Report on the investigation into

the flooding and foundering of the grab hopper dredger

Abigail H

in the Port of Heysham

2 November 2008

Marine Accident Investigation Branch
Carlton House
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Extract from

The United Kingdom Merchant Shipping

(Accident Reporting and Investigation)

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

AC	-	Alternating Current
CCTV	-	Closed Circuit Television
DC	-	Direct Current
DPM	-	Duty Port Manager
EPIRB	-	Emergency Position Indicating Radio Beacon
FFE	-	Fire Fighting Equipment
FRS	-	Fire and Rescue Service
kW	-	kilowatt
LSA	-	Life Saving Apparatus
m	-	metres
MCA	-	Maritime and Coastguard Agency
MGN	-	Marine Guidance Note
nm	-	nautical miles
Oily Waste	-	Mixture of various grades of lubricating and hydraulic oil, fuel and water accumulated in engine room bilges.
PMSC	-	Port Marine Safety Code
SART	-	Search and Rescue Transponder
SOLAS	-	[International Convention on the] Safety of Life at Sea
SOSREP	-	Secretary of State's Representative
UMS	-	Unmanned Machinery Space
VHF	-	Very High Frequency

Times: All times used in this report are local (UTC) unless otherwise stated

Abigail H

SYNOPSIS

The 50 year old grab hopper dredger, *Abigail H*, had been working in the Port of Heysham, clearing debris from the cooling water inlets of the local power station. During the evening of 1 November and in the early hours of the following morning, the vessel developed a leak which allowed water to flood into the engine room.

Four crewmen were asleep on board and were not aware that there was a problem until the flooding caused the vessel to become unstable and roll violently to port, throwing three of the crew from their bunks. The roll was stopped when the mast and dredging machine came into contact with the adjacent quay. It is unlikely that the mooring lines would have restrained *Abigail H* if it had rolled away from the quay, and the crew were extremely fortunate to escape without injury.

The current owners had put a great deal of effort into maintaining the condition of *Abigail H* and the most recent survey had found the vessel to be in a satisfactory condition. During the investigation, a leak was found near the aft end of the engine room, close to bilge suction pipework underneath the stern gland. Although it was not possible to inspect the hull plating, analysis of the bilge systems indicates that it is most likely that the leak was caused by hull plating becoming perforated in this area.

The regulations that applied to *Abigail H* did not require it to be fitted with a bilge alarm in the engine room, because it was permanently manned while the main engine was running.

Although duty personnel at the Port of Heysham activated plans to minimise the risk of pollution, the port's emergency procedures were limited by lack of planning and rehearsal. Other compartments in *Abigail H* progressively flooded over the next few days, and she sank before salvage could be arranged. The vessel was successfully salvaged on 25 November 2008 and it was estimated that approximately 100 litres of a mixture of lubricating and diesel oil were released into the harbour during the whole period.

Recommendations have been made to the MCA to introduce a requirement for all vessels greater than 24m length but less than 500 gross tons to be fitted with bilge alarms; and for owners of vessels less than 500 gross tons to formally assess the risks to crew sleeping on board overnight and check that emergency alarms are capable of alerting those asleep on board. *Abigail H*'s owners have been recommended to introduce routine procedures to check the condition of engine room pipework and hull plating. In view of the actions already taken by the Port of Heysham, no further recommendations have been made.

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *ABIGAIL H* AND ACCIDENT

Vessel details

Registered owner	:	Wyre Marine Services
Port of registry	:	Grimsby
Flag	:	UK
Type	:	Grab hopper dredger
Built	:	W J Yarwood and sons, Cheshire, 1958
Classification society	:	Built under Lloyds Register supervision +100A1 but not maintained in class
Construction	:	Steel
Registered length	:	34.18
Gross tonnage	:	324.73
Engine power and/or type	:	Lister, EVSM GR8, power output <350kW
Service speed	:	8 knots

Accident details

Time and date	:	0510, 2 November 2008
Location of incident	:	Alongside Fish Quay, Port of Heysham
Persons on board	:	Four
Injuries/fatalities	:	None
Damage	:	Declared constructive total loss
Pollution	:	Approximately 100 litres of a mixture of lubricating and diesel fuel oil

1.2 NARRATIVE

1.2.1 Background

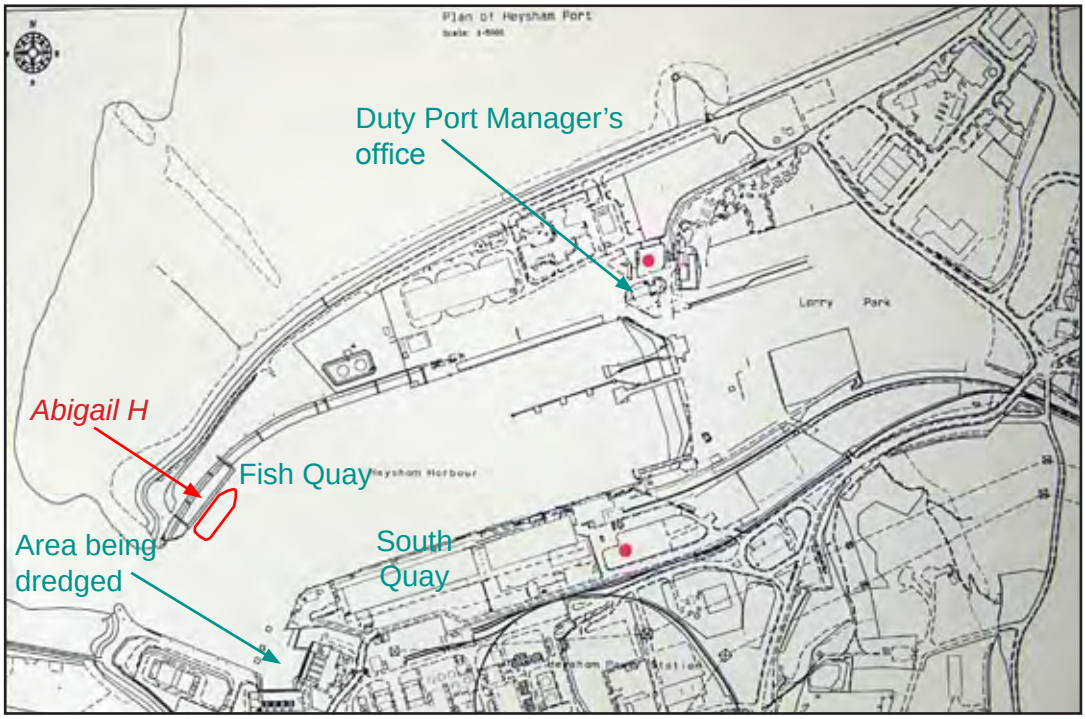
Abigail H was built in 1958, as a Class IX[1] grab hopper dredger for service in the Humber Estuary and 10nm beyond Spurn Point. The vessel was modified over the period from 1999 to 2004 to meet the requirements of Class VIII(A)[2] to allow it to work at different locations around the coast.

1.2.2 Dredging operations

Wyre Marine Services bought *Abigail H* in April 2007. The vessel was considered to be in poor condition and the company invested a substantial amount of time and money to return it to service. *Abigail H*'s size and dredging capabilities suited it to specialist tasks in confined areas.

Abigail H sailed from her base port of Fleetwood on Sunday 26 October 2008 to begin a contract to remove debris from the power station cooling inlets in the Port of Heysham. The vessel worked all week, removing three loads of silt and debris each day. On Saturday 1 November, *Abigail H* was dredging in an area close to the West Quay **(Figure 1)**, using a four point mooring to secure it in position between the mooring dolphins **(Figure 2)**.

Figure 1



Map of the Port of Heysham

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1 Definition of Class IX vessels: "*Tugs and tenders (other than ships of Classes II, II(A), III, VI or VI(A)* [passenger ships]) *that proceed to sea but are not engaged on long international voyages*".

2 Definition of Class VIII(A) vessels: "*Ships (other than ships of Classes II(A) to VI(A) inclusive* [passenger ships] *VIII(A)(T), IX, IX(A), IX(A)(T), XI and XII) engaged on voyages which are not international voyages*".

Figure 2

Mooring dolphins in the area being dredged

1.2.3 Alongside overnight

Abigail H had permission to stay alongside in the Port of Heysham overnight and during the week the vessel had been moored to several different berths. The most convenient of these was not available during the evening of 1 November and the Fish Quay was offered as an alternative.

The Fish Quay was not in regular use and it was not maintained to the same standard as other quays in the port **(Figure 3)**. The skipper decided to finish dredging earlier than usual to allow plenty of time for manoeuvring and so that mooring lines could be rigged and secured while there was still some daylight. At 1630 the skipper contacted the duty port manager (DPM) on VHF radio and requested permission to move across the harbour to the Fish Quay. The skipper was advised that a ferry was approaching and he waited to allow it to pass. Once clear, *Abigail H*'s inflatable boat was used to rig mooring lines and the vessel was secured alongside the Fish Quay. Long mooring lines, secured to the extreme ends of the quay, were used to allow for the large tidal range in the port, avoiding the need for the crew to get up in the night to adjust them. Although the crew had no intention of going ashore, they were conscious that the ladders attached to the quay were in poor condition and decided to leave their inflatable boat secured on the outboard side of *Abigail H*, ready for immediate use if necessary.

Figure 3

Access ladders at the Fish Quay

The crew completed their end of work routines, greasing the dredging equipment and cleaning mud from the decks. The hopper was full and the vessel was loaded close to her marks, ready for sailing to the spoil grounds in daylight the following morning.

The main engine was shut down and its cooling system sea inlet valve was shut. The discharge valve was above the waterline and was left open. One of the generators had a closed circuit cooling system, using water in the aft peak ballast tank; the other had a conventional sea water cooling system and its inlet valve was shut. Its outlet was also above the water line, and this was shut.

The inlet valve to the general service, bilge and ballast system sea chest was left open; this was the crew's normal practice, allowing water to be immediately available to the fire main. A small air cooled generator was also fitted in the forward hold and had originally provided power for domestic services. It was not sufficiently powerful for all the services that were now fitted, and was rarely used.

The skipper began to prepare an evening meal for the crew, but the deck-mounted generator, which was also air cooled and supplied power for domestic systems, stopped. The crew had experienced problems during the day with the fuel filter for this generator becoming clogged by contaminates in the diesel supply. The filter had been replaced several times and there was only one new filter left on board. The owner was expected to join *Abigail H* early the following morning, and he was called by the engine room fitter, who asked him to bring some more filters with him. Anticipating further problems during the evening, and wanting to save the last new filter for as long as possible, the engine room fitter took the blocked filter down to the engine room and cleaned it. This was successful and the generator was re-started. The engine room fitter also checked the machinery and stern gland; the level of oily waste in the bilge was at its normal level and he did not see any evidence of leaks. All the crew completed their work and, at around 1800, had their evening meal together.

After dinner, the crew watched television together until about 2000, before going to their individual cabins. The owners had a strict policy of not allowing alcohol on board, and there was nothing to suggest that this policy had been breached. From about 2200 onwards, the crew members went to sleep and the deck generator was left running to power the heating in the accommodation and the deck lights.

1.2.4 Flooding

At about 0215, the skipper woke briefly and noted that the deck generator had stopped running. He woke again at 0330 and got up to go to the toilet. The door at the end of the passageway leading out onto the main deck was slightly ajar, and the skipper looked out of it to see the mooring lines. There was enough background light for him to feel confident that the mooring was secure, and he closed the door and went back to bed. The deckhand also woke up to go to the toilet at around this time and had a look at the mooring lines. Neither man felt that there was anything unusual with the state of the vessel.

At about 0510, *Abigail H* rolled violently to port, tipping the skipper, engine room fitter and dredger operator out of their bunks. The vessel came to rest at a significant angle and the men met in the passageway outside their cabins, wondering what had happened. The skipper's cabin was on the centre line and he struggled to climb up the passageway as the carpet slipped against the deck. Using door frames and other fittings the three men climbed up the passageway and outside onto the starboard side of the main deck. The three crew men felt that the situation was severe, and began to untie and board the inflatable boat. However, they quickly realised that they had not seen the deckhand, whose cabin was on the deck above, and so shouted to him. He woke up and came down to join the other three in the inflatable boat.

1.2.5 Immediate actions

It was a cold night and all four men were wearing only their underpants. The skipper decided to go back and grab what clothing he could, and the dredger operator and engine room fitter followed him on board and went back to their cabins. The skipper took his foul weather gear and boots from an external locker; the deckhand stayed in the boat. *Abigail H* had come to rest with the mast crosstrees and dredger arm resting on the Fish Quay. As the crew were dressing, the crosstrees broke and the vessel lurched further to port. The men rushed back to the ship's side and climbed down the side belting and over the foul-encrusted hull into the inflatable boat.

At about 0515 the ro-freight vessel *Shield* was entering the harbour and the bridge team noticed *Abigail H* listing and the four crew men standing on the deck. *Shield* continued berthing, but the bridge team grew concerned about *Abigail H* and reported what they had seen to the DPM, using VHF radio. The DPM could not see the Fish Quay from his office and the area was not covered by Closed Circuit Television (CCTV). He attempted to call *Abigail H* on VHF radio, but got no response. *Highland Pioneer*, an offshore supply vessel, was preparing to sail, and reported that a small boat, with four people on board, had passed them.

Abigail H's crew used their inflatable boat to go to the northern part of the harbour, close to the DPM's office. They were in various states of dress: the skipper in foul weather gear and boots, the engine room fitter wearing a jumper, and the deckhand in his underpants. The dredger operator was not a mariner and had trained in the construction industry, but he had taken care to keep his lifejacket, torch, mobile phone and a high visibility jacket close at hand in his cabin, and he had grabbed these before leaving. He telephoned the owner and said that *Abigail H* was in a very bad state and that they needed his help. The owner had woken early that morning, and was already en-route to Heysham.

The crew in their inflatable boat motored to a ladder at the northern end of the harbour in order to make contact with the DPM. The ladder was covered in barnacles and as only the skipper had footwear on, he climbed up while the other three men stayed in the boat. The skipper went to the DPM's office, reported the problem and asked to borrow some clothing for the crew. The DPM's resources were limited, but the skipper was able to borrow a coat for the deckhand. The DPM was already aware that *Abigail H* was listing and, as all the crew had left the vessel safely, he considered that his priority should be to activate plans to deal with potential pollution from the vessel. The skipper left the office and went back to meet the rest of the crew. However, while he was in the office, the owner had called the dredger operator by telephone to say he had arrived and that the crew had taken the boat across the harbour to South Quay to meet him.

When the dredger operator, deckhand and engine room fitter arrived on the South Quay the owner gave them additional clothing from his kit bag and then they all got back into the inflatable boat to return to *Abigail H*. The stern of the vessel was low in the water, but the forward part was still buoyant and it appeared to be in a stable condition. The four men climbed on board to attempt to find the cause of the problem. Although the aft deck was awash, the water level had not reached above the sill of the door to the engine room. None of the doors to the superstructure were watertight, but all had substantial sills **(Figure 4)**. The owner opened the door to the engine room and used the dredger operator's torch to look inside. He saw a significant amount of water in the engine room, which covered the generator on the port side and was at least half way up the main engine. The surface of the water was still and there were no obvious sources of flooding, but he concluded that because water was not yet above the aft door sill, the cause of the flood must be in the engine room.

Figure 4

Aft deck and entrance to the engine room

There was no source of power available to drive the bilge and general service pumps, which along with their suction valves were nearly 1.5m under water. The owner told the crew to salvage personal items and electronic equipment from the bridge, while he used wooden bungs that had been attached to the tank

ventilation pipes to minimise fuel leakage and prevent any further flooding. Although he reached the ventilation pipe for the port fuel tank on the port side of the main deck, the water was by now waist deep and he was unable to cut through the vent's spark arresting gauze to fit the wooden bung.

The owner, dredger operator, deckhand and engine room fitter got back into the inflatable boat and went to the northern part of the harbour to meet the skipper and speak to the DPM. The owner went to the DPM's office and asked the DPM if the emergency services had been called and what response plans were being followed. The DPM informed him that he was using oil spill response plans, but that he was having difficulty contacting the oil spill contractor. The owner was frustrated by the lack of support, both for salvaging *Abigail H* and for the welfare of the crew. The emergency services had not been informed and, at about 0630, the owner called the coastguard to report the incident and request assistance from the local Fire and Rescue Service (FRS).

1.2.6 Subsequent actions

The weather was fine and clear with light winds from the north-west. The tide was ebbing, and at 0535 height of tide was recorded as 3.5m. Low water was predicted to be at 0732 with a height of 2.27m. *Abigail H*'s draught was 1.9m forward and 2.8m aft and, as the charted depth along the Fish Quay varied from 1.1 to 2.3m, the owner and skipper thought it likely that the aft part of the vessel was aground. The arm of the dredger was hard up against the quay and the vessel looked to be relatively stable.

The owner thought that if he could get pumps into the engine room it might be possible to start salvaging *Abigail H* at low water. He and the four crew men went back on board and released the hopper door mechanism to jettison the spoil. The vessel rose slightly in the water as some spoil was dropped, but the doors had not been able to open fully as the water was too shallow, and *Abigail H* slowly began to settle. The water level was now starting to lap over the sill of the aft engine room door, increasing the rate of flooding. The crew carried on removing personal items and electronic equipment from the bridge. The liferafts, EPIRB[3] and SART[4] were removed and other staff from Wyre Marine Services were called to bring vehicles to carry away the equipment and to deliver more clothing for the crew.

At 0640 the DPM made contact with the oil spill contractors and a response team was activated. They had some distance to travel and were expected to arrive later in the morning. Soon afterwards, the coastguard telephoned the DPM to tell him about the flooding of *Abigail H* and the risk of pollution. The day shift DPM arrived during this call, and after catching up with what had

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3 EPIRB – Emergency Position Indicating Radio Beacon; designed to transmit an emergency signal if it comes in contact with water, to assist in locating marine casualties in distress.

4 SART – Search and Rescue Transponder; designed to assist vessels fitted with radar operating in the 9GHz frequency band locate vessels, liferaft or survivors in distress.

happened, suggested calling the Port of Heysham's safety manager. One of the DPMs asked the crew of the local pilot boat to come and prepare their boat to assist, but one crewman was on holiday and the other had planned to go out for the day and was not available. The two DPMs did not consider the situation to be sufficiently serious to warrant finding an alternative crew. At 0650, Heysham power station staff were informed about the potential for oil pollution and the consequent risk to their plant's cooling systems.

The owner had returned to the DPM's office and asked for the key to open a gate on the access road to Fish Quay. He walked back round to the gate and at 0651 was just opening it when the local FRS arrived. The port's safety manager arrived shortly after 0700, and at 0715 police and FRS incident commanders met with the DPMs to get an update on the situation.

There was some uncertainty among those present as to which agencies needed to be involved and what the correct level of response should be. At 0748 police commanders recorded that clarification of who had overall responsibility was needed, and at 0754 they were still not sure if Maritime and Coastguard Agency (MCA) personnel were intending to visit the scene.

At 0805, the MCA duty Counter Pollution and Salvage Officer telephoned the DPM. He confirmed that, as the pollution from *Abigail H* was relatively minor and it was contained within the port, in accordance with the National Contingency Plan for Marine Pollution it was the port authority's responsibility to deal with it. He advised the port to ensure that salvors were formally appointed as soon as possible. The pumps carried by the FRS teams were not suitable for a salvage attempt, and they rigged inflated fire hoses around *Abigail H* as a temporary oil boom.

At 1020, the oil spill contractors arrived and began work. A police helicopter was working nearby and was asked to divert and take aerial photographs of the scene **(Figure 5),** but there was little more that the emergency services could do, and at 1230 they left the site.

1.3 PERSONNEL

1.3.1 *Abigail H*

The owner and crew were all local men, who had known each other and worked together for some time. The owner had spent much of his career at sea in the offshore industry working on supply vessels where he had progressed to becoming a master before helping to develop safety management systems in his employer's office ashore. He had become a partner in Wyre Marine Services in April 2007, and was applying many of the practices and procedures that he had learned in the offshore industry to the company's vessels. These included planned maintenance, emergency procedures and, although not required by

Figure 5

Aerial photographs taken by Lancashire Constabulary Air Support Unit

regulation, he was developing a safety management system. Wyre Marine Services had arranged sea survival, fire-fighting and first-aid courses for crew members who had not done this training previously, and all the crew involved in this accident had completed these.

The skipper had been a fisherman and had worked at sea for the last 40 years, supplementing his income from fishing, with work on offshore vessels and tugs. He held a Class 2 (Fishing) Certificate of Competency which did not qualify him to command the dredger.

The dredger operator had trained on excavators in the construction industry, but preferred marine work and had been dredging for the last 14 years.

There was no requirement for the engine room fitter to have any formal qualifications, and he had learnt his trade through technical work in the marine industry. He had worked on *Abigail H* periodically since April 2007, and during interviews after the accident showed a high level of knowledge of the engine room layout and its systems.

The deckhand had been working at sea for 27 years and had also worked in the fishing industry before moving to *Abigail H* as Wyre Marine Services built up its business. His responsibilities included operation of the vessel's inflatable boat and providing assistance with general deck husbandry.

1.3.2 Port of Heysham staff

The general manager for the Port of Heysham was also appointed as the harbourmaster. He was a master mariner and had considerable experience in the ports industry, but he was absent on holiday at the time of this accident and was not available to provide support. He had sent an email to staff informing them that he would be away, and had nominated deputies for commercial and engineering issues. The human resources manager was the most senior person in the organisation during his leave.

The DPM on watch had worked at the Port of Heysham for 30 years, including the last 17 years as a DPM. Heysham provides vessels with a Port Information Service only, and although the on watch DPM was highly experienced in the workings of the port ashore, he was not a seafarer, and other than operating a VHF radio, had little marine knowledge. Similarly, the DPM for the day shift had worked in the port for many years but had no marine experience.

The safety manager had a varied career as a fisherman and ashore in the port industry. In the absence of the general manager, he was the only other company representative immediately available with any marine experience. As arrangements for salvage began, a harbourmaster from another port owned by the Port of Heysham's parent company came to assist.

1.4 SALVAGE AND INVESTIGATION

1.4.1 Pre-salvage events

Buoyancy tanks on either side of *Abigail H*'s hopper, and the forward hold underneath the dredging machine, slowly flooded throughout the rest of Sunday 2 November. *Abigail H* became more unstable as the height of tide increased, and the vessel began to roll away from the Fish Quay. The owner was concerned that the vessel would capsize to starboard and the crew, assisted by the port safety manager, rigged mooring ropes around the dredging machine and superstructure. These were led ashore and attached to excavators that were brought to the site and positioned on a hill behind the Fish Quay **(Figure 6)**.

Figure 6

Excavators used to stabilise *Abigail H*

Abigail H's stability continued to deteriorate, and the following day she started rolling to starboard; more mooring lines were attached and secured with excavators while the vessel's insurers considered salvage. This took some time, and on 11 November, the Secretary of State's Representative (SOSREP) issued a Notice of Direction in accordance with the Merchant Shipping Act to the insurers to submit detailed plans within 24 hours for the removal of hydrocarbons and subsequent salvage of the vessel.

1.4.2 Salvage

The salvage team was mobilised on 17 November and work on site began the following day. The condition of the vessel had deteriorated; the engine room was free-flooding and water had entered the buoyancy tanks and forward hold. Diving inspections did not find any significant damage or holes in the hull. Land winches were used in an attempt to heave *Abigail H* upright **(Figure 7)** and, on 25 November, the vessel was refloated by removing water from the flooded compartments and by lifting the stern using a floating crane **(Figure 8)**.

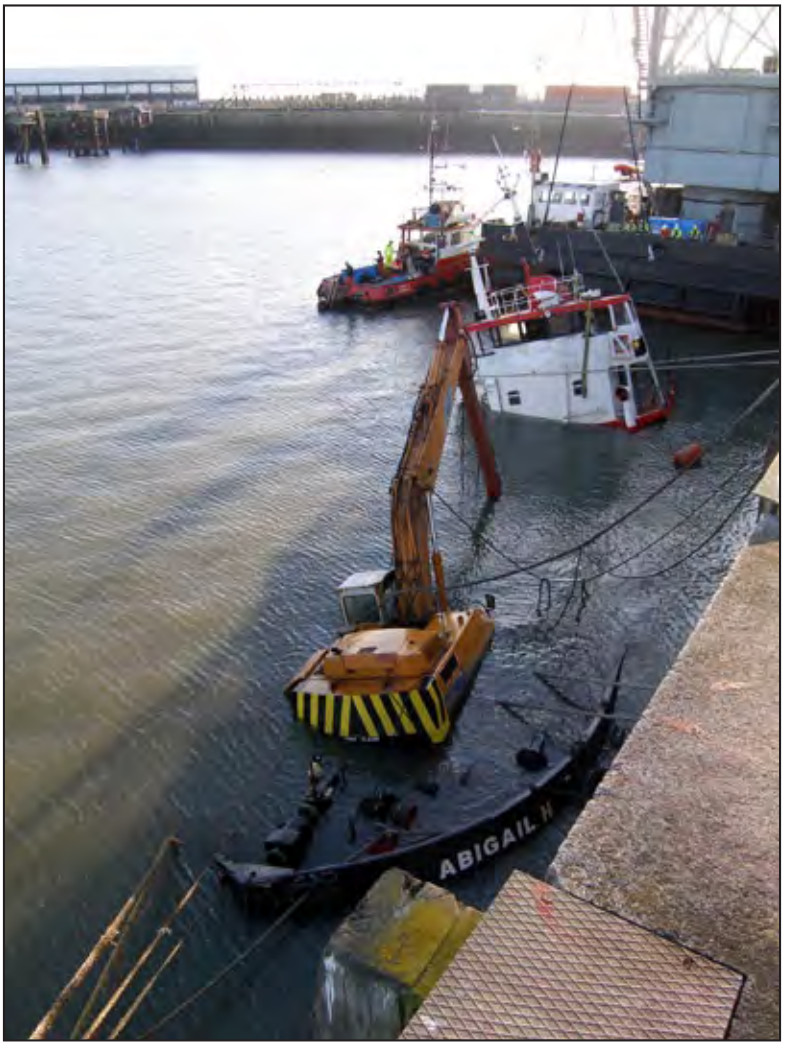
As the engine room was being pumped out, an MAIB inspector boarded the vessel with salvors and the owner to search for the cause of the flooding. No leaks were apparent and, with the vessel floating, the salvage operation was finished at 2315 and the pumps were shut down. The following morning at about 0830, the owner, the port's general manager, and MAIB inspectors returned to continue with the investigation and found that the engine room had flooded again, with the level of water now about a quarter of the way up the main engine and the vessel beginning to list to starboard. The port's general manager arranged for local contractors to provide pumps to reduce the level of floodwater.

It was estimated that 100 litres from the 4500 litres of oils and diesel fuel on board entered the dock.

Figure 7

Winches and excavators used to keep *Abigail H* upright during the salvage operations

Figure 8



Salvage arrangements

1.4.3 Engine room survey

A detailed survey of the engine room found the sea water system valves in the positions described by the engine room fitter. The inlets to the main engine and generator cooling systems were shut, and the valves allowing the fire main to be used were open **(Figure 9)**. Closing these valves made no difference to the rate of water ingress or to the level of water in the engine room.

After a considerable time, the level of water and oily waste in the engine room was reduced enough for a disturbance on the otherwise smooth surface to be seen near the stern gland. Closer inspection found evidence of water ingress in an area close to the bilge suction line on the starboard side of the stern gland **(Figure 10)**. There was no leakage from the stern gland itself.

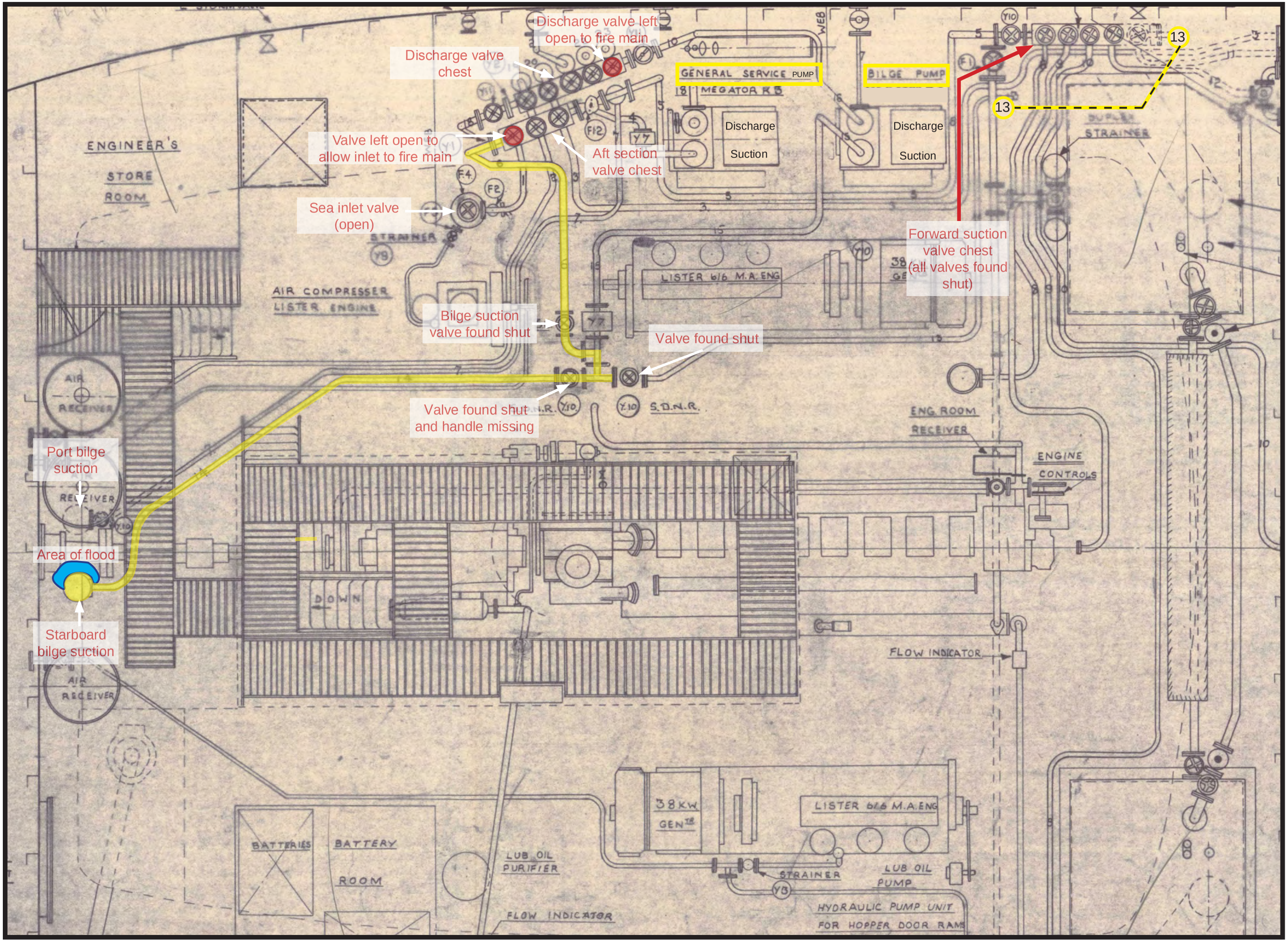
It could not be determined if the water was coming from a penetration in the hull, or by leaking back through the bilge suction pipework via connections linking it to the fire main sea water inlet **(Figure 11)**. However, the valve

Figure 9

Fire main valves on the aft suction and discharge valve chests

Figure 10

Location of the source of the flooding



General service and bilge pipe work systems

Figure 11

connecting the fire main inlet with the bilge suction system was found to be shut, as was a second, screw down non-return valve that isolated the bilge suction line to the starboard side of the stern gland from the rest of the bilge system. This valve was the only one in the system without a handle, and did not appear to have been operated for some time

Wyre Marine Services constructed a cement box in the area beneath the stern gland, and this stopped the flooding. The bilge was not pumped dry in order to minimise further pollution, and it was not possible to inspect the shell plating to confirm whether this had been penetrated.

1.5 PORT OF HEYSHAM RESPONSE TO VESSEL EMERGENCIES

1.5.1 Port Marine Safety Code

The Port Marine Safety Code (PMSC) was drawn up following a review of the Pilotage Act in 1998. The main proposal resulting from this review was that a code of best practice should be developed, summarising the legal duties and powers of harbour authorities relating to marine safety. Harbour authorities were expected to work to achieve the agreed standards in the PMSC, on a voluntary basis, by implementing its requirements and following the associated guides to best practice.

The PMSC requires that harbour authorities should conduct a Formal Safety Assessment of all aspects of their operation and, from this, derive a register of the risks involved and an effective safety management system to control them. This should include plans and procedures to react to emergencies and ensure that staff are properly trained to deal with them.

The Port of Heysham's parent company formally reported that the port met the requirements of the PMSC at the first review in 2002, and subsequently at the required 3-yearly intervals, in 2005 and 2008. Although the MCA had begun a process of conducting verification visits to ports to check compliance with the PMSC, at the time of this accident the Port of Heysham had not been assessed.

1.5.2 Port of Heysham Emergency Plan and response

The risk of a vessel flooding while alongside a berth in the port had not been identified in the Port of Heysham's risk register. The most relevant occurrences that had been identified were vessels being involved in collision or contact, and pollution in the harbour. In the knowledge that *Abigail H* had not been in collision or contact, and that the crew had evacuated the vessel without injury, the DPM decided to implement the oil spill response plan. The port only had sufficient equipment to respond to a small, Tier One[5] pollution incident and the DPM attempted to activate a pre-arranged contract with an oil spill response

[5] MCA definition of Tier One: A small operational spill employing local resources during any clean-up.

company, designed for a Tier Two[6] incident. He called the telephone numbers listed in the emergency port's plan, but they had recently been changed and the plan had not been updated. Messages were left on voice mail and, after some delay, the oil spill response company returned his calls and arranged to send a team.

The emergency plan required that the DPM was to call the general manager in any emergency. The general manager would then provide support and, if required, take charge of the situation. The emergency manual did not provide any contingencies for his absence and no-one else had been nominated to fill this role during his holiday. The DPM had no formally delegated authority to act on behalf of the general manager. There was no policy for what support should be offered to vessels in difficulty within the statutory harbour area, for example whether to take a passive position, offer assistance or even to intervene and control the operation. Although the manual stated that the DPM was to become the incident controller in an emergency, neither of the DPMs had any formal training in this role and the port had not conducted any exercises to test and practise its emergency procedures.

1.5.3 Informing the coastguard

No distress calls were made as *Abigail H* flooded and, as the crew escaped without injury, neither they nor the DPM considered that there was immediate danger to life and so they did not call the coastguard. Harbour authorities are responsible for dealing with Tier 1 and 2 pollution incidents within their harbour areas in accordance with the National Contingency Plan for Marine Pollution. The port's oil spill response plan did not state that the coastguard should be informed.

1.6 SURVEY AND MAINTENANCE HISTORY

Abigail H was built to the Lloyds Register rules of the day to meet the Merchant Shipping (Safety and Load Line Conventions) Act 1932 and was issued a UK Load Line Certificate in 1958 on completion of building.

When the vessel was sold in 1999, the new owners wanted to move it away from the Humber and offer dredging services in other ports. The owners asked MCA surveyors for details of what needed to be done to allow the vessel to conduct coastal voyages. This required *Abigail H* to be re-categorised from Class IX to Class VIIIA, which involved a substantial amount of work, including:

- increasing the amount of life saving apparatus (LSA) and fire-fighting equipment (FFE) on board;
- conducting an inclining experiment and producing a stability book;

[6] MCA definition of Tier Two: A medium sized spill, requiring regional assistance and resources.

- a detailed hull survey in dry dock, including shell and deck plate thickness measurements;
- increasing the manning on board.

This process commenced as part of the sale, with a satisfactory inclining experiment and a stability book being developed and approved. LSA and FFE were added throughout 2000 and 2001. On 6 April 2001, the MCA replied to an enquiry from the owners about manning levels, stating that the regulations did not require engine room personnel to have any formal qualifications as the main engine's power output was less than 350kW and it was not intended to operate the vessel with an unmanned machinery space (UMS). On 11 May 2001, the owners asked if bilge alarms were required in the engine room. The MCA responded on 14 June 2001, stating:

> *"The regulations applicable to this size of ship, having a continuously manned machinery space, do not call for the fitting of bilge level alarms. However, we would always support the voluntary installation of such a detection and alarm system (the requirement for bilge level alarms is part of a series of special provisions needed in ships having periodically unattended machinery spaces)"*.

Bilge alarms were not fitted, and in July 2002 the owners suspended work on the vessel due to other commitments.

Work re-commenced in January 2004, with a refit conducted at Alexandra Dock, Hull. *Abigail H* had significant defects both in the structure and the equipment on board. Ultrasonic thickness measurements were taken of the keel, bottom and bilge plating along the full length of the vessel and in way of all the sea connections. Ship side valves were removed, stripped and inspected. Stub pipes and valve chests were opened up for inspection. They were all found to be in a satisfactory condition.

A targeted inspection by the MCA in September 2004 required ship side discharge valves to be overhauled and, later, in December 2004, screw down non-return valves were required to be fitted to toilet and washing machine discharges. A Load Line Certificate was issued on 17 December 2004, valid until 11 February 2009, recording the vessel as Class VIII(A).

Despite reclassification, *Abigail H*'s limited freeboard required a Load Line Exemption Certificate to be issued each time the vessel operated outside the areas specified on the Load Line Certificate. In the period from October 1999 to March 2007, 12 Load Line Exemption certificates were issued.

The deficiencies recorded in subsequent inspections in 2005 and 2006 showed a gradual deterioration in the condition of *Abigail H*. The special survey in August 2006 recorded a number of serious deficiencies, of which the most significant were:

- Hull plating cracked at the sheer strake
- Hull plating cracked at the belting
- Bulwark stays corroded
- Diesel leaking into the starboard buoyancy tank
- Frames wasted at their bases
- Lower inspection cover to the chain locker not properly fabricated and found to be leaking
- Air receivers and relief valves out of date for testing and overhaul
- Ship side valve for starboard toilet seized open
- Broken port light in one of the cabins
- Logbooks not maintained and mandatory checks of safety equipment not completed
- Numerous LSA, FFE and other general defects

A package of rectification work that would allow *Abigail H* to start work on a local contract in September 2006 was agreed, but the vessel was not permitted to work at sea.

Abigail H was surveyed in a dry dock by the MCA in Fleetwood in March 2007. Significant work items included replacing sacrificial anodes on the hull and overhauling sea inlet valves. Throughout 2007, Wyre Marine Services replaced the dredging machine, bilge pumps, deck and auxiliary generators and began a programme to convert electrical systems from 110V DC to 415V AC. The owner and crew did a considerable amount of general husbandry and the vessel started to attract visits by enthusiasts. Their photographs showed the engine room to be well cared for.

An annual survey conducted by the MCA in January 2008 did not record any significant defects. On a visit to Whitehaven, 2 months before the accident, *Abigail H* was moored in a tidal berth and dried out at low water. The hull was steam cleaned, inspected by the owner and 12 sacrificial anodes were replaced.

1.6.1 Merchant Shipping (Ship Inspection and Survey Organisation) Regulations

In July 2006, the MCA published the Marine Guidance Note (MGN) 322, Ship Survey Standards. This defined the UK's policy on implementing European and International (SOLAS) legislation for vessels to be constructed and maintained to appropriate standards. In most cases, surveys for statutory certificates would be carried out by an authorised classification society, in accordance with the society's rules or other recognised standards. However, for vessels that had not previously been registered with a classification society, the MCA could conduct surveys for the same purpose and to an equivalent standard.

In cases such as *Abigail H*, where the MCA was conducting surveys, a significant amount of information about the vessel was required. The complete list of information required by MGN 322 is reproduced at **Annex A**, but the requirements relevant to this case are:

- Construction plans of the hull, including:
    - Engine room construction
    - Engine and thrust seatings
    - Hull penetration plans
    - Bilge keel details and weld details
    - Corrosion control and paint specifications
- General Arrangement drawings
- Capacity plan
- Lines plan or equivalent
- Dry-docking plan
- Machinery plans for:
    - Main and auxiliary engines, including gearing and couplings
    - Fire, ballast and bilge pumps
    - Valves (sea valves and any associated with pressure systems exceeding 6.8 Bar)
    - Piping diagrams

Some documentation on board *Abigail H* was lost in the course of the accident, and information held by the MCA was examined to determine what was available to surveyors. The files had been kept in two parts. The first, kept at the Marine Office currently administering *Abigail H*, contained more recent correspondence, a general arrangement and hopper construction drawings. The second group of

older files had been kept at the Marine Office which had dealt with *Abigail H* up until 2007, when Wyre Marine Services bought the vessel. While much of the information was extremely dated, there were additional drawings, one of which showed valve and pipework arrangements **(Figure 11)**.

1.7 CONTROL OF RISKS ASSOCIATED WITH SLEEPING ON BOARD

Abigail H's crew routinely lived on board during dredging contracts. They took pride in the vessel and had made an effort to make it comfortable. Although the owner had completed risk assessments and introduced procedures for many of the normal work activities, the risks associated with sleeping on board overnight had not been specifically considered. It was normal practice for all crew members on board the vessel to sleep through the night, and no measures were taken to periodically check the safety of the vessel when this occurred.

Wyre Marine Services had fitted *Abigail H* with a fire detection system that could operate from either the main domestic or emergency battery power systems. The fire detection devices were connected so that if one was activated, an alarm would sound in all of them. Crew members had considered fitting a bilge alarm in the engine room, and it was the owner's intention to do so in the medium term. However, because a bilge alarm was not required by regulation it became less of a priority compared with the large amount of work needed in other areas.

1.8 OTHER ACCIDENTS OF RELEVANCE

The Register of Ships and Seamen database has 647 vessels currently recorded with a length greater than 24m and of less than 500 gross tons. Many of these have similar characteristics and are covered by the same regulations as *Abigail H*.

Nine incidences of flooding of merchant vessels greater than 24m length and less than 500 gross tons have been reported to MAIB since 1996. Of these, five involved crew or emergency services attending vessels where severe floods had occurred on unmanned vessels overnight. The remainder happened while the vessels were manned and crew were able to discover the leaks in sufficient time to be able to control the flooding. Two of the flooding incidents occurred on dredgers.

Other emergencies that occurred on merchant vessels greater than 24m length and less than 500 gross tons moored alongside during the same period were also examined. Six cases of fire were reported, four of which occurred when all the crew were asleep on board. In these four cases, the fire detection equipment alerted the crew in time for them to either fight the fire or evacuate safely.

One significant accident occurred in 2005, on a tug which had been moored, with the crew remaining on board, ready for work at short notice. The effect of the tidal stream and local currents was greater than expected and the moorings failed, causing the tug to drift downstream until it contacted a tanker moored at a nearby berth. The crew were woken by the impact. As a result of this incident, the tug's owners introduced a procedure for crew to use the electronic chart system to sound an alarm if the vessel moved outside a pre-determined area when moored.

Since 1994, seven cases of flooding have been recorded on fishing vessels of a similar size, moored alongside overnight. On 1 August 2008, a serious fire occurred on the fishing vessel *Vision II*[7] while it was alongside in Fraserburgh. The fire detection equipment had been isolated when shore power supplies were connected, and all three people on board were killed by the fire. The MCA subsequently conducted a review of the safety issues associated with crews living on board fishing vessels in port. A number of actions were taken, including issuing an Operational Advice Note to surveyors on the areas to assess when considering whether it is safe for workers to live on board vessels in port.

On 25 June 2007, the tanker *Young Lady*[8] dragged her anchor in Tees Bay. The anchor caught on a gas pipeline, dragging it sideways and causing damage to the pipeline's protective coating and steel surface. Following the accident, the MAIB made a recommendation to the MCA, British Ports Association and UK Major Ports Group to review the criteria and procedures used by port administrations to ensure HM Coastguard receives early notification of developing situations.

7 MAIB Report 8/2009 published March 2009

8 MAIB Report 3/2008 published February 2009

SECTION 2 - ANALYSIS

2.1 AIM

The purpose of the analysis is to determine the contributory causes and circumstances of the accident as a basis for making recommendations to prevent similar accidents occurring in the future.

2.2 FLOODING

2.2.1 Cause of the flooding

Abigail H sank by the stern and the forward part of the vessel remained buoyant for several days after the accident. When the owner first boarded, he saw water inside the engine room, before the level outside had risen high enough to flood over the door sills. During the investigation, water was found flooding into the engine room in the area beneath the stern gland, and when this was covered with a cement box, the flooding stopped. The cause of the vessel flooding and foundering was water leaking into the engine room.

The leak was found on the starboard side, beneath the stern gland, in the area of the bilge suction line. The bilge could not be fully pumped out and the external hull could not be inspected, so the leak could potentially have been due, either to hull perforation, or water flooding back through the bilge suction pipework through connections with the fire main and main sea inlet.

It was understandable for the crew to leave the sea inlet to the firemain open so that the general service pump could be started easily. However, if the valve connecting the fire main sea water inlet to the bilge suction system was open or leaked, then sea water would have been able to flood into the bilge system. If the valve to the bilge suction on the starboard side of the stern gland was also open or leaked, then these two together could have allowed sea water to back flood into the bilge. However, following good engineering practice, both these valves were found to be shut, and the stern gland suction line valve was of the non-return type to prevent back flooding, even if left open. Shutting the sea inlet during the MAIB's survey of the engine room had made no discernible difference to the rate of flooding, and it is considered most likely that water entered through a perforation in the hull plating in the area near the stern gland bilge suction.

Although ultrasonic thickness measurements of the hull plating had been satisfactory in 2004, it would have been awkward to gain access to this part of the hull in subsequent surveys. Externally, the area would be close to the keel and in a position where supporting blocks would normally be needed in a dry dock or slip. Internally, even with deck plates removed, it was difficult to get in close enough to examine the area properly, and it would normally have been covered with oily waste. It is not certain that even the most diligent survey would have discovered the problem, unless a reason had been identified to target this area specifically and so make the necessary preparations to gain access.

Localised pitting and wasting of plating beneath bilge and tank suctions is not uncommon. It is good practice to keep bilges dry and to inspect these areas regularly to warn of any problems. The crew reported that *Abigail H* grounded occasionally while dredging, and this would have led to some mechanical damage to hull plating. These factors, combined with the age of the vessel and its poor condition in 2005/6 add support to the most likely cause of the flood being due to localised failure of the hull plating.

2.2.2 Reaction to flooding

Although the rate of leakage was not great, the sea inlet valves, pumps and generators were underwater by the time the flood was discovered. This prevented the crew from taking action to prevent further flooding or pump out the water using ship's systems. Neither the deck generator, nor the generator in the forward hold was capable of providing power to the general service or bilge pumps. There was no requirement for these pumps to have an emergency source of power.

The engine room fitter last visited the engine room at about 1800, and the vessel lost stability some 11 hours later. After the vessel had been salvaged, the level of water in the engine room was reduced to just below the deck plates. It then flooded for about 9 hours overnight, with the water level in the engine room rising approximately 1.2m and causing the vessel to begin listing to starboard. Comparison of the timing of these two events suggests that the leak probably began at about the time that *Abigail H* moored at the Fish Quay and the crew finished their work. The rate of flooding was sufficiently slow that it is unlikely that the engine room fitter would have seen any substantial increase in the level of oily waste in the bilge during his last inspection. A further inspection late at night, or a bilge alarm, would have alerted the crew to the flooding and allowed them to do something about it, before it was too late.

2.3 LIVING ON BOARD

The crew routinely stayed on board the vessel while working on contracts away from their base port in Fleetwood. The accommodation was relatively well furnished and had been fitted with fire alarms that worked from both the main and an emergency power source. The need to fit bilge alarms had been considered at least twice in the vessel's recent history but, because they were not mandatory, was not seen as a priority.

The owner had conducted risk assessments for many of the normal working practices on board. Some of the additional risks inherent in staying on board overnight had also been recognised, for example shutting engine cooling sea inlets and prohibiting alcohol on board. However, there was no specific assessment of the risks associated with sleeping on board overnight once normal operations had finished and machinery was shut down. The checking of compartments or the safety of the moorings was left to the crew's discretion. After spending much of the day in the engine room, the engine room fitter

had no suspicion that a flood might occur; the bilge level was known to stay relatively constant, and consequently it was not considered necessary to get up during the night to check for flooding.

Abigail H was loaded with silt, which reduced its reserve of stability. Therefore, less flooding was needed to make the vessel become unstable. It was fortunate that the vessel rolled towards, and was then supported by the jetty. If *Abigail H* had rolled away from Fish Quay, it is unlikely that the mooring lines would have restrained the roll, and it is possible that the accommodation could have become submerged and the crew trapped in their cabins.

A properly structured assessment of risks to crew sleeping on board a vessel that has been shut down overnight is required, and should consider, as a minimum:

- Security of moorings
- Vessel emergencies
    - Fire
    - Flood
    - Noxious atmosphere (ie carbon monoxide)
    - Medical casualties
    - Loss of stability
- Response to actions of other vessels
    - Contact
    - Pollution
- Effects of extreme weather

Many of these functions are, in larger ships, traditionally provided by personnel being on duty overnight. In smaller vessels this is not always practical and other means of achieving the same effect, which can attract the attention of sleeping crew, are needed. This should include a method of communication between the vessel and port authorities (such as a mobile telephone).

2.4 EFFECTIVENESS OF REGULATIONS

2.4.1 Bilge alarms

The requirement to fit bilge alarms in engine rooms exists where these compartments are periodically unattended. This is normal practice in small vessels, and the MCA's workboat and fishing vessel codes of practice require

bilge alarms to be fitted. In larger ships, UMS is common and modern control systems are built with this in mind; bilge alarms are required and engine room personnel must hold formal qualifications.

Abigail H is one of a large number of vessels that sit between these two groups.

The effect is that these relatively small vessels require no bilge alarm and are manned with engine room personnel that have not received formal training. There is no expectation for the engine room to remain manned when machinery is shut down overnight, but this incident demonstrates the results of a relatively minor leak in this type of vessel can be catastrophic if undetected.

Bilge alarms in engine rooms, and other substantial compartments that could threaten the vessel's buoyancy and stability if flooded, should be a mandatory requirement regardless of the way the engine room is manned. These and other emergency alarms should be capable of operating when the vessel's normal power supplies are shut down, and be able to wake sleeping crew in sufficient time for them to react appropriately.

2.4.2 Survey and inspection

Annex 3 of MGN 322, Ship Survey Standards **(Annex A)** details the information required by the MCA when it conducts surveys for the issue of statutory documents. However, it is not always practical to expect owners of vessels like *Abigail H* to have or to prepare much of this information. A pragmatic approach is needed in these cases, making best use of the information that is available. This should include a thorough search of the related files already held by the MCA to avoid the situation, as in this case, where potentially useful drawings were overlooked because they were stored in another office.

The regulations for vessels greater than 24m registered length and less than 500 gross tons are complicated, and many discrete sources need to be drawn together to achieve the proper effect. This is in contrast to workboats and fishing vessels, where the regulations are presented as Codes of Practice, making the requirements clear to owners and implementation more straightforward for surveyors. It was evident that applying the appropriate regulations and explaining the requirements to *Abigail H*'s various owners took up a considerable amount of MCA surveyors' time. It is an inevitable consequence that this would have put pressure on the amount of time available for detailed inspection of the vessel's condition.

It is recognised that consolidating the regulations applicable to vessels greater than 24m registered length and less than 500 gross tons into a code of practice is a substantial task, but this is a logical goal and offers multiple benefits to the MCA and owners.

2.5 PORT RESPONSE TO *ABIGAIL H* FLOODING

2.5.1 Emergency plans

The DPM did not interpret the flooding of *Abigail H* as an emergency in the conventional sense because the crew had escaped safely and the position of the vessel was not causing a problem to the traffic in the harbour. While this is understandable at an operational level, the PMSC makes it clear that the port has a responsibility for marine safety and must have a system of managing risks connected with activities in the port. This should include plans and procedures for responding to problems with vessels in the port. In normal circumstances, the DPM would call the general manager, who would attend and take control of the port's response. He was not available, so this fell to the DPM alone. The risk of a vessel flooding while alongside was reasonably foreseeable, but had not been identified in the port's formal safety assessment. Consequently, there were no specific emergency plans to guide and assist the DPM, and he had not had any formal training or taken part in any exercises to help prepare him for how to react. He did not have the authority, skills or experience of the general manager to offer assistance to *Abigail H* and, inevitably, his initial reaction was limited. In developing contingency plans, Port Authorities should consider the relevant experience of the duty personnel concerned.

Abigail H continued to sink, and the crew re-boarded to salvage what they could. The owner was disappointed with the port's initial response and felt that there was a chance that by pumping out the engine room at low tide later in the morning, the vessel could be refloated and damage and pollution minimised. He was frustrated with the lack of support available from the port, and called the coastguard, partly in case the situation deteriorated further and also to ask for help from the local FRS. The efforts, to put bungs in fuel tank vents, and to rig and maintain oil booms were commendable in minimising the amount of pollution that was released.

Although the Port of Heysham had formally declared it met the requirements of the PMSC, this had not been verified by any internal or external audit process. During this incident, the port's lack of planning, training and practice resulted in a slow and minimal response. Careful review and, where appropriate, exercising of procedures should be conducted to verify that the port does meet the industry's best practice.

2.5.2 Co-ordination with emergency services

The Port of Heysham's oil spill response plan did not require the DPM to report the incident to the coastguard when he instigated a Tier Two pollution response. Neither did his lack of knowledge of the whereabouts or condition of *Abigail H*'s crew during their attempts to salvage items from the vessel, prompt him to seek assistance either from his own organisation or the emergency services.

Regardless that it was the port's responsibility to respond to the flooding and risk of pollution from *Abigail H*, it was important to keep the coastguard informed during an incident in a port. The circumstances could have changed dramatically, for example if the crew had become trapped or injured during their subsequent attempts at salvage, or because the pollution was worse than expected. Briefing the coastguard early during the incident would have created an opportunity for the DPM to discuss with them any requirement to summon the emergency services, and it would have enabled the coastguard to respond more effectively had the situation suddenly deteriorated. The investigation into the tanker, *Young Lady*[8] dragging anchor in Tees Bay, also found that the coastguard had not been kept properly informed of the developing situation. Following that investigation, MAIB made recommendations to the MCA and to Harbour and Vessel Traffic Service Authorities to co-operate to develop criteria for notification and reporting of accidents in their areas.

Police reports show increasing frustration with the uncertainty about who had responsibility for the incident. It was unclear to them whether the MCA or Environment Agency should be involved, or if local emergency procedures for pollution or marine incidents should be activated. The DPM did report that he had activated the port's oil spill response plan, but it was clear that this would take some time to take any effect, and the emergency services did what they could to limit damage from pollution.

The limited communication between the port and the emergency services in the early stages of this accident led to confusion and, if circumstances had deteriorated, could have reduced the effectiveness of the response. This illustrates the need for duty personnel to understand and rehearse their reactions to the range of incidents that could occur in their port, and to clarify with the local emergency services when a combined response could be required, and how it would be co-ordinated.

2.6 FATIGUE

None of the personnel involved in this incident were considered to be unduly affected by fatigue.

SECTION 3 - CONCLUSIONS

3.1 SAFETY ISSUES DIRECTLY CONTRIBUTING TO THE ACCIDENT WHICH HAVE RESULTED IN RECOMMENDATIONS

1. Localised wastage and pitting of plating beneath bilge suctions is not uncommon, and it is good practice to keep bilges dry and to inspect these areas regularly to warn of any problems. [2.2.1]

2. Although the rate of leakage was not great, sea inlet valves, pumps and generators were underwater by the time the flood was discovered. Appropriate means of alerting the crew to flooding are required. [2.2.2]

3. Bilge alarms in engine rooms, and other substantial compartments that could threaten the vessel's buoyancy and stability if flooded, should be a mandatory requirement regardless of engine room manning. These, and other emergency alarms should be capable of operating when the vessel's normal power supplies are shut down and be able to wake sleeping crew in sufficient time for them to react appropriately. [2.4.1]

3.2 OTHER SAFETY ISSUES IDENTIFIED DURING THE INVESTIGATION ALSO LEADING TO RECOMMENDATIONS

1. A properly structured assessment of risks to crew sleeping on board a vessel that has been shut down overnight is required. This should include practical means of attracting the attention of sleeping crew to dangerous situations in time for them to take appropriate action. [2.3]

3.3 SAFETY ISSUES IDENTIFIED DURING THE INVESTIGATION WHICH HAVE NOT RESULTED IN RECOMMENDATIONS BUT HAVE BEEN ADDRESSED

1. The cause of the vessel flooding was water leaking into the engine room. It is considered most likely that this was due to perforation of the hull plating beneath the bilge suction pipework on the starboard side of the stern gland. [2.2.1]

2. In the absence of the general manager, the Port of Heysham's safety management and emergency response procedures had limited effectiveness. [2.5.1]

3. The limited communication between the port and the emergency services in the early stages of this accident led to confusion and, if circumstances had deteriorated, could have reduced the effectiveness of the response. [2.5.2]

SECTION 4 - ACTION TAKEN

Abigail H was declared a constructive total loss by its insurers, however it was subsequently returned to Wyre Marine Services, who intend to re-engine the vessel and return it to service.

4.1 WYRE MARINE SERVICES

Wyre Marine Services has:

- Fitted bilge alarms in the engine room and other significant compartments in *Abigail H* and the other three dredgers that they operate. These alarms operate from main and emergency power sources and are sufficient to alert sleeping crew and passers-by.
- Introduced fleet-wide procedures to conduct inspections of all compartments during periods when crew are asleep on board overnight.
- Changed operating practices so that spoil will not be kept in the hopper overnight.

4.2 PEEL PORTS GROUP

The Port of Heysham's parent company, Peel Ports Group, had already begun a process to share best practice and align the procedures used in its ports. In addition, it has appointed a Designated Person (DP) to provide independent assurance. His responsibilities will include determining the effectiveness of each port's safety management system and ensuring that they meet the requirements of the PMSC.

4.3 PORT OF HEYSHAM

Following internal review and audit of the safety management and emergency procedures, the Port of Heysham has:

- Included the risk of a vessel flooding while alongside in its risk register.
- Developed a policy to offer assistance to vessels in difficulty within the statutory harbour area and formally delegated to DPM the authority to initiate a range of pre-defined responses.
- Begun a series of training exercises and 'table top' planning sessions, supported by external training providers, to validate and rehearse emergency procedures.
- Renewed contacts with local agencies to review and define areas of responsibility in reacting to emergencies within the statutory harbour area.
- Included specific instructions in its emergency procedures for duty staff to inform and update the coastguard and the Group DP on incidents that occur within the statutory harbour area.

4.4 THE MARINE ACCIDENT INVESTIGATION BRANCH

In its report into the investigation of *Young Lady* dragging anchor 5 miles east of Teesport and snagging the CATS gas pipeline, resulting in material damage to the pipeline, on 30 January 2008, the MAIB made recommendation 2008/107 to the British Ports Association and UK Major Ports Group to:

> *Promulgate MAIB's advice to their members, for them to engage with their respective Rescue Coordination Centres, with the aim of reviewing and validating the criteria for reporting to the Coastguard details of accidents and incidents occurring in or near their jurisdictions.*

And recommendation 2008/108 to the Maritime and Coastguard Agency to:

> *Initiate a programme of negotiations between their RCCS and the Harbour Authorities and Vessel Traffic Service authorities in the RCC regions, with the aim of ensuring that comprehensive criteria exist for the notification and reporting of accidents and incidents occurring in their respective RCC areas.*

Both recommendations were accepted.

SECTION 5 - RECOMMENDATIONS

The **Maritime and Coastguard Agency** is recommended to:

2009/141 Introduce a mandatory requirement, for all vessels greater than 24m length and less than 500 gross tons, for the fitting of bilge alarms in engine rooms and other substantial compartments that could threaten the vessel's buoyancy and stability if flooded. These, and any other emergency alarms should sound in all accommodation spaces when the central control station is unmanned. In addition to functioning in the vessel's normal operational modes, alarms should be capable of operating when main power supplies are shut down, and be able to wake sleeping crew in sufficient time for them to react appropriately.

2009/142 Issue guidance, and through survey and inspection, check that owners conduct a properly structured assessment of risks to crew sleeping on board all vessels less than 500 gross tons that are moored alongside and have been shut down overnight. Where such risks are identified, check that appropriate procedures are in place to mitigate them.

Wyre Marine Services is recommended to:

2009/143 Improve existing procedures to keep the level of oily waste in the bilges of their vessels to a minimum and introduce routine inspections of pipework and internal surfaces of hull plating to identify vulnerable areas and give the maximum warning of potential failures.

In view of the actions already taken by **Peel Ports Group** and the **Port of Heysham**, no further recommendations have been made.

Marine Accident Investigation Branch
July 2009

Annex A

MGN 322, Ship Survey Standards

Maritime and Coastguard Agency

MARINE GUIDANCE NOTE

MGN 322 (M+F)

Ship Survey Standards

Notice to all ship owners, managers, ship operators, masters, shipbuilders, ship repairers and classification societies.

This notice should be read in conjunction with MSN 1672

Summary

This notice effective from 1 July 2006 outlines the survey standards for hull construction, machinery, electrical and control systems to which vessels are expected to be built and maintained.

1 Introduction

1.1 The Maritime and Coastguard Agency (MCA) does not publish its own standards for hull, machinery, control or electrical installations, but in accordance with European Standards in Directive 94/57/EC and International Standards in SOLAS Ch. II-1, Part A-1, Reg. 3-1, recognises the rules of the United Kingdom (UK) authorised Classification Societies (See annex 1) as outlined in MSN 1672. Owners can chose any of these UK authorised Classification Societies in order to obtain the most cost effective survey regime for their vessels. If vessels are "classed" with one of these Classification Societies for the type of vessel and intended service the standards are deemed to have been met. Vessels which are not "classed" ("un-classed") must be constructed and maintained to equivalent standards.

1.2 The recognised standards are the authorised Classification Society rules. There can be no technical or commercial advantage for companies adopting a lesser standard. The appropriate regulations must be complied with whoever carries out the surveys.

1.3 The most effective method of ensuring consistency in applying the Classification Society rules is for vessels to be "classed", with Classification Society surveyors undertaking surveys.

2 Policy

2.1 This policy applies from 1 July 2006 to the following 'new-build' and 'new to the UK Shipping Register' vessel types which are required by International and National Legislation to be constructed and maintained to recognised standards:

- All Passenger vessels; Hull, Machinery, Electrical, and control systems.
- Cargo vessels of 500 GT and over: Hull, Machinery, Electrical, and control systems.
- Fishing vessels 24m Registered length and over: Hull, Machinery, Electrical, and control systems.

- All other commercial vessels 24m Registered length and over, up to 500 GT; Hull construction must be to recognised standards, machinery, electrical, and control systems shall comply as far as is reasonable and practical.

2.2 Owners of all 'new-build' and 'new to the UK Shipping Register' vessels will be required to arrange for surveys for statutory certificates to be carried out by an authorised Classification Society. In practice, this will mean that those UK vessels listed in paragraph 2.1 will have to be "classed'' and maintained within "Class". A vessel which fails to meet Classification Society standards will fail to meet the regulatory requirements and certificates will not be issued or will be cancelled as appropriate.

2.3 The MCA requires that any vessel not subject to full Classification Society survey shall be constructed to an equivalent "recognised standard". Owners, builders and managers of vessels of "non classed" vessels shall adopt authorised Classification Society standards for construction outfitting and maintenance whenever appropriate, or an equivalent standard acceptable to the MCA.

2.4 With "un-classed" vessels the MCA will require equivalent standards to be demonstrated. This will require submission of plans and full supporting calculations. Since this will not be a frequent occurrence, this may involve the use of other organisations to undertake work on behalf of the MCA. The customer (e.g. owner or builder) will be responsible for all costs associated with work undertaken to verify compliance with the relevant construction and outfitting standards.

2.5 The MCA will deal with exceptional cases where classification is not appropriate on a case by case basis. In order to ensure consistency such decisions will be made by an MCA review panel to ensure appropriate equivalent standards are applied.

2.6 Existing vessels which are "classed" will be required to be maintained to "Class" to ensure that these vessels maintain adequate standards. Those currently "un-classed" will continue to be surveyed, as at present, to an equivalent standard. Annex 3 contains details of the basic requirements for "un-classed" vessels, the precise requirements may vary from this list according to features of specific vessel types. Existing "un-classed" vessels shall comply with the survey requirements contained in annex 3 and wherever reasonable and practical with the other requirements. Classification Societies will notify the MCA of vessels which have been "de-classed" and any statutory certificates relating to approved standards of construction (See annex 2) will be deemed to be cancelled until such time as the vessel is "re-classed" by a UK authorised Classification Society.

2.7 Existing vessels which have been without MCA certification for more than five years will in general be treated as new vessels, as far as practicable. It will be necessary to confirm compliance with the applicable standards as set out in this MGN before these vessels can be re-certificated by the MCA.

More Information

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Classification Societies currently authorised by the UK

American Bureau of Shipping,
Bureau Veritas,
Det Norske Veritas,
Germanischer Lloyd,
Lloyds Register of Shipping,
Nippon Kaiji Kyokai,
Registro Italiano Navale.

Approval Standards for Electrical Installations

Institution of Electrical Engineers (IEE) for the Electrical and Electronic Equipment of Ships
International Electrotechnical Commission regulations

Relevant Certification

Passenger Ship Safety Certificate
Passenger Certificate
Cargo Ship Safety Construction Certificate
Cargo Ship Safety Certificate
International Fishing Vessel Certificate
International Load-line Certificate
International Oil Pollution Prevention Certificate
High Speed Craft Safety Certificate
Dynamically Supported Craft Safety Certificate
International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk
International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk;
International Certificate of Fitness for the Carriage of INF Cargo,
International Noxious Liquids and Solids Certificate of Fitness
Certificate of Safety for submersible craft and their supporting equipment
Certificate of Compliance for a Large Charter Yacht
Any other certification issued as an equivalent to the above

Typical example of basic details required for Un-Classed Vessels:

Vessels must be examined in accordance with one of the recognised standards listed in MSN 1672.

1. Plans covering the following items:

Hull:
Mid-ship sections showing longitudinal and transverse material
Profile and Decks
Shell Expansion
Oil tight and watertight bulkheads
Propeller(s) and brackets
Double bottom construction
Pillars and girders
Aft end construction
Engine Room construction
Engine and thrust seatings
Fore end construction
Hatch cover construction
Deckhouses and superstructures
Stern-frame
Rudder, stock and tiller
Equipment (Anchor and chain cables)
Loading Manuals
Ice strengthening (as applicable)
Welding
Hull penetration plans
Support structure for masts, derricks or cranes
Bilge keel details and weld details
Corrosion control and paint specifications
Note: The above plans are to indicate thicknesses and grades of materials
and the following additional supporting documents:
General Arrangement
Capacity plan
Lines plan or equivalent
Dry-docking plan

Machinery:
Plans for all important units; such as main and auxiliary engines, including gearing, couplings, blowers and superchargers.
Shafting and bearings
Boilers for main and auxiliary services, and any other boiler with pressure exceeding 3.4 bar, including super-heaters, economisers etc.
Steering machinery
Athwart-ships thrusters
All pumps connected to the above.
All heat exchangers connected with above.
Air compressors, receivers and other pressure vessels with pressure exceeding 6.8 bar.
Fire, ballast and bilge pumps
Valves (sea valves and any associated with pressure systems exceeding 6.8 bar.
Piping diagrams

Electrical:
Cable wiring diagrams including, ratings of electrical machines, transformers, batteries and rectifiers
Feeders on main and emergency switchboards
Insulation type, size and current loadings of cables
Make, type and rating of circuit breakers and fuses
Generator circuits, including protection devices, short circuit/overload, reverse current
Instrumentation and synchronising
Preference trips
Remote stops
Earth fault indication & protection
Schedule of equipment including for that located in hazardous areas; type, protection rating, temperature class, certifying authority, certificates
Electrical equipment, and electrical propelling machinery

2. Calculations:
Supporting calculations are required, which should at least include (as applicable):
Calculation of Equipment Number
Hull Girder still water bending moment and shear force as applicable
Calculation of mid-ship section modulus
Preliminary freeboard calculation
Propeller, and shafting, strength calculations
Machinery strength calculations
Systems analysis, including; stress, torsional ,axial, and lateral vibration, and shaft alignments

2.1. Hull:
Assessment Sheets showing; Scantling item, rule reference, rule calculation, as fitted arrangements, assessment against rule requirement.
To cover, for example, keel, bottom and side shell plating thickness at different depths, and longitudinal position, deck, floors, framing, bulkheads (plating and stiffening), machinery crankshaft, propulsion shafting etc.

2.2. Electrical calculations:
- Electrical Load
- Short circuit currents for main and emergency switchboards and section boards (including those fed from transformers)
- Circuit breaker and fuse operating times and discrimination curves

3 Survey of non-classed vessels
Surveys equivalent to Class requirements will be required annually, and are to achieve an examination equivalent to a complete Class Special Survey at a maximum interval of 5 years. This 5 year cycle should include at least the following items;.

3.1. Structural Scantlings (New-build or new to flag): Owner/consultant should carry out thorough thickness checks of hull, deck, superstructures, frames and bulkheads. Detailed structural drawings should be available to MCA. **If not available**, owners will need to produce quality drawings (using consultants as necessary). On the basis of these drawings calculations should be made, preferably in tabular form, listing; item, rule reference, calculation (with maximum spans etc and location specified), required sizes, and in last column the actual scantlings. (Note; to be clear if actual is from original drawings, or “as measured” minimums).

3.2. An out of water survey for all vessels is required in accordance with relevant Class Rules to confirm reported thicknesses are correct. Check worst expected areas for corrosion etc. Specific areas to be targeted include those with difficult access i.e: behind linings and tanks, under engines, bilge areas, bulkheads in way of bilges, pipes, fittings etc where moisture may accumulate. Internal examination of integral water, fuel or ballast tanks.

Areas with cement coverings require sections of cement to be removed to surveyors satisfaction to examine plating, frames and connections (complete removal may not be required if sufficient samples found satisfactory). Thickness checks will be required in accordance with Class Rules.

3.3. Annual and mid-term (Intermediate) surveys for all vessels shall also be in accordance with Class Rules.

3.4. Survey of engine room piping, by combination of; thickness checks, hammer testing, removal of samples, pressure testing etc.

3.5. Deck, superstructure and all weather-tight closing appliances as normally expected for survey. Freeing port areas to comply with rules. Wheelhouse & deckhouse windows to be toughened safety glass, samples be checked, (if marked to BSMA 25 or if necessary by sample destructive testing).

3.6. Machinery: Complete survey of machinery, including opening up of units, pistons, linings, bearings top and bottom ends, timing gears, reduction gears. Removal of shaft, propeller, checking for wear (clearances to be recorded), corrosion and cracks in usual places, cone, threaded parts, keyways, bearing surfaces, flange radius etc. Also similar for essential auxiliary services (generators, air receivers etc if applicable). Opening up of all pumps and sea valves.

3.7. Rudder, bearings (clearances to be recorded), couplings, tiller and steering gear arrangements to be examined.

3.8. Full electrical survey in accordance with Class rules including: visual checks, insulation, securing etc. Carry out insulation and continuity checks (e.g. megger readings).
Emergency source of power and associated circuits to be tested
Fittings on main and emergency switchboards, section boards, and sub-distribution fuse boards to be examined and over-current protective devices and fuses inspected Generator circuit breakers to be tested to verify correct operation of protective devices, wherever practicable.
Generator prime movers to be surveyed and governors tested. Motors, switch, and control gear for essential services (including steering gear) to be examined and where practicable operated under working conditions.
Where appropriate Insulating oil test samples to be analysed.
Control Engineering installations; including; alarms, shut downs, safety systems etc.

3.9. All other items of equipment to be thoroughly examined and tested as appropriate.

3.10. A minimum of two bottom inspections are to be held in dry-dock or on a slipway in each five-year Survey period and the maximum interval between successive bottom inspections is not to exceed 36 months. In the case of passenger vessels annual bottom inspections are required unless alternative arrangements (See MGN 217) have been agreed.

3.11. Continuous survey arrangements may also be accepted which tie in with the planned maintenance systems of the vessel.

4. Previously Classed Vessels

Where vessels transfer from one Classification Society to another or in exceptional circumstances where a vessel is permitted to transfer surveys to MCA the requirements of Annex 13 to FSI 13/23; “Guidelines for administrations to apply to ensure adequacy of transfer of class related matters between recognized organizations” shall be applied. These were approved by IMO at MSC 80.

5. Certification

Vessels which fail to meet the recognised standards will not be issued with certificates, and certification in force will be deemed to be invalid.