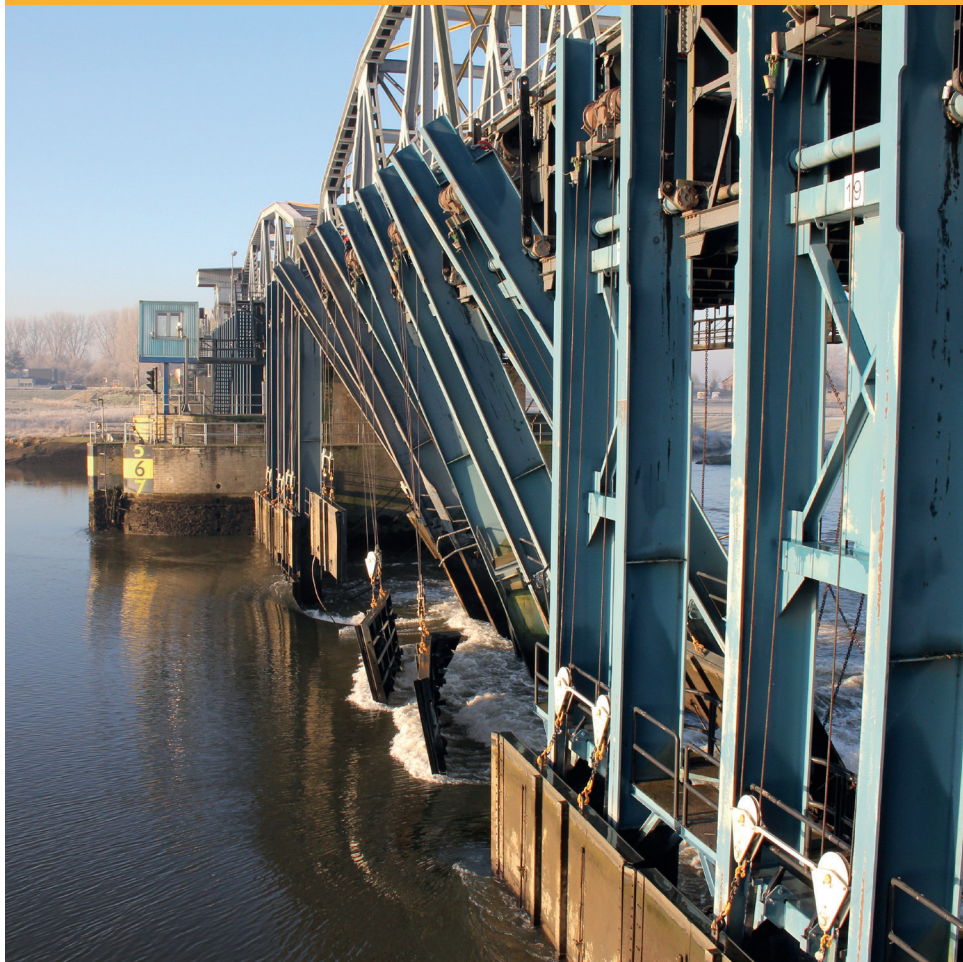




DUTCH
SAFETY BOARD

Summary

Collision with the weir near Grave by a benzene tanker



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The Hague, May 2018

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The Dutch Safety Board

When accidents or disasters happen, the Dutch Safety Board investigates how it was possible for these to occur, with the aim of learning lessons for the future and, ultimately, improving safety in the Netherlands. The Safety Board is independent and is free to decide which incidents to investigate. In particular, it focuses on situations in which people's personal safety is dependent on third parties, such as the government or companies. In certain cases the Board is under an obligation to carry out an investigation. Its investigations do not address issues of blame or liability.

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N.B. The full report is published in the Dutch language. If there is a difference in interpretation between the Dutch report and English summary, the Dutch text will prevail.

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On Thursday 29 December 2016, the inland vessel Maria Valentine, loaded with 2000 tonnes of benzene and travelling through dense fog on the Meuse collided with the closed weir near Grave. The force of the collision knocked five beams loose from the weir, creating an opening through which the water immediately began to flow strongly. The vessel was carried through the opening and ended up three metres lower on the other side of the weir, causing severe damage on deck. Nobody was injured during the incident, and only a very small amount of benzene leaked from the vessel. The Dutch Safety Board decided to launch an investigation, primarily because the incident has several dimensions from which safety lessons may be learned.

Circumstances of the collision

Because inland vessels do not carry equipment for recording conversations in the wheelhouse, the Dutch Safety Board was unable to reconstruct all aspects of the incident. According to the statements made to the Dutch Safety Board by the captain and the helmsman, upon approaching the weir, the captain fell ill at a moment when he was alone in the wheelhouse. The data that the vessel did log shows that, after passing the entrance to the lock without slowing down, the captain made a further heading correction towards the middle of the closed weir. The weir near Grave is only opened on very rare occasions. No medical reason has been found for the symptoms described by the captain. It was established after the collision that the captain was not under the influence of alcohol or medication.

From the moment that the vessel departed until the moment of the collision with the weir, the captain of the benzene tanker had been at the wheel for around 13 hours, except for short breaks while the vessel was stationary in the locks. Due to the fog, which ranged from dense to very dense and which was present for practically the entire journey, he navigated by radar for the entire journey. Navigating by radar in dense fog, without visual orientation points, is more strenuous than navigating under normal circumstances. Moreover, it was not possible for the captain to be relieved by the helmsman, who had the appropriate certification but lacked the necessary practical experience to pilot the vessel under those conditions.

Sailing with hazardous materials in fog

The Inland Navigation Act ('*Binnenvaartwet*') permits a vessel such as the Maria Valentine to travel for a maximum of 14 hours at a time¹, regardless of its cargo or the weather conditions. Unlike, for example, the Regulation for the transportation of hazardous materials by road, the Regulation on the transport of hazardous materials on the inland waterways does not restrict the transportation of these materials in fog or when there is poor visibility, because it is assumed that radar is sufficient as a navigational tool.

¹ With the exception of one day per week, on which it is permitted for 16 hours at a time.

The transport companies and chemical companies who contract for hazardous materials to be transported along inland waterways leave it to the captain to decide whether to continue in the prevailing conditions. This meant that it was possible within the legal framework for a captain of an inland vessel to decide to remain for 13 hours, without the option of being relieved, at the helm of an inland tanker travelling through dense or very dense fog and carrying 2000 tonnes of benzene. The captain in this instance was sailing through a densely-populated area along a relatively complex waterway, navigating exclusively by radar.

Preventing collisions with water-borne man-made objects on the water

The collision near Grave involved not only a collision by a benzene tanker, but also a collision with a water-borne man-made object. Since May 2017, *Rijkswaterstaat* has a framework in place to manage collision risks for moveable objects such as barriers, flood gates, locks, weirs and retractable bridges. This framework (which has existed since 2013 in a not yet formally approved version) had not been applied to the weir near Grave, because *Rijkswaterstaat* currently only applies the framework at specific points during an object's lifetime, such as when it is undergoing renovation. Neither did the weir near Grave undergo any other integrated, explicit assessments, with regard to the barriers located (or missing) at the weir, intended to reduce the likelihood of a collision or to limit the potential consequences of a collision for shipping and for the surrounding area. The barriers that were in place were either not visible due to the fog or did not have the desired effect.

Crisis management and emergency response

The *Maria Valentine* was not expected at the Grave lock. IVS90 – the onshore monitoring system that records vessel data and cargo details of vessels travelling along inland waterways – automatically maps a route between the vessel's point of departure and its destination. This route differed from the route actually taken by the *Maria Valentine*, via Grave, making it impossible to follow the entire route taken by the *Maria Valentine* through the land-based IVS90. Because a *Rijkswaterstaat* patrol vessel happened to be nearby, *Rijkswaterstaat* was aware soon after the incident that the collision had involved the *Maria Valentine* and what cargo the *Maria Valentine* was carrying.

Following the incident, the *Rijkswaterstaat* employees at the scene initiated the internal upscaling and began to manage the consequences for the water system. Because the incident was initially viewed as a problem primarily within *Rijkswaterstaat's* sphere of responsibility, it was more than an hour before the emergency services received the first report of the presence of hazardous materials on board the vessel. The involvement of *Rijkswaterstaat's* front-line crisis organisation did not lead to the proper and timely notification of emergency services.

The crisis management and emergency response following the collision with the weir, as well as the associated cooperative efforts, were severely hampered by the dense fog. In ordinary visibility, everyone present at the lock complex could have visually established crucial information, such as the location of the vessel, the damage to the weir and its loss of function and the condition of the Maria Valentine. The limited capacity for visual observation, the lack of inter-regional forward planning and the fact that this situation was not easily imaginable led to the risks and consequences of the incident initially being underestimated.

The incident took place on the border between two provinces, two safety regions and three municipalities, as well as two *Rijkswaterstaat* regions. The border between the two safety regions that were most involved follows the Meuse, precisely in the middle of the waterway. No joint plan had been drawn up by the relevant safety regions with their safety partners for the section of the Meuse where the weirs are located. The relevant safety regions did have their own coordination plans, which were designed on the basis of geographical units other than the water system. The common denominator between these coordination plans is that they are relevant to the coordination of the emergency services within each individual safety region, but that none of these plans formally includes coordination with the emergency services on the other side of the Meuse.

The consequences of the falling water level in the Grave-Sambeek reservoir, together with the associated risks to objects in the surrounding area and the necessary response measures, were not immediately apparent to the *Rijkswaterstaat* crisis organisation. For this reason, the decision to close the weir near Sambeek led to a greater difference in water level between the water reservoirs separated by the weir and the lock near Sambeek. This led to a significant hydraulic strain on the weir near Sambeek, which it had not previously been exposed to. The eventual involvement of specialist services from *Rijkswaterstaat* ultimately led to some response measures being taken, which caused the measures initially taken by the crisis organisation to be partially adjusted.

During the incident response efforts, the information exchange between *Rijkswaterstaat* and the relevant safety regions, and between these safety regions themselves, faltered. Also, several concerned parties, both in the safety regions and in *Rijkswaterstaat*'s crisis organisation, lacked a clear understanding of the expected operational upscaling and the necessary coordination in the event of water-based incidents that cross regional borders.

Despite the efforts of the safety regions concerned and *Rijkswaterstaat*, the emergency services were not certain that the Maria Valentine's cargo did not pose a threat to the surrounding area, and some officials had an inadequate understanding of the situation. In spite of this, on multiple occasions over the course of the evening people acted as if this certainty could be assumed.

The collision with the weir near Grave by the benzene tanker Maria Valentine involved not only a collision by an inland vessel loaded with hazardous materials, but also a collision *with* a water-borne man-made object. It therefore involved a double incident, which moreover took place in dense fog. Although the likelihood that this combination of incidents in these specific circumstances will be repeated is small, it has been shown that there are regular collisions with bridges, locks or weirs, or between inland vessels, involving vessels loaded with hazardous materials. The incident near Grave presents several points for concern containing lessons that can help improve safety on and around the inland waterways.

These points for concern mainly relate to the transportation of hazardous materials along inland waterways, crisis management and emergency response in fog and multidisciplinary and cross-border cooperation in crisis management and emergency response. In addition, the incident invites us to pay closer attention to “small chance, big effect” scenarios when assessing risks. It is unrealistic to expect a specific handbook to be developed for every conceivable incident in that category. However, to make it possible to perform effectively in this kind of scenario, there is a need for well-planned and rehearsed generic planning and cooperation across regional borders. The lessons provided by the investigation into the collision with the weir near Grave therefore apply not only to the inland navigation sector, the chemical sector and the administrative parties in the Meuse region, but also more broadly.

Whilst conducting the investigation into the collision with the weir near Grave, a sense of astonishment grew within the Dutch Safety Board at the circumstances of the incident. Under the relevant legislation and regulations and the mores within the sector, a captain of a tanker loaded with 2000 tonnes of inflammable benzene was permitted to sail uninterrupted for 13 hours in dense fog through a densely-populated area, on a relatively complex waterway, without the possibility of being relieved. The onshore monitoring system, which records vessel data and cargo details of vessels travelling along inland waterways, could not report where the vessel was located at the time of the incident. This combination of circumstances would be unthinkable in many other transport sectors. Several parties bear responsibility for preventing this kind of situation from arising.

In the first place, captains of inland vessels bear significant responsibility. By making adequate preparation for the journey, captains should take sufficient measures to avoid putting people or objects in danger. This incident shows that, in persistent dense fog on a relatively complex waterway, especially in situations in which a captain has no possibility of being relieved, the decision must be taken sooner to temporarily moor the vessel. There is sufficient opportunity to do this along the Meuse.

Secondly, the Ministry of Infrastructure and Water Management also bears responsibility. As the custodian of the waterways, *Rijkswaterstaat* must be able to halt shipping in a localised area in extreme weather conditions. This requires an integrated assessment framework. Weather conditions may differ between locations, and different waterways also have different characteristics that affect the risk. Some waterways have vessel traffic service (VTS) in place while others do not, some waterways are more difficult to navigate than others, and the type and amount of traffic varies. In comparison with other rivers, for example, the Meuse is a complex corridor, with multiple locks that are placed adjacent to the waterway. As well as being able to halt traffic locally, there is also a need for an improved onshore system that can track the route of vessels carrying hazardous materials 'in real time' and sound the alarm at the first sign of danger.

Lastly, the chemical companies involved in the transportation of hazardous materials along inland waterways also bear responsibility. In previous reports², the Dutch Safety Board raised the point that chemical companies also bear responsibility when their hazardous materials are being stored, transported or processed by another company. In inland shipping, it is already common for shippers of hazardous materials to set safety requirements when transporting these materials, such as the requirement that hazardous materials be transported in a double-hulled vessel. Along the same lines, agreements may be made with transport companies about the circumstances under which vessels may or may not travel with the shipper's hazardous materials on board, and about contacting the shipper in the event of incidents or in other exceptional circumstances.

It is even more important for all parties to take steps to reduce the risk of an incident involving hazardous materials in dense fog, given that dense fog severely hinders crisis management and emergency response in the event of an incident. On the evening of the collision with the weir, this incident was shown to exceed the predictive capacity of many of those concerned. The fog hid things that, in normal weather conditions, would have been visible, and a lack of integrated forward planning meant that what verified information there was reached the emergency services in a limited and unstructured way. This caused the risks and consequences of the incident to be initially underestimated.

In previous investigations, the Dutch Safety Board has³ established that carrying out crisis management and emergency response efforts in dense fog, places greater demands on the cooperation and communication between all of the parties concerned. Situations in which people are both literally and figuratively in the dark, such as under conditions of dense fog, benefit from good generic planning and swift, preventive upscaling. Unlike in ordinary situations when there is good visibility, it is difficult to eliminate "small chance, big effect" scenarios in conditions of poor visibility. Following preventive upscaling, once a better understanding of the situation has been achieved, the incident can then be scaled down as necessary.

2 Fire at Chemie-Pack in Moerdijk (2012), Safety of Odfjell Terminals Rotterdam, 2000–2012 (2013), Risk management when transporting hazardous materials by rail, rail crash at Tilburg (2016)

3 Missing aeroplane – Cessna incident on Maasvlakte 2 (2013)

The administrative complexity surrounding the weir near Grave is an extra reason to be well prepared for incident response along this stretch of the Meuse. Rivers often form a border between safety regions, municipalities and *Rijkswaterstaat* regions, which is why generally safety regions have drawn up incident response plans for the various water areas, together with their safety partners. However, this particular section of the Meuse lacked such a plan containing agreements about cooperation. The Dutch Safety Board considers that it is precisely at this kind of location – where cooperation does not arise on its own – that it is especially important to set out that cooperation in joint plans and in rehearsing those plans. It is now up to the safety regions concerned to achieve this as soon as possible, together with their safety partners such as *Rijkswaterstaat*.

RECOMMENDATIONS

The Dutch Safety Board makes the following recommendations, for which every effort has been made to take into account all current developments in the relevant sectors.

Nautical management on waterways and the transportation of hazardous materials along inland waterways

To the Minister of Infrastructure and Water Management

1. That *Rijkswaterstaat* be provided with the legal authority, together with a clear assessment framework based on that authority, to halt shipping traffic locally, entirely or in part, in extreme weather conditions.
2. That the Grave case be included in the study⁴ currently taking place at an EU level into the workload of crew members on inland vessels. That this investigation takes into consideration the fact that navigating for an extended period in foggy conditions or with poor visibility can negatively impact a helmsman's performance of his or her duties, and the consequences this should have for:
 - the current working hours and rest periods of crew members on inland vessels;
 - the requirements made of crew members other than the captain to steer the vessel.
3. That the initiative be taken to enter into binding agreements with the inland waterways sector and the chemical sector regarding:
 - a. the circumstances under which a vessel carrying hazardous materials may or may not continue to sail along inland waterways, and regarding contacting the shipper in the event of incidents or in other exceptional circumstances;
 - b. equipping vessels that carry hazardous materials along inland waterways with a recording system that records actions and conversations in the wheelhouse (*Voyage Data Recorder*)).

⁴ Towards A Sustainable Crewing System (TASCS)

Prevention, crisis management and emergency response

To the Safety Region of North Brabant, the Safety Region of South Gelderland and the Safety Region of North Limburg

4. That a coordinating safety region be set up and given responsibility for planning and coordinating incident response measures in the interlinked high-risk water system⁵ of Noord-Brabant / Limburg. That a joint Incident Response Plan be established and regularly rehearsed, in coordination with relevant “wet” and “dry” safety partners, including *Rijkswaterstaat*.

To the Minister of Infrastructure and Water Management

5. That a collision risk analysis be made for bridges, locks and weirs, including an explicit and integrated assessment of potential measures to limit the likelihood of collisions. That this analysis involves not only the existing collision risk framework, but also the potential consequences of a collision for shipping and for the surrounding area.
6. That the obsolete Information and Monitoring System for Shipping (IVS90) be replaced at the earliest opportunity with the improved IVS Next monitoring system, and that an alert feature be linked to this in order to sound the alarm immediately in the event of incidents involving vessels carrying hazardous materials.
7. That *Rijkswaterstaat*'s crisis organisation for tackling waterway incidents be improved by embedding alerting of the relevant safety region and by improving the safeguarding of specialist knowledge within the crisis organisation. That, in agreement with the board of safety regions, waterway incident scenarios ('vaarwegincidentscenario's') be harmonised at a national level⁶.

⁵ See the Incident Control on the Water handbook ('Handboek incidentbestrijding op het water'), p. 112

⁶ Following the example of ProRail's nationally harmonised rail incident scenarios

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