructions of the Dutch Safety Board, TNO carried out inspections onboard operational passenger ships for the purpose of verifying the information obtained. The closing paragraph of this chapter provides information on the type and age of the passenger ships inspected, and a summary is given in tables 1 and 2.



*Figure 2: A burning passenger ship on the Wadden Sea
(Source: Royal Netherlands Navy).*

2.2 CAUSE AND DEVELOPMENT OF THE FIRE

Of the 10 fires that broke out onboard the ships, 8 originated in the engine room. The most common causes were short circuit, a fuel leak and/or heat radiation. The 2 remaining incidents involved overheating of the cables behind the panels in one of the accommodation rooms. The fires were characterised by a rapid spread of the fire as a result of a number of things, including:

- the use of non-fire retardant or heat resistant materials, such as untreated wood panels
- the presence of flammable materials, such as insulant saturated with oil
- cable ducts without adequate sealant and partition transits
- open doors
- non-compartmentalised lowered ceilings.

A fire alarm had been installed on 8 of the 10 ships. In 2 cases it emerged that the alarm was not in working order. On 3 ships the alarm sounded however in 3 cases it was not heard. In the remaining cases, the fire did not originate in the vicinity of the fire alarm. The investigation revealed that almost all of the fires onboard the passenger ships were discovered more or less by chance by passengers or crew members.

2.3 FIRE FIGHTING AND EVACUATION

In the case of 6 of the 10 fires investigated, the crew had made an attempt to combat the fire. In one instance, however, the fire had spread to such an extent that it was no longer possible to tackle the fire successfully. In 2 of the aforementioned 6 cases, the efforts made by the crew were effective and it was no longer necessary for the fire department to take action. On these ships, a fire extinguisher was installed in the engine room and it was possible to successfully activate this. In the remaining incidents, the fire department eventually took over combating the fire. On 1 of these 8 ships a fire extinguisher had been installed, but could not be used as the key required to activate the system was not available (see box).

In April 2002, a hotel ship carrying approximately 170 passengers was sailing on the River Waal when a fire broke out. The two engineers attempted to extinguish the fire using a couple of dry-chemical extinguishers. They were forced to evacuate the engine room due to the large amount of smoke produced by the fire, and they closed the entrance door leading to the engine room. It was not possible to operate the fire extinguisher that had been installed, as the access door to the extinguisher was locked. Of the two keys that would have released the access door, one was hanging in the control room, which could no longer be accessed due to the smoke, and it was discovered that the second, held by the captain, did not fit.

4 of the 10 ships were moored when the fire broke out. It was possible for the passengers of these moored ships to reach safety relatively easily by moving on shore. 6 of the ships were underway at the time of the fire. 2 of these were sailing on open water (Lauwersmeer and Wadden) and were not able to moor during the fire. One of the ships was sailing on a large river (the Waal) and was not able to moor. It was only possible to evacuate the passengers onboard these three ships by means of transfer to another ship. The remaining 3 ships were able to reach a berth in good time.

A day cruise ship was sailing on the Wadden Sea with 31 passengers onboard. During the journey, a fire broke out. Attempts by the crew to tackle the fire with an extinguisher were unsuccessful. The passengers onboard were gathered on the afterdeck. It was not possible to moor in good time, as the ship was sailing on open water, far from the wharf or any harbour. The captain climbed up the aluminium superstructure in order to throw the four life rafts situated there overboard so that they would be ready for use. When he threw the first raft overboard, however, it failed to open out and was therefore unusable. He did not have the opportunity to throw the remaining three rafts into the water, as in the meantime; the deck had literally become so hot under his feet that his shoes had become stuck to the aluminium deck. A short time before the flames spread to the upper deck, it was possible to transfer the passengers to a fish cutter that had rushed to assist the ship.



Figure 3: The evacuation of passengers to a fish cutter on the Wadden Sea. Next to the burning passenger ship it is possible to see the unopened (and unusable) life raft (Source: Royal Netherlands Navy).

The escape routes onboard the inspected ships led to emergency exits, which in turn led into the open air (deck or cabin roof). The so-called assembly zone, the zone near to the 'emergency exit' as referred to in the new regulations, did not always appear to be designed to hold the potential number of people trying to escape, i.e. the maximum number of passengers. For instance on one

of the ships inspected, which had a maximum capacity of 400 passengers, the escape route led to a deck with a surface area of just 30 m². On the basis of current legislation, this surface area should have been 180 m² at the very least². Pursuant to current legislation, the assembly zone is completely inadequate, however the ship in question has been granted an exemption from this requirement until 2045 on the basis of its year of construction (1971).

The maximum number of passengers permitted per ship varied from 40 to 400. The ratio of crew members to passengers varied from 1 crew member per 5 passengers to 1 crew member per 100 passengers. On those ships on which a fire broke out, the average number of passengers onboard was approximately 25% of the maximum number permitted.

As a result of their structure, passenger ships have many concealed spaces behind, for instance, the pre-fab toilets and shower cabins, such as cavities behind the hull plating, spaces below the flooring, and spaces above the lowered ceilings. The inspections revealed that on 6 of the 10 ships, compartmentalisation of these spaces had been implemented in an inconsistent manner. It subsequently emerged that these spaces were used as a storage area for materials or as tunnels for cables and pipes. There were no smoke or fire detectors installed in these areas. Smoke and fire could easily spread if these 'separate areas' are not interrupted with fire-resistant partitions. Furthermore, the smoke would be able to spread more rapidly due to the limited height of the spaces. The result is that fire and smoke could develop and spread without being detected by passengers or crew, whilst there would also be a delay in the triggering of the alarms.



Figure 4: The steel deck is shown in red, the path of the fire in orange: the fire started in the engine room, spreading across the lower deck where the cabins for both the crew and passengers are situated, to the middle deck, where further passenger cabins are situated (Source: Dutch Safety Board).

² ROSR Article 15.06, paragraph 8. The prescribed total surface area of the assembly zone (A in m²) is $0.35 \times F_{\max}$ (m²) for day cruise ships and (A in m²) $0.45 \times F_{\max}$ (m²) for hotel ships. F_{\max} stands for the maximum number of passengers permitted. For this ship, the total surface area in the case of day trips should be 140 m², and in the case of overnight journeys, at least 180 m² in order to meet the requirements.

On the 18th of August 2001, a fire broke out in the engine room of a hotel ship. At the time, the ship was sailing in the region of the Muiderbrug on the Amsterdam-Rhine Canal. The fire spread via the door of the engine room. This was possible as the door could not be closed adequately, as well as due to the ventilation ducts leading towards the stern. In the stern, the fire spread via a wooden section in the otherwise steel ceiling towards the upper deck, then travelling back towards the fore part of the ship as far as the reception area. The fire was able to spread to the successive areas via the non fire-resistant cable transits for the electric cables and due to the presence of flammable materials in the walls and doors (see Figure 5). The entire stern, consisting of two decks housing the cabins for passengers and crew, eventually completely burned out.



Figure 5: Photographs of the cable transits after the fire. The openings shows that the cable transits were not designed to be fire resistant (Source: Dutch Safety Board).

2.4 FIRE SAFETY MEASURES IN PRACTICE

The degree of safety in the event of a fire is affected by the preventative safety measures that have been taken.

Further to the inspection described above, sub-investigations were carried out into the situation with regard to fire safety measures on board randomly selected passenger ships for the purpose of verifying the findings made. The investigation was divided into a technically-oriented fire safety inspection onboard 16 passenger ships and an investigation into the human aspects on 14 other passenger ships. Both investigations were carried out by TNO on behalf of the Dutch Safety Board. The Board also carried out additional inspections on 10 randomly selected operational passenger ships in order to verify the first set of results.

A total of 50 passenger ships were involved in the theme study. On the basis of figures from 2004³, this amounts to 23% of the total number of hotel ships (24 of 108) and 6% of the total number of day cruise passenger ships (26 of 414). See the tables below for the most important characteristics.

³ Source: IVW/Shipping Inspectorate (Inland).

Total	Hotel ships	Day cruise passenger ships
Numbers	24	26
Breakdown of random checks:		
Investigation as a result of a fire	6	4
Investigation into technical aspects (TNO)	8	8
Investigation into human aspects (TNO)	4	10
Investigation into fire safety in general	6	4

Table 1: Breakdown of the type of passenger ship according to focus of the investigation.

	Year of construction		
	<1976	1976-1995	>1995
Breakdown of passenger ships:			
Investigation as a result of a fire	7	1	2
Investigation into technical aspects (TNO)	7	5	4
Investigation into human aspects ⁴ (TNO)	n/a	n/a	n/a
Investigation into fire safety in general	6	2	2

Table 2: Breakdown of the ships inspected according to year of construction.

This distribution enabled the Dutch Safety Board to gain a broad insight into the various elements that play a role in terms of fire safety onboard passenger ships.

The investigations into technical aspects carried out by TNO revealed that, in practice, the effect of fire-resistant and fire-retardant measures was in many cases also being cancelled out on the newer ships. On 9 of the 16 ships where this was examined, fire-resistant doors were propped open with a hook. On 10 of the 16 ships, cable transits had been installed through fire-resistant walls and partitions in a way that would allow a fire to spread to adjacent areas.

The theme study revealed that a number of basic provisions to guarantee a safe evacuation were inadequate, not permitted or of insufficient quality, or in some cases did not exist at all:

- on 6 of the 16 ships, the pictograms (escape route and exit) were not clearly visible
- blind passages (>2 metres) are not permitted onboard ships. Nevertheless, these were encountered on 4 of the 16 ships
- on 5 of the 16 ships, the instructions were not available in more than one language
- the instructions contained conflicting information, e.g. 'await instructions from the crew' and 'make your way to the assembly point'
- on 8 of the 16 ships, the secondary escape routes were situated in locations that were not obvious, for instance via a kitchen area or store room
- on all of the ships inspected, the assembly zone only provided space for a (too) limited number of people
- on 8 of the 16 ships, the instruction booklets in relation to potential evacuation, emergency and evacuation plans, which are required by law, were absent.

During the theme study into the human aspects relating to fire safety it emerged that the crew members of the passenger ships had either received no training at all, or the basic company emergency response provision (BHV) training. Half of the shipping companies required nautical crew members to follow a BHV training course. The remaining service personnel onboard were not required to follow this training.

The crews of the passenger ships inspected mainly consisted of nautical and service personnel of various nationalities. The working language amongst the nautical crew members was generally Dutch or German. In many cases, the service personnel onboard the hotel ships were from Eastern Europe. Onboard the various ships that were visited, the wide range of nationalities meant that there was no common language of which all of the crew members had a sufficient command.

⁴ The investigation focused entirely on the human aspects. The year of construction of the 14 ships inspected was not recorded by TNO.

The investigation also revealed that regular drills were not carried out onboard the ships (>90%) for the purpose of rehearsing procedures to be followed in the event of a fire, emergency or evacuation. Only one of the ships inspected held an emergency drill without passengers once every season. On more than half of all of the ships, neither the passengers nor the crew had been issued with safety instructions.

Verification of these findings by means of inspections carried out by the Dutch Safety Board on 10 other operational passenger ships revealed the same general picture. Apart from one exception, no drills were held, the fire safety provisions were not effective and the instructions provided to the crew and passengers were not clear.

Interviews with crew members revealed that they assumed that there would be fatalities in the event of an evacuation from a non-moored ship. Incidentally, this can vary according to the shipping company and even according to the ship. It depends entirely upon the circumstances in which the incident takes place.

3 ASSESSMENT FRAMEWORK

3.1 INTRODUCTION

The assessment framework forms an essential part of the theme study, as it is important to provide an indication of the standards and criteria against which an incident is assessed. The assessment framework consists of three parts, namely:

- a. a description of the relevant, applicable legislation and regulations within the sector in which the incident took place
- b. a description of additional standards, guidelines and insights from the relevant sector itself
- c. a description of the general assessment framework for safety management.

The first two parts of the assessment framework are sector-specific and their concrete details depend to a large extent on the type of incident. The third part of the reference framework is a general section, which sets out the Dutch Safety Board's expectations with regard to the way in which the parties involved interpret their own individual responsibility for safety. This chapter examines the three parts in greater detail.

3.2 LEGISLATION AND REGULATIONS

Licensing of passenger transport, i.e.: the granting of permission to operate passenger ships, is based on whether or not the requirements of the Certificate of Inspection have been met. Many owners/skippers of passenger ships appear to assume that, if the technical requirements of the 'Certificate of Inspection (proof that the ship meets the requirements imposed with regard to seaworthiness), issued by the Transport and Water Management Inspectorate, are met, all of the requirements (i.e., including those in relation to the organisational aspects of safety), have been fulfilled. The requirements in respect of the Certificate of Inspection are set out in maritime legislation.

With regard to fire safety provisions onboard passenger ships, there are two relevant statutory frameworks: maritime legislation and working conditions legislation.

3.2.1 *Maritime legislation*

There are 2 legislative regimes that set out requirements in relation to fire safety onboard passenger ships:

- a legislation aimed at the regulation for the inspection of vessels for the Rhine Navigation (ROSR), and
- b Dutch legislation in respect of national inland navigation vessels decree (BSB, including implementation of EU Directive).

The fire safety requirements will become almost identical under both Acts following the implementation of Directive 2006/87/EC on 30 December 2008. The requirements focus on structural measures, fire protection, fire fighting, fire safety equipment and safety procedures and planning. The legislation stipulates that both the skipper and the owner of the ship are responsible for ensuring compliance. Prior to implementation of the Directive, passenger transport on inland waterways is still subject to various requirements under the non-identical legislative regimes (ROSR and BSB).

International Rhine navigation

The Central Commission for Navigation on the Rhine (CCR) lays down rules with regard to the architectural layout and crewing of ships that sail in the international waters of the Rhine. The requirements in respect of construction, equipment and crewing are set out in the ROSR, which became operational in 1976. Radical changes were made to the ROSR in 1995 and 2006. In the legislation, these dates also recur in the context of the transitional arrangements for older ships. The statutory basis lies in a multilateral treaty, the revised Rhine navigation convention (Mannheim Convention). In the case of the Netherlands, implementation is provided for in the ROSR decree. Article 1 of the Mannheim Convention stipulates that a uniform regime (principle of free navigation) applies on the Rhine, and by signing the Convention, the Netherlands transferred authority to impose rules at a national level in respect of Rhine navigation within the waters covered by the convention to the CCR. Article 46 of the Convention stipulates that (unanimous) decisions made by the CCR shall have a binding effect (without the possibility of sanctions if the decision has not been implemented in the legislation of the Member State) on the states that are party to the Convention.

The uniform regime for navigation on the Rhine is an entirely independent legal system, which is acknowledged in European Union regulations. In the application of EC regulations, account must be taken of the legal community of the Mannheim Convention, which cannot be infringed. The Mannheim Convention dates from 1868 (later resolutions can be traced directly back to the original Convention) and pursuant to Article 307, paragraph one, of the EC Treaty, rights and obligations arising from such conventions that predate the EC Treaty are not affected by the provisions of the EC Treaty. As a result of the developing insight and powers of the European Community (EC) in this area, supported by judgments handed down by the Court of Justice of the European Communities, the individual authority of Member States might eventually disappear. For the time being, efforts are being focused on achieving a more intensive collaboration between the CCR and the European Commission.

Legislation in respect of Rhine navigation and European Directive 82/714/EEC was subject to a review in 2006. As a result of the far-reaching collaboration between the CCR and the European Commission, the text of the revised European Directive and the updated ROSR, with the exception of a few specific distinctive rules in respect of (moving) river traffic, is almost identical and set out in Directive 2006/87/EC. This is certainly true when it comes to fire safety in relation to passenger ships.

National legislation

Responsibility for legislation in the Netherlands rests with the Ministry for Transport, Public Works and Water Management. The statutory basis lies in the National Inland Waterways Ships Act (BSW). The BSW stipulates rules with regard to:

- the seaworthiness and layout of, and equipment on, the ship
- safety, health and welfare in connection with employment onboard the ship
- the expertise, skills and physical condition of the skipper.

The BSW is a framework Act. The specific rules are laid down by Order in Council (AMvB). For the purpose of the implementation of the BSW, the requirements in respect of construction and equipment are provided for in the national inland navigation vessels decree (BSB). The BSB stemmed from the former EU Directive 82/714/EEC (October 1982), which set out the national and international requirements in relation to inland navigation. Directive 82/714/EEC was reviewed and re-introduced in March 2006 as Directive 2006/87/EC. The Directive must be implemented in national legislation before 30 December 2008. The BSB combines the European requirements with the additional Dutch requirements.

3.2.2. Legislative reform

On the 17th of May 2007, the Lower House approved the introduction of the Inland Navigation Act, which is due to enter into force on 30 December 2008. This Act will simplify the existing regulations by combining three acts (the National Inland Waterways Ships Act, the Sailing Hours and Crew Numbers (Inland Waterways) Act, and the Inland Waterway Transport Act). The introduction of the Inland Navigation Act will bring the regulations as closely in line with the rules established by the CCR as possible. The new Inland Navigation Act will be set up as a framework act. The requirements in relation to construction and equipment will be set out once again in the BSB. Directive 2006/87/EC will also be implemented in this. For the first time, the revised European Directive will incorporate additional requirements in respect of passenger ships, which means that these will also become effective at an international level. Furthermore, the new legislation (the ROSR and the European Directive) will for the first time stipulate requirements with regard to the training of crew members. The legislation has been supplemented with new regulations, the Passenger Ship Safety Personnel Regulations, which entered into force on 1 January 2006 in respect of the waters that fall under the scope of the ROSR. These regulations introduced the Passenger Ship Expert, the First Aider and (in the case of hotel ships) the compressed-air mask carrier. The introduction of the new regulations also saw the establishment of requirements in respect of these positions. Some examples of these requirements are:

- knowledge of the prescribed layout of, and equipment onboard, passenger ships
- basic principles with regard to the stability of passenger ships
- the prevention and combating of fire, use of fire extinguishers
- basic principles with regard to preventing panic
- principles of conflict management.

There is also a practical component. The training course concludes with an examination, and the participant is then issued a certificate stating that he or she is a certified 'Passenger Ship Expert'.

Transitional provisions in respect of the new maritime legislation

Ships that were put into commission prior to the date of commencement of these or previous regulations are not, or are not immediately, required to comply with various rules (phased

transitional provisions). In some cases, the term of the transitional provisions that apply to existing ships almost equals the technical service life of the equipment in question. The effect of these transitional provisions is that although the majority of ships may be fully certified, as a result of the transitional provisions they are not required to (fully) comply with (parts of) the current legislation. The transitional provisions are set out in chapter 24 of both the ROSR and Directive 2006/87/EC (see Annex 6 for an overview of the transitional provisions).

All of the provisions must have been complied with no later than by the time of the first renewal of the COI after 1 January 2045. In the case of new constructions, alterations or conversions, the components in question are required to comply with the statutory provisions from the outset. After 2045, deviations from the regulations may be permitted. These deviations must be recorded on the Certificate of Investigation.

National inland navigation police regulations (BPR) and the Rhine Navigation traffic regulations (RPR)

The rules for navigation are laid down by Order in Council (AMvB). The Shipping Traffic Act and the National Inland Waterways Ships Act provide a basis for such rules. The rules for navigation also include articles relating to onboard safety. In the RPR (international navigation) this is Article 1.16, Rescue and assistance. In the BPR, Article 1.04 is devoted to the precautionary measures that must be taken in order to avoid placing individuals' lives at risk (Article 1.04).

Besides these regulations, a number of additional regulations that apply to specific situations have been drawn up, such as the Western Schelde shipping regulations.

3.2.3 Working Conditions Legislation

At the time of the investigation, all organisations with employees were subject to the provisions of the Working Conditions Act 1998 (Working Conditions Act), which also included passenger ships. The Working Conditions Act lays down rules in relation to health, safety and welfare during the performance of work duties. The basic principle in this regard is to limit risks. If the danger cannot be removed or contained, the employer may use other preventative solutions, such as the provision of personal protective equipment.

Every company that has employees (i.e., including companies that operate within the passenger transport sector) is obliged to carry out a so-called Occupational Health and Safety Hazard identification and analysis (RI&E). The employer must have the RI&E assessed by a licensed expert⁵. This RI&E forms the basis for a well-founded and well-considered safety policy and also incorporates a plan of approach in relation to the problem areas identified.

At the time that the inspections were carried out onboard the ships, Article 15 of the Working Conditions Act was in force. Pursuant to this Article, the ships were required to meet the obligation to have a company emergency response provision system. The special provisions of Article 2.44 of the Working Conditions Decree did not, however, apply to inland navigation ships.

The new Working Conditions Act became operational on 1 January 2007. With the introduction of the new Working Conditions Act, the specific company emergency response provision regulations and the exceptions to these were dropped from the Working Conditions Decree, including the aforementioned exclusion of inland navigation. On the basis of the findings from the RI&E, the operator of a ship must take a number of steps such as organising company emergency response provisions and measures to avert danger to third parties (passengers).

3.3 ADDITIONAL STANDARDS AND GUIDELINES

Standards

Standards are published under the responsibility of standardisation bodies such as the NEN (the Dutch Standardisation Institution). Some of these standards can be found in international CE standardisation. A large number of standards apply to inland waterway navigation (and therefore also to inland passenger ships), particularly in relation to structure, technical layout and elements of this. No specific standards have been published in respect to the structures and layout of passenger ships in relation to fire safety.

The standard NEN 4000 applies to company emergency response provision. NEN 4000 is based on a company emergency response provision policy that is supported by the management as well as

⁵ In the case of companies with 10-25 employees, a so-called quick assessment by an occupational health and safety expert is permitted; companies with 25 or more employees must arrange for a full assessment to be carried out.

being subject to periodic reviews. The risks and normative factors – which are not prescribed by law – are used as the basis for the elaboration of a company emergency response provision plan. This plan forms the starting point for the establishment of a company emergency response provision system. Training, refresher courses, in-service training and drills are all measures that focus on reinforcing the company emergency response provision system and ensuring that the company is prepared, and remains prepared, for an emergency situation. The standard also provides an indication of the number of company emergency response team members, and states certification of (parts) of the process or system as an option. This can include certification of individuals, the company emergency response provision system, or of an entire company or organisation. The government printing house (Sdu) also publishes an information sheet on the company emergency response provision, as a guide to potential ways of meeting the company emergency response regulations as laid down in the Working Conditions Act.

Sector guidelines

Besides the abovementioned legislation, no additional guidelines have been established within the sector.

Developments within the sector

The inland navigation sector has a number of specific characteristics that must be taken into account when assessing risks and perceived safety. It is a sector in which the skipper is often also the business owner. Within the context of passenger transport, an increase in scale has meant that the skipper/business owner has been replaced with shipping companies with salaried employees.

Legislation within the shipping sector has increased in line with the developments and the size of the ships, however it focuses on the navigational and technical conditions. The government prescribes standards in respect of the technical level of measures to guarantee safe navigation. The legislation is lagging behind sector developments, which means that the minimum prescribed safety level is not always up-to-date. There are two reasons for this. On the one hand, it takes considerable time to develop new legislation. On the other hand, new legislation is the result of political and social considerations. The standard-providing and detailed method of legislation applied within the shipping sector creates the impression that once the statutory provisions have been complied with, safety standards have been met in full.

3.4 ASSESSMENT FRAMEWORK FOR SAFETY MANAGEMENT

Past experience has shown that the structure of a safety management system and the implementation of this system by organisations and employees play a crucial role in the demonstrable management and continuous improvement of safety. The Dutch Safety Board acknowledges that the assessment of the way in which organisations interpret their own individual responsibility in relation to safety depends on the organisation in question. Aspects such as the nature or scale of the organisation can be important in this regard, and should therefore be taken into account during the assessment. Although the assessment may differ on a case-by-case basis, the underlying approach and basic principles remain identical.

In principle, the way in which an organisation interprets its own individual responsibility for safety can be examined and assessed from various angles. This means that there is no universal handbook to suit all situations. The Dutch Safety Board has selected the following five points, which must be addressed in all cases:

1. Insight into risks as a basis for safety strategy
2. A demonstrable and realistic safety strategy
3. Implementation and enforcement of the safety strategy
4. Tightening up of the safety strategy
5. Guidance provided by management, commitment and communication

4 PARTIES INVOLVED AND THEIR RESPONSIBILITIES

Skipper

Pursuant to current maritime legislation, the skipper is responsible for the safe transport of the passengers and crew and for the seaworthiness of the ship. The specific responsibilities of the skipper are laid down in Article 5, paragraph one, of the Rhine Ship Inspection Regulation.

Owner of the ship

From a legal perspective, the owner of the ship is also responsible for its operational safety. The specific responsibilities of the owner are laid down in Article 5, paragraph two, of the Rhine Ship Inspection Regulation.

Employer (owner/skipper)

The employer is responsible for the health and safety of his or her employees regarding all aspects of the employment and, to this end, must pursue a policy with the purpose of creating the best possible working conditions (Article 3, paragraph one of the Working Conditions Act).

Ministry for Transport, Public Works and Water Management

Amongst other things, the Minister for Transport, Public Works and Water Management is responsible for legislation, policy, inspections and supervision in respect of ships, including fire safety.

Transport and Water Management Inspectorate (IVW)

The Shipping Inspectorate (inland) of the IVW (previously the Shipping Division) is responsible for supervising compliance with laws and regulations. In this context, the IVW focuses on the inland navigation company, licensed classification societies and loss adjustment agencies and ship crews, as well as companies that are involved in the transport of hazardous substances.

Ships are granted a Certificate of Inspection (COI) if they are found to meet the requirements currently imposed by law. The majority of passenger ships have been granted a Certificate of Investigation in accordance with the ROSR (valid for 5 years). Only passenger ships that never sail on the waters covered by the ROSR have a certificate granted on the basis of national legislation (BSB). In the case of passenger ships, the certificate must be renewed every 4 years. The ship must also be subject to a further inspection (during the intervening period) in the event of any radical changes (not described in any further detail in the Act) and following a change in function. The owner of the ship must apply for the certificate. The Shipping Inspectorate (inland) of the Transport and Water Management Inspectorate is responsible for issuing the certificates.

Ministry of Social Affairs and Employment

Amongst other things, the Minister of Social Affairs and Employment is responsible for legislation, policy, inspections and supervision in relation to working conditions onboard passenger ships.

Health and Safety Inspectorate

The Minister of Social Affairs and Employment is responsible for legislation in respect of working conditions. The Health and Safety Inspectorate is responsible for supervising compliance with the obligations imposed on employers and employees by the Working Conditions Act. The main obligations within the context of this investigation in respect of which the AI is responsible for monitoring compliance are the drawing up of a risk assessment and a risk reduction policy. The AI is authorised to issue binding instructions.

The AI carries out project-based inspections for the purpose of verifying whether or not employers and employees are complying with the statutory regulations. The inspections focus on those sectors in which a high risk of malpractice is anticipated and/or that involve the greatest health and safety risks for employees.⁶

Security region

A security region⁷ is an area within the Netherlands in which various authorities and services collaborate in the field of fire department services, disaster management, crisis control, medical assistance in accidents and disasters (GHOR) and maintaining public order and safety. For this purpose, a division that corresponds with the police regions has been maintained, and the

⁶ This is known as carrying out 'risk-based' inspections.

⁷ The legislative proposal on Security Regions was submitted to the Lower House on 30 July 2007. Work has been taking place for some time now on the organisation of the security regions on the basis of the Joint Regulations Act.

Netherlands therefore has 25 security regions. Collaboration takes place on the basis of the Joint Regulations Act (WGR).

The law dictates which tasks must be performed at a regional level. These include multidisciplinary tasks focusing on disaster management. Examples of these are:

- the compulsory notification of the municipal authorities with regard to disaster management plans and the details of these plans
- official support for the mayor's authority in the event of a disaster
- the setting up and maintenance of a joint operations room.

Fire department

In general terms, municipal fire department forces are responsible for fire fighting. The priority of the fire department (with the exception of a number of specific company fire brigade forces) is always to save victims. Even if it is only suspected that there may be people inside the structure that is on fire, or if the possibility that people are present cannot be excluded, efforts will be focused on 'rescue', until such time that it is certain that rescue efforts are not, or are no longer, required.

Central Commission for Navigation on the Rhine (CCR)

On the basis of a multilateral treaty (the 1868 Mannheim Convention), the Central Commission for Navigation on the Rhine (CCR) is responsible for laying down regulations in respect of the Rhine basin. The decisions reached by the CCR have a binding (without sanctions) and direct effect in the states that are party to the Mannheim Convention. All states through which the Rhine passes, and also Belgium, are represented in the CCR in Strasbourg.

European Commission (EC)

Pursuant to the EC Treaty, the Commission is authorised to propose directives, amongst other things for the purpose of promoting safety on inland waterways. New directives are enacted following approval by the European Parliament and the Council of the European Union.

Netherlands Rhine and Inland Shipowners' Association (CBRB)

The CBRB is the largest employers' organisation in the inland navigation sector in the Netherlands. Its aim is to 'strengthen the position of those inland navigation companies that are members of the association and of the inland navigation sector'. Its members operate in areas such as passenger transport and ferry services.

Royal Schuttevaer

The Royal Schuttevaer protects the interests of inland navigation professionals in the field of navigational and technical matters and in relation to shore infrastructure for inland navigation.

Dutch Association of Travel Agents and Tour Operators (ANVR)

The ANVR represents the travel industry. Ship operators generally negotiate directly with travel agents/tour operators with regard to trips, prices and conditions in respect of one-off trips or trips organised on a seasonal basis. The travel agents then offer the trips directly to the consumer and/or other travel organisations.

5 ANALYSIS

5.1 INTRODUCTION

In addition to the investigation results obtained onboard ten ships on which fires had broken out, a further forty ships were subject to closer inspections under normal operating conditions in order to further substantiate the findings made. The Inspection reports drawn up by TNO in relation to technical and human aspects are included in full in Annexes 4 and 5 to this report. A total of 50 passenger ships were involved in this special investigation. The investigation focused on the structural provisions, fire protection, fire fighting and fire safety equipment and safety procedures. Legislation and the effect of government supervision in these areas were also included in the analysis.

5.2 FIRE SAFETY, EQUIPMENT AND PROVISIONS

5.2.1 *Safety procedures*

In the event of a fire, the crew of the ship will need to simultaneously combat the fire and prepare passengers for a potential evacuation. As it is not possible for the emergency services to immediately reach the location of the fire, there is a basic reliance on the self-sufficiency of the crew and passengers. The safety procedures provide guidelines in relation to this self-sufficiency. Safety procedures have been compulsory under the ROSR since 1 January 2006, and are also prescribed in the EU Directive to be implemented. The safety procedures are defined in the law and are made up of three parts: a) a safety list with instructions, b) a safety plan of the ship in question showing locations of safety equipment, and c) the placing of instructions in each cabin.

The implementation of safety procedures does not mean that the skipper/owner has met all of the requirements. Sound preparations and effective training of the crew are also essential in order to guarantee a rapid response to disasters and safe evacuation in the event of an emergency. Unfamiliarity with the relatively complex maritime environment and the absence of firm ground – certainly in the event of an emergency – has a negative impact on the behaviour of passengers. During drills, efforts must be made to recreate a realistic situation onboard. For instance, passengers can vary widely in terms of age, nationality and physical condition. It has also been established that crew members of various nationalities are employed onboard the ships. These factors can play a major role in determining whether or not it is possible to evacuate passengers and crew in good time.

On the majority of ships, there are no drills for the purpose of rehearsing procedures to be followed in the event of a fire, emergency or evacuation. Only one of the ships investigated held an emergency drill without passengers once each season. On more than half of all of the ships inspected, neither the crew nor the passengers had been issued with safety instructions. The crews of the passenger ships inspected mainly consisted of nautical and service personnel of various nationalities. The working language amongst the nautical crew members was generally Dutch or German. In many cases, the service personnel were from Eastern Europe. Onboard a number of ships, the wide range of nationalities meant that there was no common language of which all of the crew members had a sufficient command (see also section 5.3 Human factors).

5.2.2 *Fire-resistant and fire-retardant measures*

Due to the large number of low, concealed and inaccessible areas, as well as the specific structure and finish, fires onboard passenger ships can spread rapidly and unnoticed. The study revealed that none of the ships investigated for construction-related aspects had any documentation available in relation to the materials used. This means that there was no information on the fire-resistant or fire-retardant properties of these materials. Furthermore, the investigation revealed that half of the ships inspected featured areas in which smoke and fire could spread rapidly and unnoticed.

The investigation also revealed that in practice, the fire-resistant/fire-retardant effect of provisions is often cancelled out. On 9 of the 16 ships inspected it was discovered that the (fire-resistant) doors were propped (hooked) open. On 11 of the 16 ships these doors were also found to be in poor condition. On 8 of the 16 ships inspected there were no fire-resistant partitions, or the partitions installed were of poor quality. Finally, it emerged that on 10 of the 16 ships the cable transits through fire-resistant walls and partitions had not been fitted correctly, which meant that should a fire break out, the fire could still spread to the adjacent rooms. Moreover, it was discovered that 4 of the ships had not had fireproof windows installed inside the ship.

The investigation revealed that, as far as could be determined, none of the ships inspected featured fire-retardant wallpaper, ceiling finishes, curtains, floor coverings, furniture etc. The documents/certificates relating to the materials used, required by law, were not present on any of the newer ships. There was also no information available on these provisions onboard the ships in the relevant files held by the IVW.

5.2.3 *Fire protection, fire fighting and fire safety equipment*

The rapid and timely detection of a fire, a clear alarm system and proper fire extinguishing equipment are essential preconditions for effective self-sufficiency. A limited number of these aids had been installed onboard the passenger ships. There were a large number of extinguishers present. A sprinkler system had not been installed on any of the ships inspected.

The investigation carried out by TNO revealed that fire safety provisions found onboard the passenger ships had not been well thought-out. Some examples:

- heat detectors had been installed instead of smoke detectors on 3 of the 16 passenger ships (smoke detectors are generally triggered earlier)
- onboard alarms were only tested by means of random spot checks
- no inspection certificates were found for smoke alarms
- in a number of cases, no fire/smoke detection equipment had been installed in storage areas.

On the majority of the ships, and certainly the older ships, there was no automatic gas extinguisher in the engine room. The ROSR was amended in 1995 and, as a result, passenger ships whose keel was laid down after 1 January 1996 must have a fixed, built-in fire extinguisher. Ships constructed prior to 1996 are exempt from this requirement until 2045. None of the ships inspected that were constructed before 1996 had had this type of extinguisher installed on the owner's own initiative.⁸

The assessment revealed that owners/skippers are not sufficiently aware of the dangers associated with smoke in the event of a fire. The greatest danger in the event of a fire is often presented not by the fire itself, but by the smoke produced. This is what claims the most victims. Smoke contains all sorts of toxic fumes, such as carbon monoxide. This gas has an intoxicating effect, which can lead to loss of consciousness and potentially death. The smoke produced in the event of a fire can penetrate all areas of the ship and can severely complicate the evacuation of the passengers and crew. It is also impossible to locate the seat of the fire and to combat the fire without a compressed-air mask in the event of severe smoke production.

5.3 CREW AND PASSENGER ASPECTS (*HUMAN FACTORS*)

5.3.1 *Introduction*

Onboard ships, and passenger ships in particular, it is essential that the crew have received effective training and instructions regarding combating fires and organising evacuations. If an emergency situation arises, passengers are largely dependent upon the crew. Crew members can be expected to be aware of the correct safety procedures, familiar with the ship and aware of where the safety equipment is located and how to use it properly. As a result of their unfamiliarity with the ship, passengers must be able to rely on the crew in the event of an emergency. The crew must also play an important role in combating the fire, especially if the ship is sailing on open water. The absence of a safe assembly zone for passengers onboard in the event of a fire means that the objective in combating the fire must be to extinguish the fire or to delay the fire from spreading in order to increase the chance of a safe and timely evacuation.

Within the context of the shipping industry, responsibility for combating fires is laid down in the legislation. The requirements in respect of the training of the crew members explicitly take account of the fact that they must take full responsibility for combating the fire. New legislation in respect of inland navigation incorporates a description to this effect.

The investigation carried out by TNO revealed that the scope and quality of fire safety measures taken onboard ships vary widely, and that these new requirements are not yet being met. The passenger ships are required to meet the new requirements by such time as the certificate of

⁸ Article 15.11 should be read as follows: either non-flammable material or a sprinkler system. The transitional measure is aimed at ships that incorporate flammable materials and do not have a sprinkler system. E.g. paragraph 4 (decoration of ceilings/walls). This type of ship is permitted to remain in operation until renewal of the COI after 2045, and is not required to either replace the decoration or install a sprinkler system until after 2045.

investigation are due for renewal. This means that those ships whose certificate was renewed immediately prior to the introduction of the new legislation will not be required to comply with the revised legislation until after 1 January 2010. This is because the certificate is linked to the four-yearly inspections and the requirements that apply at the time that the inspection is carried out. As far as training is concerned, legislation in respect of inland navigation is moving in the direction of existing requirements in relation to marine navigation.

5.3.2 *Training*

Buildings in which large groups of people assemble must be adequately staffed by trained personnel in order to ensure that efficient assistance is provided in the event of small or large scale emergencies. On shore, call-out times apply to the emergency services (15 minutes) and the fire department (8 minutes). These standards do not apply, however, to the shipping sector.

As a result of the time that elapses between the reporting of the incident and the arrival of the emergency services, passengers' onboard ships have a longer time during which they are required to cope on their own. In practice, this means that the crew is responsible for combating the fire and (preparing for) the evacuation of passengers.

During the investigation it emerged that the crews of the passenger ships had either received no training at all, or had followed a basic company emergency response provision (BHV) training course. As a rule, these BHV training courses are designed to address fire fighting and evacuation procedures within *non-nautical* organisations and settings and are not tailored to the specific situation and circumstances onboard (passenger) ships. As a result, the operators of the passenger ships that were inspected had implemented these (BHV) training courses in a number of different ways. Around half of the shipping companies required crew members to follow a BHV training course. The remaining service personnel onboard were not required to follow this training. Various providers now offer training courses that are specifically tailored to the situation within the shipping industry.

Due to the introduction of the compulsory safety procedures in the ROSR and the EU Directive, the Passenger Ship Safety Personnel Regulation (RVP) and the new Working Conditions Legislation, owners are now obliged to place a greater focus on the provision of onboard assistance. The company emergency response provision prescribed for businesses will therefore become part of the safety procedures onboard ships.

5.3.3 *Perception of the problem*

The interviews with the crews of the passenger ships revealed that, in general terms, they regard the likelihood of a fire breaking out onboard the ship as being limited. They have a great deal of confidence in the preventative measures that are taken. In the event that a fire should indeed break out, however, it is assumed that it will be possible to bring the ship to a safe mooring place quickly and thus evacuate the passengers and crew in a timely manner. The crew stated that they expected to receive adequate instructions from the skipper. The skipper should also, in their opinion, assume leadership in the event of an emergency.

Passengers with reduced mobility

A relatively large number of older passengers are found onboard hotel ships and/or foreign passengers who do not speak the working language onboard the ship. These passengers include persons with reduced mobility. Persons with reduced mobility can be subdivided into individuals who are able to travel independently and those who require assistance. Six of the 16 ships inspected did not have adequate provisions in place for this user group in the event of an evacuation. For instance, escape routes generally included stairs, which were often (too) steep. In so far as stair lifts had been installed, it emerged that on 4 of the 16 ships, these stair lifts were not connected to an emergency power supply.

On half of the 16 passenger ships inspected, no or very little account was taken of the problems that may arise during the evacuation of passengers with physical limitations (wheelchair users, weak walkers etc.). For instance, envisaged escape routes were found to include steep staircases and heavy hatches.

Assistance

As far as assistance is concerned, passengers' onboard inland passenger ships are in the first instance required to cope on their own. The mobile nature of inland passenger ships means that the emergency services are not aware of the presence of passenger ships within their response area. Emergency services such as the fire department, ambulance service and the police are each responsible for the performance of their duties within their own operational area. The Dutch Safety Board assumes that, if the ship is underway, the call out times that apply to peripheral locations

will apply. This means that the crew will have to be entirely self-reliant for at least the first 15 minutes after the alarm is raised.

In practice, it is not possible for the emergency services to assess a ship in advance in order to identify specific risks, or the practicalities and impracticalities in the event of an emergency. Even if a ship is able to moor to the shore in the event of an emergency, this location may not necessarily be accessible to the fire department and the other emergency services.

In the Netherlands, there are three fully equipped fire-extinguishing ships available, stationed in Nijmegen, Tiel and Dordrecht. Depending on their location in relation to the ship on which the incident is taking place, it may take the fire-extinguishing ship more than 3 hours to reach the site of the fire. At seaports, patrol boats belonging to the Port Authorities are often also fitted out with fire extinguishing equipment. Finally, a limited number of local fire department forces have small ships at their disposal. The regional fire departments do not have extensive expertise in the field of ship fires. There is a separate training module on ship fires available for fire department forces. There are also several locations in the Netherlands where practical training exercises in relation to these types of fires can be carried out. Not all forces that are situated in the vicinity of shipping thoroughfares take advantage of these opportunities.

The assessment of the fire onboard the 'Willem van der Zwan' fishing ship in Velsen on the 30th of January 2007 carried out by the Institute for Safety and Crisis Management (COT) and the Netherlands Institute for Safety (NIBRA) led to a number of recommendations for the fire department⁹. In this assessment it was recommended that a ship fire-fighting protocol should be drawn up in order to reinforce preparations for, and the implementation of, ship fire-fighting procedures. Attention was also drawn to the use of teaching and subject material aimed at technique and tactics in relation to ship fire fighting.

The waterway in which the passenger ship is located also has an impact in terms of the availability of emergency services. This waterway can be a narrow channel, but also open water, such as the IJsselmeer or the Wadden Sea. The emergency services may therefore need a great deal of time to reach certain locations (the 'call-out time'), which means that the crew and the passengers must be able to cope on their own. The investigation revealed that the owner, the skipper and the crew are not sufficiently aware of the need for self-sufficiency. As a result, safety procedures had not been tailored to the requirements imposed in practice. Those involved may therefore also learn from the conditions that apply in the case of marine navigation, where self-sufficiency is the central principle. Examples include the presence of sprinkler systems and, when sailing on open water, the availability of group life-saving equipment such as life rafts and lifeboats.

In 2006, national government launched the Waterrand project. On the basis of an assessment, the project aims to achieve a straight-forward organisation of assistance and crisis management in the event of emergencies on the water. This led to the creation of a uniform, countrywide working procedure and effective collaboration between the parties involved. Part of the project involved establishing call-out/navigation times in respect of emergencies on the water. It is anticipated that standards will be established during 2008, followed by implementation in December 2009.

Occupational Health and Safety Hazard identification and analysis (RI&E)

None of the crews or skippers of the passenger ships that were involved in the investigation were aware of the occupational health and safety hazard identification and analysis (RI&E) required by law. The RI&E provides an overview of the health and safety risks within an organisation. The RI&E should then serve as a basis for a plan of approach in order to draw up measures for improvements, for the purpose of counteracting the (residual) risks in a structural manner. In conjunction with the prescribed safety procedures, the skipper/owner can set up a system designed to incorporate all of the necessary safety management features. In combination with drills and through the evaluation of smaller-scale incidents, the skipper and the crew learn how to deal with risks and are therefore better prepared for larger-scale incidents such as a rapidly spreading fire.

Influence of tour operators

A percentage of the tour operators are aware of the risks and require the operators of hotel ships to carry out evacuation drills. These drills were only actually performed on one of the ships. The aim of the evacuation drills is to ensure that the passengers become familiar with the ship and the emergency procedures to be followed in the event of a fire or other disaster.

⁹ COT and Nibra report dated 11 June 2007

During evacuation drills, some skippers/owners assign an important role to the tour guide, who does not play a formal role in the event of a fire and does not form part of the nautical crew either. Officially, the tour guide is not required to have any knowledge of the ship and/or is generally not appropriately qualified and/or trained to take on such a role.

Tour operators and/or sector organisations can encourage the introduction of new initiatives. In Germany, for instance, a quality mark has been developed for passenger ships which provides consumers with an idea of the level of quality and safety of a ship. The quality mark consists of the awarding of stars to a ship according to the level of provisions and safety. Criteria include the general status with regard to safety, the safety procedures and fire safety measures and provisions. Owners who act in anticipation of the transitional arrangements are rewarded by means of extra stars. Good seamanship such as safe working practices and order and tidiness on deck are also taken into account. The stars are awarded on the basis of periodic inspections by an independent body (in this instance the TÜV).

5.4 GENERAL FIRE SAFETY, LEGISLATION AND SUPERVISION

5.4.1 Legislation

Over the past few years, the basic principles with regard to navigational technical, working conditions and safety legislation have changed considerably in some areas. For instance, new requirements in relation to fire safety measures have been formulated in the relevant maritime legislation in respect of structure and equipment. It is however striking that a long transitional period applies in the case of ships that were constructed in accordance with the old legislation. These ships are not required to comply with elements of the new legislation until 2045 (see Annex 6 for the transitional provisions).

Article 24.01, paragraph one, of the ROSR states that the transitional provisions referred to in Article 24.02 to 24.04 inclusive apply to ships with a valid certificate of investigation issued prior to 31 December 1994.

Article 24.02 subsequently provides an overview of the specific transitional provisions for each chapter of the ROSR. Each of the provisions referred to in this Article is accompanied by a date by which the transition to the new legislation must be achieved. The dates laid down vary from 1-1-2010 for changes that can be implemented relatively easily (such as emergency stop switches) to 1-1-2035 for more extensive adaptations to the ship (such as dimensions of doors). As a number of adjustments are more difficult to carry out for ships constructed before 1-4-1976 (e.g. watertight windows and emergency power systems), these fall under a number of specific transitional provisions, referred to in Article 24.03. The remaining deviations are set out in Article 24.04.

Article 24.05 subsequently focuses specifically on transitional arrangements in relation to the physical aptitude of the crew.

Article 24.06 specifies the deviations from preceding regulations that apply to ships that do not fall under Article 24.01. These are ships that were issued a certificate of inspection for the first time after 1-1-1995, with the exception of ships that were already under construction or reconstruction on 31-12-1994.

The following paragraphs provide a number of examples of the implications of these changes.

Effect of legislation on structural provisions

The changes with regard to structural layout requirements principally relate to the realisation of fire compartments. Various compartments are created in inland passenger ships using the fire-resistant properties of walls, decks and doors, which prevent fires from spreading rapidly to other compartments. This compartmentalisation must also be implemented in air treatment and ventilation systems through the use of fire valves. Spaces behind panels must also be broken up with non-flammable structures.

Cable transits through decks or partitions must be designed in such a way that they do not have a negative impact on the closure and fire-resistant properties of the compartments. In order to delay the fire from spreading, more stringent requirements have also been imposed in relation to the fire-retardant effect of the interior and upholstery, such as furniture, curtains and wallpaper. These new requirements apply to newly constructed ships, alterations (not replacements!) or conversions of (part of) the ship. In the case of ships that have already been put into commission, these requirements will enter into force no later than on renewal of the Certificate of Inspection after 1 January 2045.

Effect of legislation on fire protection, fire fighting and fire safety equipment

In the case of hotel ships, all rooms must be connected to a fire alarm system that is continuously monitored by the crew. Equipment such as extinguishers, life-saving devices, a PA system and an alarm system must also be available onboard. Hotel ships renewing their Certificate of Inspection after 1 January 2006 must meet this requirement. Day cruise ships must have complied with this requirement no later than on renewal of their Certificate of Inspection after 1 January 2010.

Compulsory certification of the materials used

The law stipulates that the fire-resistant properties of the materials used must be certified.

Effect on type of life-saving devices

Group life-saving equipment (e.g. life rafts) is not prescribed. This is based on the assumption that it will always be possible to carry out an evacuation by means of mooring the ship in a timely manner. The European Directive that is to be implemented only prescribes group life-saving equipment for ships sailing on open water (for instance on the Wadden Sea). This equipment is not obligatory in the case of other waters. Ships that have been issued a ROSR certificate are permitted to sail on all Dutch waters, including the Wadden Sea. The Dutch government has therefore imposed additional requirements which mean that this group life-saving equipment is also compulsory in the case of ships sailing on zone 2 waters.

Effects of the new Working Conditions Act

Employers and employees are responsible for working conditions within their organisation or branch of industry. Employers are obliged to identify the risks involved in the work, propose improvements and assess the policy pursued in accordance with the RI&E. They have to provide information and instructions in relation to these risks and the measures that have been taken in order to limit them. Employees are obliged to follow the safety instructions and use the protective equipment provided. The aim is to improve safety and wellbeing on the shop floor. The government merely lays down the objectives: employers and employees are responsible for determining what steps should be taken in order to achieve these objectives.

With the introduction of the amended legislation and regulations, the specific company emergency response provision regulations were dropped from the Working Conditions Decree, including the aforementioned exclusion of inland navigation. The employer is obliged to organise the company emergency response provision for his or her company on the basis of the findings made during the RI&E. In addition to the abovementioned general obligation, the requirement to have safety procedures in place was incorporated into the international maritime legislation (ROSR) on 1 January 2006.

New legislation in respect of onboard safety procedures

The term 'safety personnel' was used for the first time in the ROSR 2006 (which entered into force on 1 January 2006) and in the abovementioned Directive 2006/87/EC. The organisation of safety procedures onboard passenger ships, partly on the basis of the separate Passenger Ship Safety Personnel Regulation, is somewhat similar to a company emergency response provision within organisations as referred to in the Working Conditions Act. However, the requirements imposed on the Expert and one or two First Aiders are more stringent than those imposed on company emergency response team members. In the case of hotel ships, a compressed-air mask carrier is also compulsory.

A transitional period up to 31 December 2010 applies to the obligation to have a safety officer onboard. This transitional period applies subject to the condition that there is a crew member onboard the ship that holds a Rhine certificate or commercial ships master's certificate.

In the case of day cruise ships, there are two categories of occupancy: <250 passengers and >250 passengers onboard. If there are fewer than 250 passengers onboard, there must be 2 crew members acting as safety officer: an expert and a First Aider. For ships with an actual occupancy of more than 250 passengers, a second First Aider is required.

In the case of hotel ships, there are two categories of occupancy: <100 passengers and >100 passengers onboard. If there are more than 100 passengers onboard, there must be an expert and 2 compressed-air mask carriers present on the ship. If there are fewer than 100 passengers onboard, there must be 1 First Aider. In the event of more than 100 passengers there must be 2 First Aiders.

5.4.2 (Government) supervision

The owner is responsible for arranging the periodic inspection required by law carried out. As a rule, ships are examined once every 5 years by the inspectorate. Inspections are carried out on a more frequent basis during the construction phase. The periodic four to five-yearly inspection

provides a random indication of the situation onboard and depends on the choice of points for attention and the personal interpretation of the inspector and the owner. The investigation revealed that these inspections are documented in accordance with the standard working procedures, but that the concrete details depend on the points for attention identified by the inspector.

The ship may also be inspected by the police during the intervening period, as part of the police's enforcement tasks. These inspections are generally limited to checking the validity of certificates and the prescribed sailing times and rest periods.

The IVW believes that there have been positive developments in the field of fire safety onboard passenger ships. The amendment of the legislation has seen the introduction of additional provisions in relation to fire safety. To date, the IVW has not considered there to be any reason to introduce an inspection policy specifically geared towards passenger transport. The standard statutory time limits determine the intervals and the focus of the inspections.

Inspection method

The IVW states that the course of an inspection depends on the situation that is encountered. If there are grounds to suspect that the statutory requirements are not being met, a more intensive inspection will be carried out. On average, an inspection onboard a passenger ship will take around half a day. According to the IVW, an inspection onboard a large hotel ship will generally take a full day. In the case of newly constructed ships, the IVW is closely involved in the construction process. On average, a shipyard is visited on fifteen occasions during the construction phase for the purpose of carrying out interim inspections. Existing ships are inspected on a one-off basis, and the inspection therefore provides a random indication of the situation onboard.

The legislation that forms the basis for the inspections principally relates to the technical aspects of a ship. As a result, the inspections themselves also focus mainly on checking the technical aspects of the ship, and therefore very little attention – if any – is paid to onboard procedures and/or the crew. Requirements in relation to working conditions are only examined during the inspection if the IVW inspector judges the situation onboard to constitute a potential risk to the crew. The RI&E is not checked by the IVW. The implementation of the RI&E is subject to supervision by the Health and Safety Inspectorate, and is not, as in the case of ocean shipping and offshore installations, transferred to the respective inspectorates, i.e. the Ocean Shipping Supervision Unit of the IVW and the State Supervision of Mines.

The IVW inspectors determine themselves to a large extent what aspects they will focus on during the inspection. The IVW has not developed any guidelines or checklists for these types of inspection in addition to the aspects referred to in the relevant legislation. Inspectors do not have access to logbooks in which all faults, adaptations and activities are recorded, as is the case with aircraft, ocean-going ships and trains. The owner of a ship is responsible for providing information on any adaptations made to the ship that may be of relevance.

Following an inspection, the IVW can demand that measures for improvement be taken and impose a completion time for the implementation of such measures. In the case of minor shortcomings, for instance measures that must be taken within the next year, the inspector will solely make an agreement with the owner. The IVW will subsequently verify that these measures have been taken at the next regular COI inspection (in some cases 4-5 years later). Major shortcomings may lead to withdrawal of, or refusal to renew, the certificate of inspection.

Pursuant to the ROSR and the BSW, the IVW has the authority to deviate from the applicable regulations. Within this context the IVW has stated that to date, it has never taken advantage of its power to grant an exemption to passenger ships.

Documentation

During the investigation it emerged that information on the materials and constructions used onboard was only available on one of the ships inspected. This information was not available or present on the remaining ships inspected. It is not a simple matter to determine whether the materials used onboard meet the fire-resistance requirements. The absence of this documentation means that it is impossible or extremely difficult to verify fire-resistance during inspections.

The legislation stipulates that the owner or his or her representative must present the ship for inspection in an unoccupied, clean and fully equipped state. He or she is also obliged to provide any assistance required during the inspection and to open up any parts of the hull or installations that are not directly accessible or visible.

If, during the inspection (search), a ship or its equipment are found to have major defects that could pose a risk to the safety of people onboard or to other shipping traffic, the certificate must be withdrawn.

Vision and policy of the IVW

The IVW is of the opinion that there have been a number of improvements in terms of fire safety over the past few years. They also encounter less resistance during inspections if inspectors demand that improvements or adaptations be made in accordance with the regulations. According to the IVW, this is because the structural and safety requirements have now generally been introduced more than 15 years ago (BSW). The owners of passenger ships have become accustomed to the regulations, which means that there is a greater level of support for the implementation of safety measures. The IVW has, however, been informed by the Netherlands Shipbuilding Industry Association (VNSI) on several occasions that in its opinion, the construction of ships under the new requirements and conditions will not be cost-effective.

The Transport and Water Management Inspectorate aims to supervise compliance with legislation and regulations within the chain as effectively as possible. In this context, the IVW is keen to optimise its collaborations with other inspection services and with companies. This stems from the Cabinet's project entitled "Uniform Supervision"¹⁰, which aims to achieve a significant reduction in the burden in relation to supervision for business owners by means of efficient and effective collaboration between supervisory authorities. During 2008, the IVW will conduct research¹¹ into whether, and if so how, government inspectorates can collaborate with companies and private supervisory authorities in order to reduce the burden associated with supervision by the IVW of companies where there is effective internal supervision. In order to achieve this, the IVW wants to introduce systemic supervision. This would enable inspection capacity to be focused more on the 'weak links' in the transport chain.

Role of safety regions

The Safety Regions Decree lays down further rules in relation to the security regions and the fire department. The Decree is based on the legislative proposal on Security Regions submitted to the Lower House in 2007. The aim of the security region is to ensure that our country is better prepared to cope in the event of a disaster or crisis situation. The legislative proposal stipulates that the organisation of fire department services, disaster management and crisis control should take place at a regional level. The Security Regions Decree lays down further rules in relation to the security regions and the fire department, including, for instance, basic requirements with regard to crisis management and call-out times for the fire department. The Decree sets out the basic level that the procedures and activities within the regions and fire department service must meet. The aim of the Decree is to create uniformity in terms of procedures and activities within the regions. Uniformity plays an essential role in facilitating interregional assistance and a supraregional approach.

Role of the fire department

The fire department plays an advisory and/or executive role in the granting of licences to companies on land. Planning permission is granted, for instance, if a technical inspection has shown that the requirements laid down in the Buildings Decree have been met (fire and smoke-resistant partitions, escape routes, extinguishers, emergency lighting etc.). The fire department does not play an official role in relation to the inspection and supervision of fire safety onboard passenger ships. This is striking because on the one hand, the available expertise is not being used and on the other hand, the fire department is expected to have sufficient knowledge in the event that assistance is required. The Dutch Safety Board is fully aware that the application of the available expertise in each security region may come up against practical objections, however believes that this expertise is available within organisations such as the Netherlands Association of Fire and Disaster Control Services (NVBR).

Role of the Health and Safety Inspectorate

The Health and Safety Inspectorate supervises compliance with the Working Conditions Act by means of special inspections. If any infringements are identified, the Health and Safety Inspectorate will demand additional information, such as the relevant RI&E. A number of special inspections have been carried out within the inland navigation sector, which primarily related to the personal safety of the skipper and the crew.

¹⁰ Parliamentary Papers: 2000-2001, 27 831, no. 1 and 2006-2007, 27 831, no. 21, Lower House.

¹¹ Vision document on inland navigation 2009 - certification by external parties.

6 CONCLUSIONS

6.1 FINDINGS

The study revealed that fires onboard passenger ships are not uncommon. In many cases, the crew members were unable to bring the fire under control without external assistance. As a result of the specific design of passenger ships, fires can remain unnoticed for a long time and fire and smoke can therefore spread rapidly and unnoticed through a ship.

The study also revealed that many ships, even ships not covered by the transitional arrangement, do not meet the statutory requirements in relation to fire safety and that (in many cases) the statutory requirements in relation to fire safety procedures are not being met.

6.2 FIRE SAFETY PROVISIONS

Provisions that have not been implemented

During the study it was established that the provisions that ships are required to have by law are not always present. In practice, it emerged that the necessary attention is not being paid to the implementation of fire safety measures.

Examples include the compulsory construction-related measures for ships constructed after 1 April 1976 for the purpose of limiting or delaying fire and smoke from spreading. In practice, it was established that partition transits for cables and pipes are not always fire-retardant or fire-resistant, which means that in practice a fire could still spread to adjacent areas.

Incorrect use of provisions that have been implemented

It was also established that in some cases, fire safety provisions that had in fact been implemented were rendered ineffective by means of incorrect use.

For instance, fire-resistant doors were found to have been propped open on a hook. This means that in the event of a fire, the fire and smoke could spread freely through the ship.

Provisions that had not been implemented as a result of the transitional arrangement

As a result of the transitional arrangements, existing ships are not automatically required to comply with the latest statutory fire safety requirements. This means that older ships are often not equipped with the latest fire safety features and are therefore less fire-resistant. The transitional arrangements therefore do not encourage owners of older ships to make improvements in the field of fire safety.

For example, a sprinkler system has been a prescribed safety feature since 1 April 2002, however a transitional period has been established. Owners of ships that hold a certificate of inspection issued prior to 1 April 2002 are not required by law to have a sprinkler system installed until after 1 January 2035. Although the owner him or herself may decide to have this type of equipment installed at an earlier point in time, this had not happened on any of the ships that were inspected.

Supervision of fire safety provisions

The current method of inspection and supervision of fire safety onboard ships means that the shortcomings identified can remain unremedied.

The Transport and Water Management Inspectorate is responsible for assessing fire safety onboard ship, but this is just part of the range of duties assigned to its inspectors. By contrast, the assessment of fire safety within buildings is a core responsibility of the fire department.

On the basis of the investigation, the Dutch Safety Board established that in a number of instances, the Certificate of Inspection had been wrongly issued by the Transport and Water Management Inspectorate, as the requirements applicable at the time had not been met.

6.3 EVACUATION

The legislation and regulations do not take sufficient account of the specific characteristics of the target groups, such as persons with reduced mobility. This can potentially lead to problems on both old and newer ships in the event of a fire and the evacuation of passengers whilst the ship is underway.

The risks in the event of a fire are greatest on open water, but also in those locations that are poorly accessible to the fire department, such as wide rivers with foreland. In such instances, it is often very difficult for the emergency services to reach the ship in good time, which means that an evacuation may be necessary. In the event of a fire, this therefore also means that the crew and passengers will be forced to cope on their own for a considerable length of time. To date, the sector itself and the legislator have taken little or no account of the evacuation of specific target groups. In the event of an emergency onboard ship, the emphasis is on *self-sufficiency*.

In practice, however, there are severe complications that affect the self-sufficiency of both the crew and the passengers. On the one hand, this is the result of the specific circumstances in which the ship may find itself (including poor accessibility for the emergency services and/or an inability to moor) and on the other hand, of evacuation problems that could arise due to the sometimes large numbers and specific characteristics of the passengers. The limited number of crew members trained to deal with emergency situations, which are expected to both assist in the evacuation and attempt to extinguish any fires onboard, reduces the chance that passengers and crew will successfully make it through the period of self-sufficiency. In comparison with ocean shipping and the normative factors in the case of hotel or restaurant businesses, there is considerable room for improvement when it comes to fire safety onboard inland passenger ships.

The amendments to maritime legislation (ROSR) that entered into force on 1 January 2006 mean that passenger ships are now required to have onboard safety procedures and safety experts. These experts must follow specific training courses on fire prevention, fire fighting and evacuation procedures. It is envisaged that the introduction of the compulsory safety procedures under the new legislation and the training/certification and deployment of experts in the field of (fire) safety will improve the situation.

6.4 RISK ASSESSMENT

The investigation revealed that, despite the statutory obligation under the Working Conditions Act, none of the skippers/owners or crews of the ships inspected (including those ships visited after 1 January 2006, the date on which the obligation entered into effect) were aware of an occupational health and safety hazard identification and analysis (RI&E). This meant that, for instance, risks in relation to evacuation and fire fighting had not been identified, let alone addressed.

The skipper/owner is responsible for the condition of the ship and the safety of its passengers. In order for him or her to take measures in relation to this individual responsibility, it is essential that he or she is sufficiently aware of the risks to crew members and passengers. Provided that they have been carried out correctly and accepted, risk assessments provide valuable information with regard to residual risks once the statutory fire safety requirements have been met. The knowledge obtained by means of the RI&E should be used for the purpose of taking appropriate and/or additional measures. These may include measures (exceeding the statutory minimum) such as interim alterations, additional provisions or additional organisational measures such as training in safety procedures. The occupational health and safety hazard identification and analysis (RI&E) is already a statutory requirement under Working Conditions legislation. None of the crews on the ships inspected were aware of this type of RI&E.

With a few exceptions, the skippers/owners of the ships had devoted little attention to fire safety onboard. In many cases, the skippers/owners simply focused on meeting the statutory (minimum) requirements in order to obtain a Certificate of Inspection from the IVW.

6.5 RESPONSIBILITY FOR FIRE SAFETY

The view that simply meeting the statutory (minimum) requirements does not necessarily guarantee the safety of passengers, is not widely shared within the sector. Ship owners do not

generally regard onboard fire safety as a problem area that requires additional attention, or the implementation of additional measures.

All ships have been issued a valid Certificate of Inspection, which gives the impression that the ships officially comply with the statutory regulations. As a result of the transitional arrangement these regulations can vary from ship to ship, which means that the level of facilities such as fire safety provisions can vary according to the ship. Passengers do not have any insight into the current safety situation onboard the ship, nor into the quality of the onboard safety procedures. This means that they are unable to make an informed choice between ships or shipping companies on the basis of fire safety considerations.

Responsibility for passenger safety rests in first instance with the skipper/owner of the ship, and in second instance with the Transport and Water Management Inspectorate, in its supervisory capacity.

6.6 STRUCTURAL SAFETY FAILINGS

The study revealed that many ships, despite being in possession of a COI, do not meet the fire safety requirements even where they are required to do so by law, and that (in many cases) the requirements in relation to safety procedures are not being met.

Despite the view expressed by the Transport and Water Management Inspectorate that there have been improvements in relation to fire safety over the past few years, the Dutch Safety Board considers that the findings of the investigation reveal structural failings in the field of fire safety.

As previously stated, crew and passenger safety is the primary responsibility of the skipper/owner of the ship, as he or she is responsible for compliance with the regulatory requirements, including those in relation to the fulfilment of his or her individual responsibility for the safety of the passengers and crew.

The Dutch Safety Board is of the opinion, however, that the Transport and Water Management Inspectorate also has a degree of responsibility in this regard.

The Dutch Safety Board has therefore reached the following conclusions in relation to fire safety onboard passenger ships:

1. Skippers/owners are failing to meet the statutory requirements. In addition to shortcomings with regard to the technical requirements, little or no efforts are being made to identify and manage risks in the field of fire safety or to implement the required safety procedures for this purpose.
2. Skippers/owners are providing employees and passengers with no, or an insufficient, insight into the quality of the safety procedures and the fire safety status onboard passenger ships.
3. The Transport and Water Management Inspectorate has wrongly issued Certificates of Inspection in a number of instances.

7 RECOMMENDATIONS

On the basis of the special investigation into fire safety onboard inland passenger ships, the Dutch Safety Board has drawn up the following recommendations.

3. The Dutch Safety Board advises the Netherlands Rhine and Inland Shipowners' Association and the Royal Schuttevaer to:
 - a. improve (fire) safety onboard passenger ships in order to ensure that the crew and passengers are able to cope without the assistance of the emergency services in the event of an incident, and
 - b. introduce a certified quality/safety mark¹² that provides tour operators and passengers in particular with an insight into the current level of onboard (fire) safety provisions and safety procedures.

4. The Dutch Safety Board advises the Minister of Transport, Public Works and Water Management to:
 - a. develop uniform criteria relating to such aspects as safety procedures to be applied during inspections performed within the context of the granting of a Certificate of Investigation to passenger ships, and
 - b. incorporate, in consultation with the Netherlands Association of Fire and Disaster Control Services, a fire safety assessment as a permanent component of these standard criteria.

Administrative authorities to whom a recommendation is addressed must state their position with regard to compliance with this recommendation to the relevant Minister within six months of the date of publication of this report. Non-administrative authorities or individuals to whom a recommendation is addressed must state their position with regard to compliance with the recommendation to the relevant Minister within one year. A copy of this response should simultaneously be submitted to the chairman of the Dutch Safety Board and the Minister of the Interior and Kingdom Relations.

¹² Comparable with the Foundation Coach Mark Company or the German safety certificate introduced in the federal state of Mecklenburg-Western Pomerania.

ANNEX 1: JUSTIFICATION OF THE STUDY

1 General

On the 18th of August 2001, a fire broke out onboard a hotel ship. The fire, which originated in the engine rooms, rapidly spread across the entire rear section of the lower deck, where the crew's cabins were situated, subsequently spreading towards the middle deck, where the passengers' cabins were situated. The 12 passengers and 16 crew members onboard the ship at the time of the fire were able to evacuate in good time, however 2 of the passengers and 2 of the crew members sustained minor injuries. The stern was completely burnt out. The theme study launched into the incident quickly revealed that the relatively good outcome of the incident was more a result of fortuitous circumstances than of effective onboard safety provisions and measures. On the basis of the findings, the Dutch Safety Board¹³ reached the conclusion that if the passenger ship had been full to capacity – with around 80 passengers onboard - and/or it had not been possible to moor the ship in good time, which had in fact been possible in this case, the outcome could have been much worse.

Initial investigations on the basis of the Dutch Safety Board's accident database revealed that the fire onboard the passenger ship was not an isolated incident within the context of passenger transport on inland waterways. Prior to the fire, 2 fires onboard passenger ships had been reported to the Dutch Safety Board and subsequently investigated during the period 1999-2001. In these previous incidents too, fortuitous circumstances, such as the fact that few passengers were onboard at the time of the fire and the chance presence of a passing ship that was able to provide assistance in good time, meant that major problems that could have led to serious casualties or fatalities were averted. For the time being, the effects have been mainly limited to material damage.

However, the findings from the investigation into the passenger ship and the preceding investigations conducted by the Dutch Safety Board into the fires onboard other passenger ships gave sufficient cause to suspect structural safety issues in the field of fire safety onboard inland passenger ships.

In view of the large number of people that these ships can potentially carry, the Dutch Safety Board deemed the risk onboard these ships to be so great that it commissioned a targeted theme study into the fire safety onboard inland passenger ships (hotel ships, day cruise ships and ferries). The study focused on obtaining the necessary information via 2 separate investigative phases. The first phase involved the organisation, integration and analysis of the accident dossiers to which the Dutch Safety Board already had access on the basis of its own accident investigation. Seven 'new' incidents involving fires onboard passenger ships that took place during the data collection phase of the study (up to the end of 2004) were added to the existing selection of dossiers. The Dutch Safety Board did, however, take note of the various incidents that have taken place since the end of 2004.

The second phase consisted of obtaining information on safety onboard passenger ships by means of conducting targeted inspections onboard a representative random sample of these ships onboard which no fire or incident had occurred.

The Dutch Safety Board has also taken note of the developments in relation to the provision of assistance, i.e. fire fighting. Research has also been carried out, for instance, into the progress made within the Waterrand project and the establishment of the Security Regions. As this investigation concerned fire safety onboard passenger ships and the corresponding individual responsibility, the duties of the emergency services, such as the role of the fire department, were not examined in any further detail.

¹³ The investigation was launched by the Dutch Transportation Safety Board. The activities and responsibilities in relation to the investigation were transferred to the Dutch Safety Board in 2005

2 Research questions

A number of research questions were formulated for the purpose of the investigation into the fire safety onboard inland passenger ships:

1. What is the situation in practice with regard to fire safety measures onboard passenger ships?
2. How is fire safety regulated? How do individual responsibility and government regulation work?

3. Research sources and research methods

The results of the theme study are based on inspections onboard a total of 50 passenger ships. In 10 cases, this involved inspections onboard ships on which a fire had broken out, whilst the remaining 40 inspections were conducted onboard passenger ships under normal operating conditions (not as a result of an accident, fire etc.), namely:

- Investigations into the circumstances onboard 10 passenger ships on which a fire had actually broken out
- Investigations onboard 10 passenger ships into the general situation with regard to fire safety
- Investigations onboard 16 passenger ships into the requirements in relation to construction, naval architecture and design (fire protection, fire fighting and fire safety) by TNO
- Investigations onboard 14 passenger ships into the human aspects (evacuation and behaviour of passengers and training of crew and service personnel) by TNO Defence, Security and Safety on behalf of the Dutch Safety Board

In addition to the abovementioned focus areas, information was also obtained via:

- an assessment of the relevant ship's papers
- documentation held by the Transport and Water Management Inspectorate
- legislation (past, current and future national and international regulations)
- interviews with those involved, passengers, crew members onboard the ships inspected
- interviews with officials from the Ministry of Transport, Public Works and Water Management and the Ministry of Social Affairs and Employment.

4. Analysis techniques

Interviews

Within the context of the safety study into fire safety onboard passenger ships, dozens of interviews were held by investigators from the Dutch Safety Board itself, as well as by investigators from TNO. Interviews were conducted with the crews of the passenger ships and the passengers staying onboard. Policy assistants from the various ministries involved and supervisory officials were also interviewed. Information with regard to construction methods and the certification of materials used was obtained from the companies involved in the construction of passenger ships.

Investigation into technical aspects

The technical aspects were assessed onboard the passenger ships. The investigation into the fire safety onboard passenger ships was conducted on behalf of the Dutch Safety Board by the Centre for Fire Safety of TNO Built Environment and Geosciences.

Investigation into human aspects

The human aspects were assessed onboard passenger ships under operational conditions by TNO Defence, Security and Safety on behalf of the Dutch Safety Board. Special points for attention included: the passengers (physical capabilities, awareness of what to do in the event of a fire, effects of property binding), the physical environment (complexity of the ship, signposting, emergency equipment) and crew (whether or not the crew members had been trained in what to do in the event of a fire). Interviews were conducted with crew members and passengers in relation to how they would be expected to behave during a situation involving a 'fire onboard'.

Accident inquiry

Investigations into the circumstances were conducted onboard passenger ships on which fires had recently broken out.

Various additional types of investigation were also carried out onboard the passenger ships. These consisted of investigations into the technical condition of the ship, as well as technical check lists and observations.

Document analysis

Comparative research was carried out into the specific maritime legislation, but also into the legislation that applies to similar sectors or situations. Research was carried out into current legislation, as well as future laws and regulations.

Drafts

The draft final report (minus the consideration and recommendations) was submitted to the parties involved for the purpose of assessment in order to identify any factual inaccuracies. In so far as relevant, the Dutch Safety Board has incorporated the responses received into the definitive final report.

The Ministry of the Interior and Kingdom Relations stated that it did not wish to make any observations in relation to the draft report.

The Netherlands Association of Fire and Disaster Control Services refrained from commenting on the report.

In its response to the report, the Transport and Water Management Inspectorate stated that collaboration with the fire department had been sought in the past, however due to the specific shipping regulations, this was found to be of little use. The Inspectorate also stated that it believed that the inspections carried out had been adequately documented.

The Health and Safety Inspectorate provided a number of useful additions to the report. The main addition was the obligation to have a company emergency response provision onboard. This is examined in further detail below.

The Netherlands Rhine and Inland Shipowners' Association (CBRB) issued a detailed response to the report. The members of the CBRB operate more than 200 passenger ships, i.e. around one quarter of the total fleet of passenger ships in the Netherlands. The CBRB's response draws attention to the fact that the incidents investigated took place a number of years ago now, namely prior to 2004. According to the CBRB, certain findings identified in the report are outdated. Terms such as 'shortcomings', 'inadequate' and 'structural safety shortcomings' were regarded by the CBRB as being unnecessarily negative and biased. According to the CBRB, the report completely disregards the fact that many passenger ship owners do indeed take safety issues very seriously. In its response, the CBRB drew the Dutch Safety Board's attention to a number of misinterpretations. The report was subsequently amended. Besides this, the CBRB agreed with the Dutch Safety Board's findings that the transitional period is long in the case of some technical adaptations. The technical issues identified by the Dutch Safety Board during the investigation will be addressed by the sector.

In the same response, the CBRB stated that there was a major lack of clarity in relation to company emergency response provision (BHV) onboard passenger ships. During the period in question, neither the Health and Safety Inspectorate nor the Shipping Inspectorate was willing to confirm that the company emergency response provision was compulsory. The Dutch Safety Board was able to infer from the Health and Safety Inspectorate's response to this report that under the previous legislation, the company emergency response provision was also compulsory in the case of passenger ships. The Dutch Safety Board still finds it a cause for concern that only nautical personnel receive this type of training and that the service personnel, as a result of the part-time nature of the work, amongst other things, are excluded from the requirement to follow this training.

In its findings, the Dutch Safety Board states that none of the crews of the ships inspected were aware of the occupational health and safety hazard identification and analysis (RI&E). The CBRB is confident however that the RI&E has been available onboard the ships operated by its members for a number of years now.

6. The project team

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