Final report MO-2012-203: Fire on board *Amaltal Columbia*
12 September 2012

The Transport Accident Investigation Commission is an independent Crown entity established to determine the circumstances and causes of accidents and incidents with a view to avoiding similar occurrences in the future. Accordingly it is inappropriate that reports should be used to assign fault or blame or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

The Commission may make recommendations to improve transport safety. The cost of implementing any recommendation must always be balanced against its benefits. Such analysis is a matter for the regulator and the industry.

Final Report

Marine inquiry MO-2012-203
Fire on board *Amaltal Columbia*
12 September 2012

Approved for publication: February 2017

Transport Accident Investigation Commission

About the Transport Accident Investigation Commission

The Transport Accident Investigation Commission (Commission) is a standing commission of inquiry and an independent Crown entity responsible for inquiring into maritime, aviation and rail accidents and incidents for New Zealand, and co-ordinating and co-operating with other accident investigation organisations overseas. The principal purpose of its inquiries is to determine the circumstances and causes of occurrences with a view to avoiding similar occurrences in the future. Its purpose is not to ascribe blame to any person or agency or to pursue (or to assist an agency to pursue) criminal, civil or regulatory action against a person or agency. The Commission carries out its purpose by informing members of the transport sector and the public, both domestically and internationally, of the lessons that can be learnt from transport accidents and incidents.

Commissioners

Chief Commissioner	Jane Meares
Deputy Chief Commissioner	Peter McKenzie, QC
Commissioner	Stephen Davies Howard
Commissioner	Richard Marchant

Key Commission personnel

Chief Executive	Lois Hutchinson
Chief Investigator of Accidents	Captain Tim Burfoot
Investigator in Charge	Robert Thompson
General Counsel	Cathryn Bridge

Email	inquiries@taic.org.nz
Web	www.taic.org.nz
Telephone	+ 64 4 473 3112 (24 hrs) or 0800 188 926
Fax	+ 64 4 499 1510
Address	Level 11, 114 The Terrace, PO Box 10 323, Wellington 6143, New Zealand

Important notes

Nature of the final report

This final report has not been prepared for the purpose of supporting any criminal, civil or regulatory action against any person or agency. The Transport Accident Investigation Commission Act 1990 makes this final report inadmissible as evidence in any proceedings with the exception of a Coroner's inquest.

Ownership of report

Citations and referencing

Information derived from interviews during the Commission's inquiry into the occurrence is not cited in this final report. Documents that would normally be accessible to industry participants only and not discoverable under the Official Information Act 1982 have been referenced as footnotes only. Other documents referred to during the Commission's inquiry that are publicly available are cited.

Photographs, diagrams, pictures

Unless otherwise specified, photographs, diagrams and pictures included in this final report are provided by, and owned by, the Commission.

Verbal probability expressions

The expressions listed in the following table are used in this report to describe the degree of probability (or likelihood) that an event happened or a condition existed in support of a hypothesis.

Terminology (adopted from the Intergovernmental Panel on Climate Change)	Likelihood of the occurrence/outcome	Equivalent terms
Virtually certain	> 99% probability of occurrence	Almost certain
Very likely	> 90% probability	Highly likely, very probable
Likely	> 66% probability	Probable
About as likely as not	33% to 66% probability	More or less likely
Unlikely	< 33% probability	Improbable
Very unlikely	< 10% probability	Highly unlikely
Exceptionally unlikely	< 1% probability	

The *Amaltal Columbia* (image supplied by Talley's Group Limited)

Source: mapsof.net

Location of accident

Contents

Abbreviations ii
Glossary ii
Data summary iii
1. Executive summary 1
2. Conduct of the inquiry 2
3. Factual information 3
3.1. Narrative 3
3.2. Firefighting and fire detection appliances aboard *Amaltal Columbia* 6
3.3. Maritime Rule Part 40D Design, Construction, and Equipment – Fishing ships 6
4. Analysis 7
4.1. Introduction 7
4.2. The fire 7
Potential sources of ignition that were discounted: 8
Potential sources of ignition that could not be discounted: 8
4.3. Crew response 10
4.4. Detecting the fire 10
4.5. Containing the fire 11
4.6. Fuelling the fire 13
4.7. Risk 13
5. Findings 15
6. Safety actions 16
General 16
Safety actions addressing safety issues identified during an inquiry 16
Safety actions addressing other safety issues 16
7. Recommendations 17
General 17
Recommendations 17
8. Key lessons 18

Figures

Figure 1 General Arrangement of the *Amaltal Columbia* 4
Figure 2 Fishmeal bagging room of *Amaltal Columbia*'s sister vessel 7
Figure 3 Photo showing fishmeal bagging room of *Amaltal Columbia*, taken from approximately same position as Figure 2 8
Figure 4 Ventilator opening with ventilator damper in open position 12
Figure 5 Ventilator opening with strut hanging down obstructing the damper from closing 12
Figure 6 Photo taken within fish processing factory deck 13

Abbreviations

CO_2	carbon dioxide
SCBA	self-contained breathing apparatus

Glossary

bulkhead	a dividing wall between compartments on a ship
self-contained breathing apparatus	a breathing device worn by firefighters that provides breathable air in an atmosphere dangerous to health
grandfathering	a provision in which an old rule continues to apply to an existing vessel while a new rule will apply to all future vessels. Those exempt from the new rule are said to have grandfather rights

Data summary

Vehicle particulars

Name:	*Amaltal Columbia*
Type:	fishing factory freezer trawler
Class:	Lloyd's Register
Limits:	unlimited
Classification:	stern trawler, ice class 1D, +100A1, LMC (Lloyd's Machinery Certificate), UMS (Unmanned Machinery Space)
Length:	64 metres
Breadth:	13 metres
Gross tonnage:	1,899 tonnes
Built:	1991
Propulsion:	2,460 kilowatts driving single propeller
Service speed:	12.5 knots
Owner/operator:	Talley's Group Limited
Port of registry:	Nelson
Minimum crew:	10

Date and time	12 September 2012 at about 0500[1]
Location	43° 13.8S 173° 46.1E
Persons involved	41 crew members
Injuries	two crew suffered minor smoke inhalation
Damage	extensive heat and smoke damage to the fish processing factory deck, and extensive smoke damage to the accommodation areas of the vessel

[1] Times in this report are in New Zealand Daylight Time (Universal Co-ordinated Time + 13 hours) and are expressed in the 24-hour mode.

1. Executive summary

1.1. In the early hours of 12 September 2012, the fishing factory trawler *Amaltal Columbia* was fishing off the Canterbury coast when fire broke out in the fishmeal bagging room on the fish processing deck.

1.2. The master made a Mayday call, and two nearby fishing vessels were requested to stand by the *Amaltal Columbia* to assist.

1.3. Despite the fire-fighting efforts of the crew, it was necessary for them to abandon ship. The entire crew were transferred to the assisting vessels, one of which took the *Amaltal Columbia* under tow to the port of Lyttelton.

1.4. The New Zealand Fire Service met the vessel on arrival and subsequently declared the fire 'out'. Nobody was seriously injured but the vessel was extensively damaged.

1.5. The Commission found that the fire was seated amongst bales of polypropylene bags that were stored in the fishmeal bagging room, but was unable to establish with any certainty what started the fire.

1.6. The Commission also found that the *Amaltal Columbia*'s design and systems for the prevention, detection, containment and fighting of a fire met the standards of the applicable maritime rules; however, there were some aspects that could have been improved, and the consequences of the fire could have been lessened, with a more risk-based approach to operations.

1.7. Key lessons arising from this accident included:

- the early detection of fires is critical to preventing their taking hold and spreading
- older-style fluorescent light fittings are more prone to failure and likely to start a fire than more modern fittings. Operators of older ships should consider the risk of not replacing such lights with more modern and safer lights
- arrangements that are designed to close off a space and contain a fire need to be quick, easy and intuitive to use, taking account of the conditions the crew are likely to encounter in a real fire
- the use of fire-retardant materials in the construction and fit-out of spaces on board ships will help to prevent the ignition and spreading of fires.

2. Conduct of the inquiry

2.1. At about 0700 on 12 September 2012 the Transport Accident Investigation Commission (Commission) was notified by the Rescue Coordination Centre New Zealand that a fire had occurred on board the fishing vessel *Amaltal Columbia* approximately 85 kilometres north-east of Lyttelton.

2.2. The Commission opened an inquiry under section 13(1)b of the Transport Accident Investigation Commission Act 1990 and appointed an investigator in charge.

2.3. On 13 September 2012 two investigators travelled to Lyttelton to conduct a site investigation on board the vessel, collect evidence and conduct interviews of the crew.

2.4. The investigation of the scene of the fire was conducted jointly by representatives from the Commission, the New Zealand Fire Service and the vessel's insurance company. The Commission referenced the Fire Service investigation report while preparing this report. Fire-damaged electronic items were uplifted and subsequently examined by the New Zealand Police E-Crime Laboratory as potential sources of the fire.

2.5. On 20 September two investigators travelled to Nelson to conduct further interviews of some of the *Amaltal Columbia*'s crew and members of the *Amaltal Columbia*'s shore management.

2.6. The Maritime Operations Centre keeps a 24-hour watch on all the stations in the radio network. The operators respond to distress calls, handle trip reports and broadcast safety information. The Maritime Operations Centre's log of events was obtained and used to collate a timeline of events.

2.7. On 2 November 2016 the Commission approved the draft final report to be circulated to interested persons for comment. Four submissions were received and any changes resulting from those submissions have been reflected in this final report.

2.8. On 22 February 2017 the Commission approved the final report for publication.

3. Factual information

3.1. Narrative

3.1.1. The *Amaltal Columbia* is a deep-sea factory trawler[2] built in 1991. It was purchased new and operated by Talley's Group Limited from its home port of Nelson.

3.1.2. In the early morning of 19 August 2012 the *Amaltal Columbia* departed from Nelson to fish waters to the east of New Zealand. Fishing commenced on the night of 19 August. Fishing continued for the next three weeks without incident.

3.1.3. At about 0230 on 12 September, the crew shot the net[3] and began trawling. The swell was about four metres and the wind strength about 45 knots (about 83 kilometres per hour).

3.1.4. The *Amaltal Columbia* was equipped with a fishmeal plant, which rendered fish processing waste into dry fishmeal powder. Fishmeal is a by-product of fish processing. The waste (fish heads etc) from the fish processing factory is dried and ground into powder.

3.1.5. The actual rendering machine was located aft of and below the fish processing factory (see Figures 1). The dried fishmeal was fan-blown in powder form through ducting from the rendering machine to the bagging room, which was a purpose-built room on the same level as and forward of the fish processing factory, sectioned off by a steel-framed plywood bulkhead.

3.1.6. The fishmeal plant and the fishmeal bagging room were operated by one crew member (the fishmeal plant operator). The fishmeal plant operator was working in a different part of the vessel when at about 0445 he went to prepare and start the fishmeal plant (shown in Figure 1). Starting the fishmeal plant also started the transfer fan in the bagging room. He had not been to the bagging room before the time the fire was discovered.

3.1.7. At about 0500 the second mate was making his way forward through the factory deck (see Figure 1). Workers on the fish processing packing line told him they could smell smoke. He continued forward and noticed smoke coming out of the open door of the fishmeal bagging room. The smoke increased in intensity as he got closer.

3.1.8. The second mate immediately returned to the fish processing packing line and notified the crew working there that there was a fire in the fishmeal bagging room. There was a fire hose located close to the fishmeal bagging room door. Two of the crew connected the hose to a hydrant, charged it and began to fight the fire.

3.1.9. The second mate notified the watchkeeper on the bridge of the fire. The watchkeeper had already been alerted to the fire by the automatic fire detection alarm panel on the bridge, which had activated the vessel's fire alarm system. By the time the second mate had finished talking to the watchkeeper on the bridge, the thick, black smoke billowing out of the bagging room door had filled the room down to knee level.

3.1.10. The two crew attempted to fight the fire while the second mate withdrew and proceeded to the emergency muster station on the deck aft of the bridge.

[2] A factory trawler is a fishing vessel that has an on-board fish processing plant.
[3] Deploying the trawl net from the vessel to begin trawling is known as 'shooting' the net.

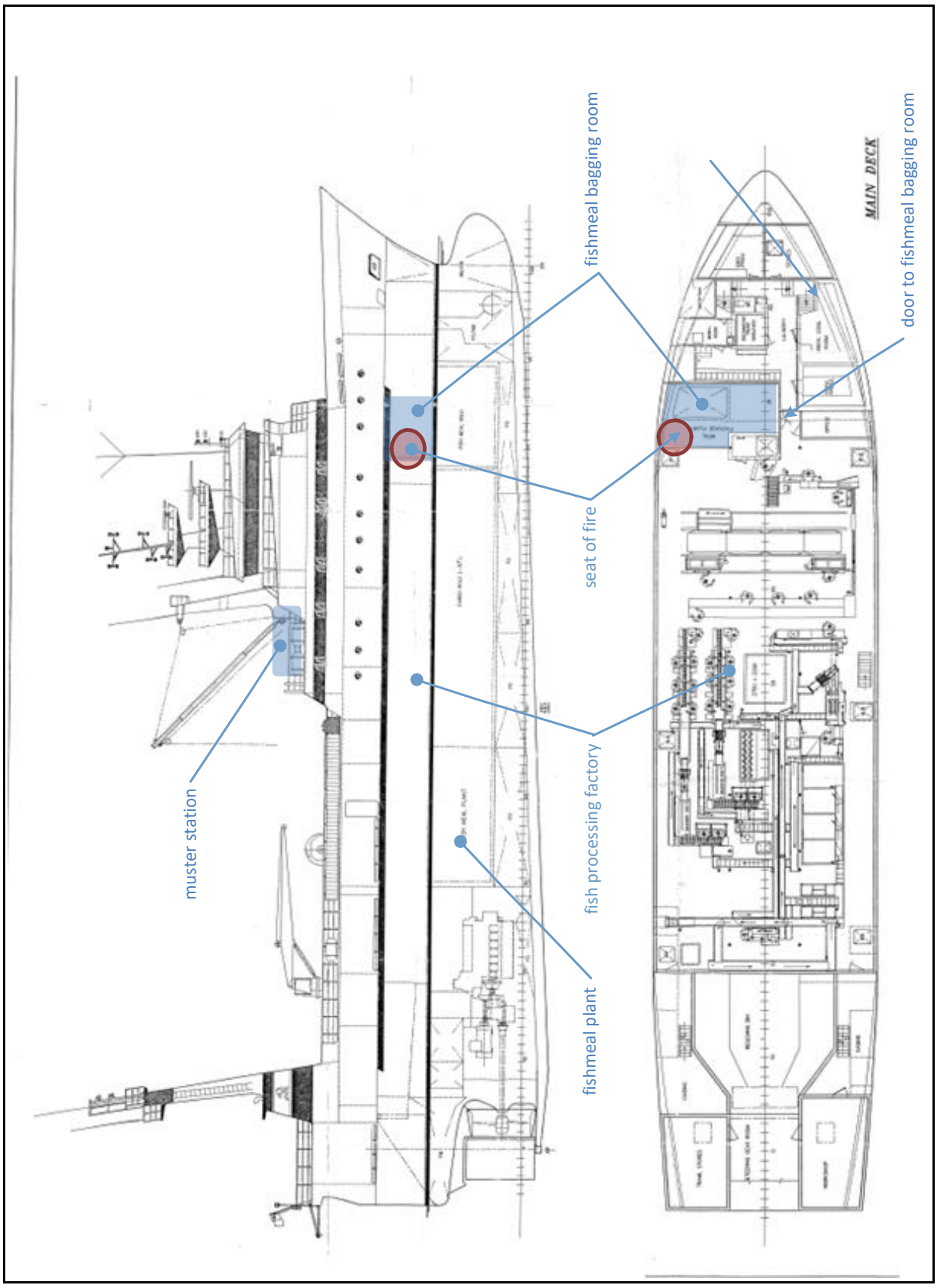

Figure 1
General arrangement of the *Amaltal Columbia*

3.1.11. The master proceeded to the bridge. Once on the bridge the master realised that a SCBA (self-contained breathing apparatus[4]) team would be required to fight the fire. A two-man SCBA team was identified and briefed by the master. They prepared to fight the fire with two handheld carbon dioxide (CO_2) extinguishers. A hose party was deployed to boundary-cool the area surrounding the fire.

3.1.12. The chief engineer and two other crew members manned the engine room. The remainder of the crew mustered at the emergency muster station behind the wheelhouse.

3.1.13. At about 0519, shortly after the master had arrived on the bridge, he transmitted a Pan-Pan[5] urgency message on the very-high-frequency radio, channel 16. The Pan-Pan message was acknowledged by Kaikoura Radio[6]. About five minutes later the fire was growing more intense, so the master transmitted a Mayday[7] signal. The Mayday signal was acknowledged by Kaikoura Radio, which broadcast a Mayday relay. The crew began preparations to abandon ship.

3.1.14. At about 0610 two other fishing vessels in the area, the *San Discovery* and the *Ivan Goublets*, were requested by the Maritime Operations Centre to assist the *Amaltal Columbia*.

3.1.15. Meanwhile, the SCBA team returned to the wheelhouse after they had discharged the two CO_2 fire extinguishers into the fishmeal bagging room. Visibility was very poor on the factory deck due to the thick smoke. They attempted to contain the fire by closing the fishmeal bagging room door, but were unable to close it fully.

3.1.16. They collected another two fire extinguishers, one CO_2 and one dry powder, returned to the factory deck and discharged both extinguishers into the fishmeal bagging room. They then withdrew from the factory deck, exchanged their SCBA air tanks and returned to fight the fire with a fire hose.

3.1.17. Fire-fighting ceased when the SCBA team had used all but one of the air tanks. The firefighters joined the rest of crew at the muster station and prepared to abandon ship.

3.1.18. By 0800 the fire had damaged propulsion and steering control system lines between the wheelhouse and the engine room. As a result the *Amaltal Columbia*'s speed reduced and it would not respond to the helm. The vessel had lost the ability to manoeuvre.

3.1.19. Although it appeared that the fire had died down and the smoke was significantly less, the master ordered the crew to abandon ship. The rescue boat was launched and shortly afterwards the first of three life rafts was towed by the rescue boat towards the *Ivan Goublets*. All the crew were transferred from the *Amaltal Columbia* except for the master and chief engineer.

3.1.20. At about 1013 the master and chief engineer transferred to the *San Discovery*, where they planned further emergency response and vessel recovery operations.

3.1.21. Once all the crew were safe, and all arrangements were in place to take the vessel under tow, the mayday was cancelled at 1035. The fire had not been confirmed as extinguished at that time. The master and four crew subsequently returned to the *Amaltal Columbia* to begin preparations for taking the vessel under tow.

3.1.22. The *Amaltal Columbia* was taken under tow during the afternoon of 12 September 2012, and berthed at Lyttelton Port at about 0100 on 13 September 2012.

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[4] A self-contained breathing apparatus is a breathing device worn by firefighters that provides breathable air in an atmosphere dangerous to health.
[5] The radio telephone urgency signal 'Pan-Pan' is used to indicate that a vessel has a very urgent message to transmit about its safety (for example, fire on board).
[6] Kaikoura Radio is operated by the Maritime Operations Centre.
[7] The radio telephone urgency signal 'Mayday' is used to indicate that a vessel faces a grave and imminent threat and requires immediate assistance.

3.1.23. The Fire Service attended the vessel on its arrival at Lyttelton Port and at about 1200 on 14 September determined that the fire had been extinguished.

3.2. Firefighting and fire-detection appliances aboard the *Amaltal Columbia*

3.2.1. The *Amaltal Columbia* had an automatic fire detection and fire alarm system. On the factory deck there were one smoke detector and two manual call points in the vicinity of the fish processing plant. There were another six smoke detectors located in other compartments on the factory deck. There was no fire detector inside the fishmeal bagging room, although there was one outside adjacent to the door.

3.2.2. Portable extinguishers were positioned at various locations throughout the vessel and included ABE dry powder[8], CO_2 and water. There were also fire hydrants and hoses positioned at various locations throughout the vessel. A fixed Halon firefighting system was installed in the engine room and ammonia room, and a CO_2 flood system was installed in the auxiliary engine room. There was no fixed firefighting system on the fish processing deck or in the bagging room.

3.2.3. There were six SCBA sets on board and nine spare 1,800-litre SCBA cylinders. Two complete sets of firefighting clothing were available for the SCBA team to use.

3.2.4. The firefighting appliances on board were in-date and had been serviced and tested regularly by an independent organisation. The appliances used to fight the fire functioned correctly.

3.3. Maritime Rules Part 40D Design, Construction and Equipment – Fishing Ships

3.3.1. The *Amaltal Columbia* had been brought into the Lloyd's Register safe ship management system in November 1997, at which time it was classed as Lloyd's Register Class +100A1[9]. Although the vessel had been built to the Lloyd's Register's Rules and Regulations, it was also subject to the New Zealand Maritime Rules.

3.3.2. Maritime Rules Part 40D prescribed the requirements for the design, construction and equipment of New Zealand fishing ships registered under the Fisheries Acts of 1983 and 1996.

3.3.3. Maritime Rules Part 40D covered the *Amaltal Columbia*'s fire protection. The rule had come into force in February 2000 but the *Amaltal Columbia* had been built in 1991. In accordance with Part 40D.7 the *Amaltal Columbia* had been approved as compliant via a survey that found it fit for its intended service.

3.3.4. Classification societies[10] require that vessels' machinery and hulls, built under their rules, be surveyed every five years. It can be an onerous workload to survey all items on a vessel during a single inspection at five-yearly intervals. Another approach is to distribute surveys of items over several years, such that all individual items are surveyed on a five-yearly cycle, but not necessarily at the same time (called a continuous survey). The *Amaltal Columbia* was subjected to a continuous survey for both machinery and hull.

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[8] An ABE type dry powder fire extinguisher is a general-purpose fire extinguisher.
[9] LR +100A1 UMS (Unmanned Machinery Space) means it was built under special survey, out of steel to Lloyd's Register's Rules and Regulations, with on-board mooring and anchoring equipment. UMS means the control engineering equipment has been arranged and installed to allow the vessel to be operated with the machinery space unattended.
[10] A classification society establishes and maintains technical standards for the construction and operation of marine vessels and offshore structures.

4. Analysis

4.1. Introduction

4.1.1. A fire of this magnitude on board a vessel has the potential for loss of life, serious injury and significant damage to the vessel.

4.1.2. Ship systems and procedures must deal with the prevention, detection, containment and fighting of a fire, without the aid of external emergency services. Early detection and action are paramount. In this case the shipboard response to the fire followed standard procedures and was well conducted by the crew.

4.1.3. The Commission has not been able to determine conclusively the cause of the fire. However, several safety issues have been identified that either did hamper or could have hampered the detection of and response to the fire:

- the location of fire detector sensors
- the flammability of some materials used on the fish processing deck
- the design of the closures on the ventilation grilles around the fish processing deck.

4.1.4. The following sections discuss the potential sources of ignition for the fire and each of these safety issues.

4.2. The fire

4.2.1. The seat of the fire was in the fishmeal bagging room located at the forward port side of the fish processing factory (shown in Figure 1). The fishmeal bagging room of the *Amaltal Columbia*'s sister vessel is nearly identical in layout and content. A photograph of it is reproduced in Figure 2.

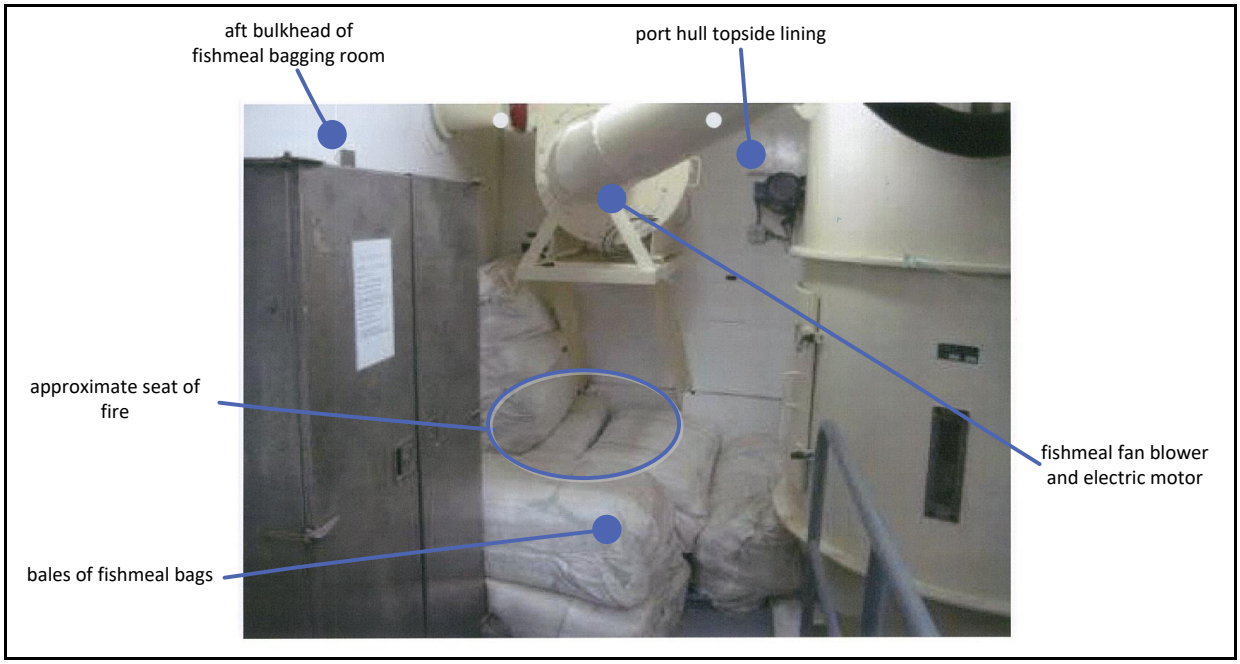

Figure 2
Fishmeal bagging room of the *Amaltal Columbia*'s sister vessel

4.2.2. The seat of the fire was identified by accounts from the crew who first saw the fire, and the pattern of the burn damage assessed during the scene examination.

Figure 3
The fishmeal bagging room of the *Amaltal Columbia*, from approximately the same position as Figure 2

4.2.3. There were six potential sources of ignition identified; three were discounted as causal and the remaining three were inconclusive.

Potential sources of ignition that were discounted

4.2.4. A fan powered by an electric motor was used to move fishmeal from the processing plant to the bagging room. It would have been possible for the electric motor to overheat and catch fire, and for burning debris to fall onto the bales of empty polypropylene fishmeal bags stored below. However, the interior of the electric motor was undamaged; the damage to the electric motor was to its exterior as a result of the fire. The Commission determined that the electric motor for the fishmeal fan was not the source of ignition.

4.2.5. Two luggage bags were stored on top of the bales of fishmeal bags. One bag contained clothing. The other bag contained a laptop computer. Although the battery of the laptop computer could have been a potential source of ignition, the laptop was neither plugged in nor being charged. An examination of the laptop showed that the battery and other internal parts of the computer had not failed. The only damage it had suffered was external damage caused by the fire. The Commission determined that the laptop was not the source of ignition.

4.2.6. It is known that fishmeal stored in bulk can spontaneously combust from the heat generated by oxidation of the fishmeal. However, full bags of fishmeal were not stored in the bagging room. The only fishmeal present in the bagging room would have been any residue within the bagging plant or small amounts on the deck. The Commission determined that spontaneous combustion of fishmeal was not a source of ignition.

Potential sources of ignition that could not be discounted

Fluorescent lights (safety issue)

4.2.7. The bagging room was lit by fluorescent lights. Fluorescent light fittings rely on an internal component called ‘ballast’, which protects the lights from variations in electrical voltage. The ballast in some fluorescent light fittings manufactured before 2000 was made of pitch. Such light fittings have been known to malfunction and overheat. Overheating can cause the pitch to liquefy and ignite, which in turn may result in burning pitch falling onto whatever is below

the light fitting[11]. The *Amaltal Columbia* had been built in 1991 and the fluorescent light fittings installed then.

4.2.8. The bales of polypropylene bags used for the fishmeal were stored under the fluorescent light fitting. Polypropylene is a highly flammable material and would have provided a good source of fuel for the fire. It also burns with a thick, black, acrid smoke, similar to what was observed on the fish processing deck in the early stages of the fire.

4.2.9. The ballast in fluorescent lights is known to fail for a number of reasons, including: leaving burned-out tubes in the fitting; using the wrong-sized tubes; incorrect wiring; incorrect line voltage; operation at temperatures below or above the rated limits; power surges; and age.

4.2.10. There was no conclusive evidence that the fluorescent light fitting was the source of ignition because the light fitting was totally consumed by the fire. However, for the reasons given above the possibility could not be ruled out.

4.2.11. Modern fluorescent light fittings use a different type of ballast. However, there has never been a requirement to replace the older type on existing ships.

4.2.12. Safety management systems (and more recently MOSS [Maritime Operator Safety System]) require ship owners to take a risk-based approach to their ship operations. The risk to any vessel that is still fitted with these older-style fluorescent light fittings could be high. Therefore ship owners should consider checking and/or replacing them on a voluntary basis, as they represent a safety issue for any ship where they are fitted.

Electrical extension lead (safety issue)

4.2.13. An electrical extension lead had been run from a power outlet in the fish processing factory, along behind a locker and then through a redundant pipe duct in the steel-framed wooden bulkhead that formed the fishmeal bagging room. The extension lead had been permanently rigged to supply power to a knife sharpener inside the bagging room.

4.2.14. Electrical cables on ships are normally run in conduits or secured to cable tracks to prevent the vibration associated with operating ships at sea damaging the insulation. The extension lead did not comply with industry best practice. It was not secured along its length and was free to abrade against the bulkhead or where it passed through the pipe duct.

4.2.15. Under Maritime Rules 40D.30 and 32, changes to the electrical system were subject to plan approval, class surveys and inspection. The system was also subject to routine planned maintenance. However, because of the ad-hoc nature of fitting the extension lead there was no record of it in the planned maintenance system. The presence of the cable was not immediately obvious, so it is possible that its condition had not been checked since fitting.

4.2.16. Using an electrical extension lead on board a vessel is not necessarily unsafe, as long as it is fit for purpose and fitted to industry best practice and its condition is regularly examined as part of a planned maintenance routine.

4.2.17. Worn insulation can result in an earth-fault or short-circuiting and consequent arcing or a build-up of heat. Any build-up of heat can cause ignition if a suitable source of combustible material is present, such as residual fishmeal or polypropylene bags. However, the most likely location for abrasion to insulation to occur was not in the immediate vicinity of combustible material, and no equipment was plugged in to the extension lead at the time. Therefore, the Commission concluded, it was very unlikely that the power lead was the ignition source for the fire, but the possibility could not be excluded.

[11] Case Studies: PCBs/Ballast Burnout in Schools, Crandall, Elliott, and Votaw, Applied Occupational and Environmental Hygiene Vol. 5, Iss. 9, 1990.

The fishmeal fan unit

4.2.18. The fishmeal fan was fitted with drive belts to transfer torque from the electric motor to the fan. The electric motor, the drive belts and the fan were enclosed within the fan-blower casing. If the fan seized or was prevented from turning for any reason, the electric motor would be driving the rubberised fan belts around a stationary pulley. Slipping drive belts can cause significant heat, sufficient to begin a fire if combustible material is present. There was evidence of charred remains within the fan casing, but it could not be established whether they were the cause or a result of the fire.

4.2.19. The Fire Service report found this potential source of ignition to be the "most probable cause" but still concluded that the cause of the fire was "unknown". The Commission concluded that there was insufficient evidence to determine whether the fan unit was the ignition source for the fire, but that it could not be excluded.

Findings

1. The seat of the fire was located within bales of empty polypropylene bags stored in the fishmeal bagging room on the fish processing deck.
2. The Commission was not able to establish conclusively the source of ignition for the fire. However, it was about as likely as not to have been either the failure of a fluorescent light fitting or a failure within a fan unit, both of which were located above the seat of the fire.

4.3. Crew response

4.3.1. The crew performed a fire drill once per trip. When interviewed the crew were aware of their responsibilities should a fire occur. When they discovered the fire the crew responded quickly and their actions were in accordance with the instructions contained in the Safe Ship Management Manual.

4.3.2. First responders began fighting the fire with appliances immediately to hand. One crew member notified the bridge and officer of the watch of the situation, and the remainder of the crew began mustering.

4.3.3. The Commission did not identify any safety issues arising from the actions of the crew. The crew responded with decisive command and control of the situation.

4.4. Detecting the fire

4.4.1. The location of fire detectors in the fish processing factory was not prescribed under Maritime Rules Part 40D. The vessel was designed with the fishmeal bagging room separated from the fish factory by a plywood bulkhead, and hence it could be totally enclosed. It was not required by the Maritime Rules to be treated as a separate compartment with respect to the fire plan. There was a fire detector located outside the compartment and another above the fish processing plant, but none had been fitted inside the bagging room.

4.4.2. How the fire started, and how much time elapsed before the crew noticed smoke, were not determined. When the crew noticed smoke the fire had taken hold and spread quickly. The early detection of fires is critical for preventing their spreading and thereby minimising the damage caused. Had a fire detector been fitted in the fishmeal bagging room it would have alerted the crew earlier and may have improved their chances of successfully extinguishing the fire before it spread to the rest of the fish processing deck.

4.4.3. The arrangement was compliant with Maritime Rules. However, fire protection rules are a minimum standard and do not exclude a vessel's managers and crew from making their own assessments of the risks and exceeding the minimum requirements in the interests of safety.

4.5. Containing the fire

4.5.1. A critical aspect of firefighting is starving the fire of oxygen. This is achieved by closing off all openings through which air can enter a space. In this case there were 32 ventilation ducts that allowed air to be supplied to the various compartments in the vessel. Three of these supplied air to the fish processing deck. Each ventilation duct had a hinged flap that could be closed to shut off the flow of air. The flap was normally propped open by a strut, which was attached to the inside of the flap. When the strut was dislodged it would naturally hang down and prevent the flap being fully closed. In order to close and secure the flap fully, the free end of the strut had to be folded up behind the flap.

4.5.2. Figure 4 shows the ventilator flap in its fully open position. The ventilator flap is hinged at the top and gravity allows it to swing shut, provided the strut is folded up behind the flap as it swings down.

4.5.3. The operation and inspection of the ventilator flaps were included in the planned maintenance system and the flaps were regularly checked by the crew. They were also operated during planned fire drills.

4.5.4. During the post-fire examination the flaps were able to be closed and secured as designed, and the master said they had been closed during the firefighting effort. However, during the fire the crew found it difficult to close the flaps when unable to see the mechanism through the dense smoke, and were hindered further by the intense heat and their manoeuvrability being hampered by the firefighting suits and breathing apparatus.

4.5.5. Fighting fires on board a ship is a time of high stress for the crew, who are working under difficult conditions, as this case demonstrates. For this reason mechanisms for shutting down ventilators in the event of fire should be quick, easy and intuitive to operate. The design of the ones on board the *Amaltal Columbia* did not meet these criteria.

4.5.6. The vessel had been built before the current Maritime Rules Part 40D came into force in 2000, and the rule applied to new-builds and vessels undergoing major refit, neither of which applied to the *Amaltal Columbia*.

4.5.7. When the vessel was allowed to be 'grandfathered'[12] into the safe ship management system, compliance with Maritime Rules 40D was accepted.

4.5.8. Regardless of whether the fire flaps were compliant with the Maritime Rules or not, from a risk perspective the owner should have considered altering the design of the flaps to make them quick, easy and intuitive to use.

4.5.9. Owing to the damage caused by the fire, it could not be established why the crew were unable to close the door to the fishmeal bagging room when fighting the fire. Fully closing the door would have helped to prevent the spread of fire.

[12] 'Grandfathering' is a provision in which an old rule continues to apply to an existing vessel while a new rule will apply to all future vessels. Those exempt from the new rule are said to have grandfather rights.

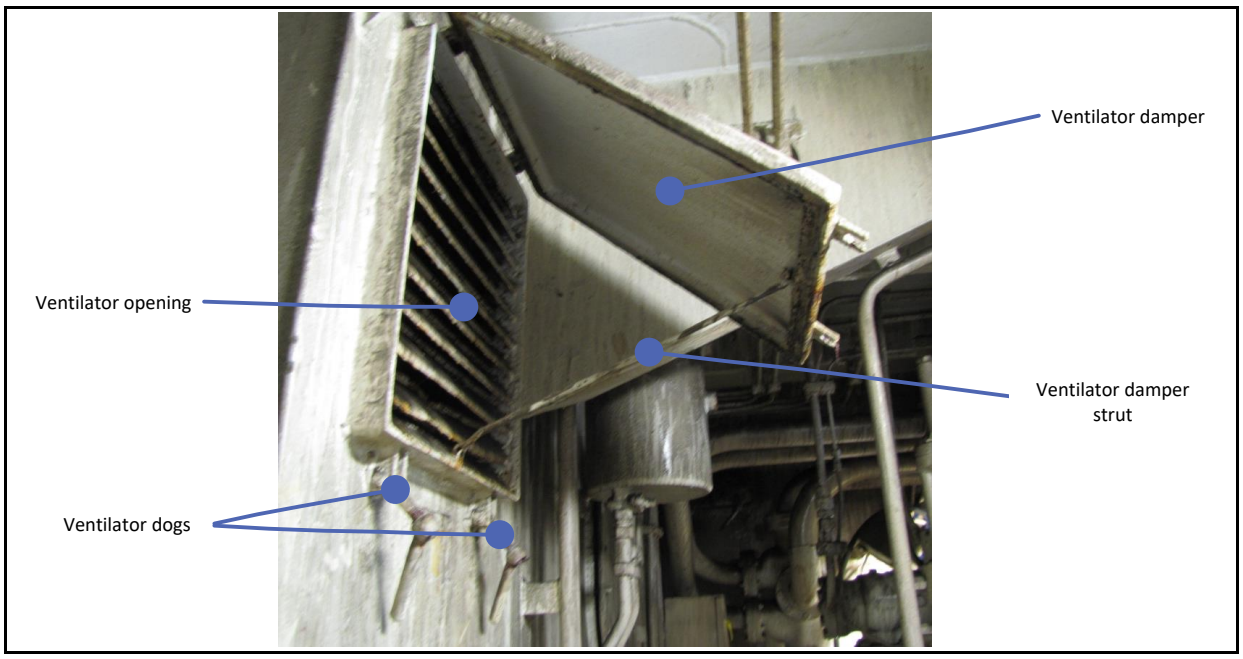

Figure 4
Ventilator opening with ventilator flap in open position

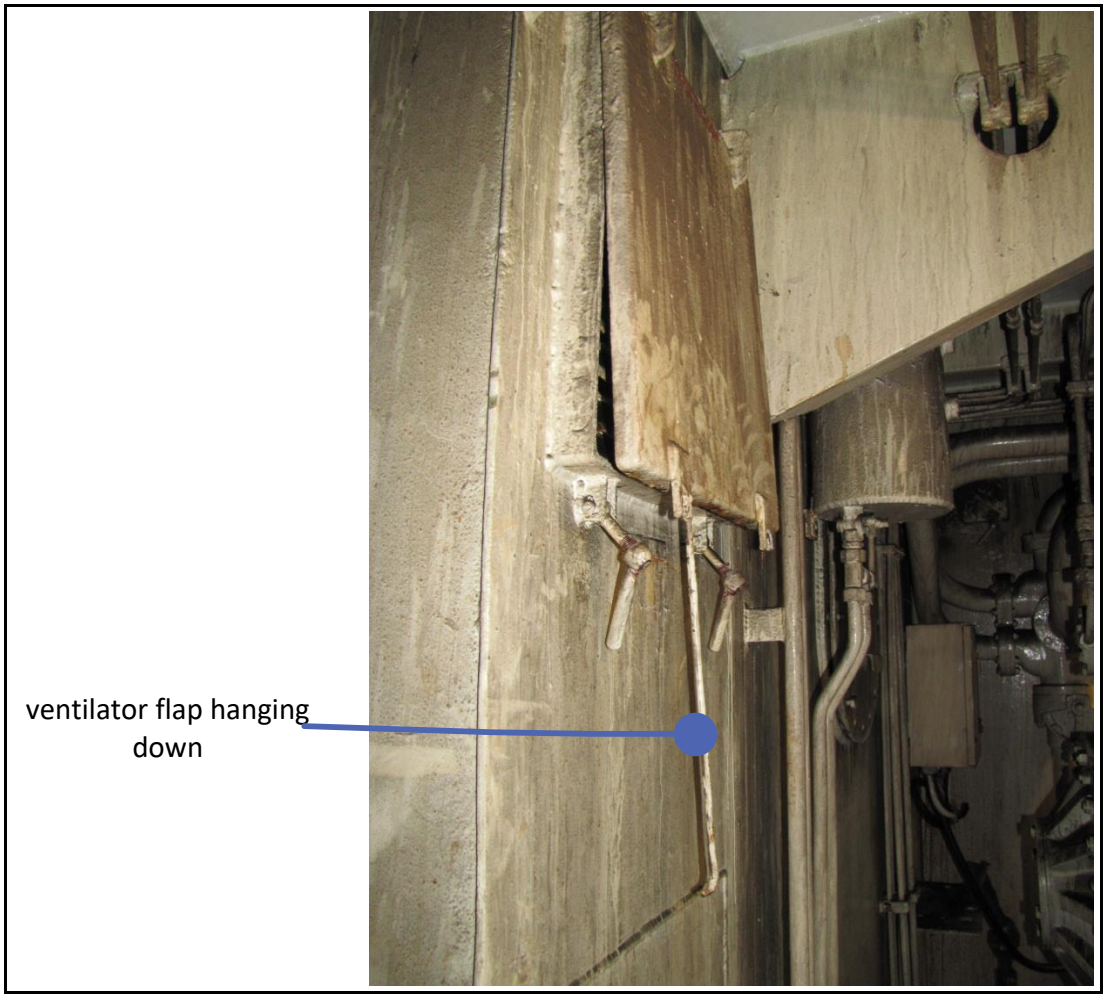

Figure 5
Ventilator opening with strut hanging down, obstructing the flap from closing fully

4.6. Fuelling the fire

4.6.1. The fish processing factory was lined with plastic sheeting as required by the rules for food safety. However, the rules only consider food safety and not the consequences in the event of a fire.

4.6.2. The plastic lining melted and appeared to have burnt during the fire, producing thick, acrid smoke that hindered initial firefighting efforts. An example of the burnt and melted plastic lining can be seen in Figure 6. Most plastics are highly flammable and will accelerate the spread of a fire.

4.6.3. Nobody knew the fire rating of the plastic lining. Current maritime rules require that such materials are fire retardant so as to slow or help prevent the spread of fire. As with the other aspects of ship design referred to above, the vessel had been built before Part 40D came into force, and requirements around fire-retardant linings had not applied.

4.6.4. From a risk perspective, operators should consider the fire-retardant qualities of materials used in all areas of a ship prone to fire, especially when changing or refitting any space.

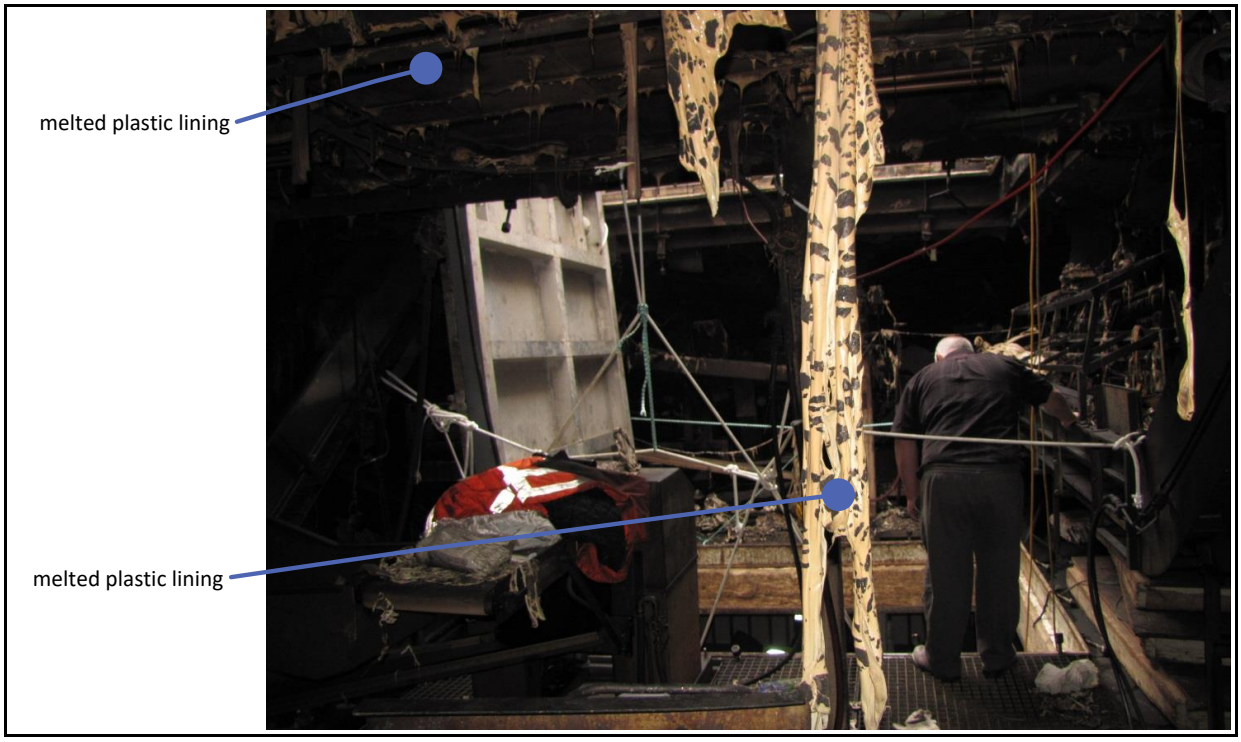

Figure 6
Photo taken in fish processing factory

4.7. Risk

4.7.1. Maritime rules lay out a set of minimum standards with which ships must comply. As lessons are learnt from accidents and incidents, and advances in technology prompt safer systems, the maritime rules evolve to reflect these advances.

4.7.2. As maritime rules change or evolve, there are inevitably grandfathering provisions to avoid unrealistic costs being imposed on owners of existing vessels. However, a concept of safety management systems is that owners and operators should take a risk-based approach to their

operations. Hazards must be identified and risks must be assessed and reduced to as low as reasonably practicable to prevent damage to property and harm to people.

4.7.3. This means that owners and operators cannot rely solely on compliance with the minimum technical standards laid out in maritime rules for meeting their obligations under the other various rules and regulations.

4.7.4. Several examples have been given above of equipment and systems complying with the rules of the day but where, if a risk-based approach had been taken, several improvements could have been made that may have prevented or minimised the consequences of this fire.

4.7.5. The fire on board the *Amaltal Columbia* occurred during the time that safe ship management systems were used to manage the safety of vessels. Since that time Maritime New Zealand's Maritime Operator Safety System (MOSS) has come into effect. Since MOSS was introduced Maritime New Zealand has been actively encouraging operators to take a robust, risk-based approach to managing the risks in their operations. Maritime New Zealand has been promoting this message through education material and publications as well as active engagement with operators. The Commission acknowledges Maritime New Zealand's approach and does not make a recommendation on this issue.

Findings

3. The crew had difficulty completely closing the flaps on the ventilation ducts to the fish processing deck where the fire was located, which would have hindered their attempts to contain the spread of the fire.
4. The fire flaps designed for closing off ventilation ducts in the event of a fire met the minimum standards prescribed in maritime rules and were capable of being fully closed and secured. However, their design meant they were not quick, easy and intuitive to operate.
5. From a risk perspective, the operator should consider amending the design of the closing arrangement on all the ventilation ducts to allow quick and easy closing in the event of a fire.
6. It could not be established whether the material used to line the fish processing deck had fire-retardant properties, but it appeared to have burned and likely accelerated the spread of fire.
7. The *Amaltal Columbia*'s design and systems for the prevention, detection, containment and fighting of a fire met the standards of the applicable maritime rules; however, there were some aspects that could have been improved with a more risk-based approach to operations.

5. Findings

5.1. The seat of the fire was located within bales of empty polypropylene bags stored in the fishmeal bagging room on the fish processing deck.

5.2. The Commission was not able to establish conclusively the source of ignition for the fire. However, it was about as likely than not to have been either the failure of a fluorescent light fitting or a failure within a fan unit, both of which were located above the seat of the fire.

5.3. The crew had difficulty completely closing the flaps on the ventilation ducts to the fish processing deck where the fire was located, which would have hindered their attempts to contain the spread of the fire.

5.4. The fire flaps designed for closing off ventilation ducts in the event of a fire met the minimum standards prescribed in maritime rules and were capable of being fully closed and secured. However, their design meant they were not quick, easy and intuitive to operate.

5.5. From a risk perspective, the operator should consider amending the design of the closing arrangement on all the ventilation ducts to allow quick and easy closing in the event of a fire.

5.6. It could not be established whether the material used to line the fish processing deck had fire-retardant properties, but it appeared to have burned and likely accelerated the spread of fire.

5.7. The *Amaltal Columbia*'s design and systems for the prevention, detection, containment and fighting of a fire met the standards of the applicable maritime rules; however, there were some aspects that could have been improved with a more risk-based approach to operations.

6. Safety actions

General

6.1. The Commission classifies safety actions by two types:

(a) safety actions taken by the regulator or an operator to address safety issues identified by the Commission during an inquiry that would otherwise result in the Commission issuing a recommendation

(b) safety actions taken by the regulator or an operator to address other safety issues that would not normally result in the Commission issuing a recommendation.

Safety actions addressing safety issues identified during an inquiry

None identified.

Safety actions addressing other safety issues

None identified.

7. Recommendations

General

7.1. The Commission may issue, or give notice of, recommendations to any person or organisation that it considers the most appropriate to address the identified safety issues, depending on whether these safety issues are applicable to a single operator only or to the wider transport sector. In this case, recommendations have been issued to the Director of Maritime New Zealand.

7.2. In the interests of transport safety it is important that these recommendations are implemented without delay to help prevent similar accidents or incidents occurring in the future.

Recommendations

No new recommendations identified.

8. Key lessons

8.1. The early detection of fires is critical to preventing their taking hold and spreading.

8.2. Older-style fluorescent light fittings are more prone to failure and to start a fire than more modern fittings. Operators of older ships should consider the risk of not replacing such lights with more modern and safer lights.

8.3. Arrangements that are designed to close off a space and contain a fire need to be quick, easy and intuitive to use, taking account of the conditions the crew are likely to encounter in a real fire.

8.4. The use of fire-retardant materials in the construction and fit-out of spaces on board ships will help to prevent the ignition and spreading of fires.

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Price $13.00

ISSN 1173-5597 (Print)
ISSN 1179-9072 (Online)