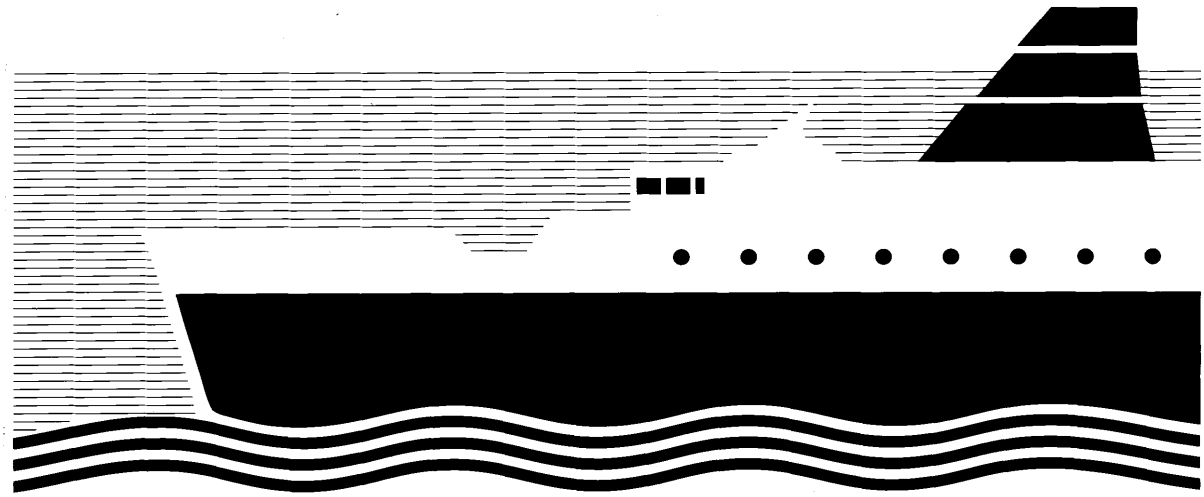
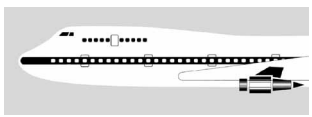
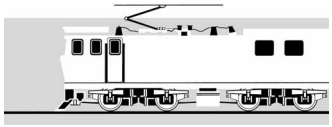


# MARINE OCCURRENCE REPORT

**04-210** **restricted limit passenger vessel *Esprit de Mer,* fire, Milford Sound** **30 June 2004**


**TRANSPORT ACCIDENT INVESTIGATION COMMISSION**
**NEW ZEALAND**

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.

# Report 04-210

## restricted limit passenger vessel *Esprit de Mer*

## fire

## Milford Sound

## 30 June 2004


## Abstract

On Wednesday 30 June 2004 at about 1530, the restricted limit passenger vessel *Esprit de Mer* with a skipper, one staff member and 7 passengers on board was returning from the Milford Deep Underwater Observatory at Harrison Cove to the ferry terminal at Milford Sound. As the boat approached the wharf, the skipper noticed black smoke coming from a port-side engine room ventilator. The boat was secured alongside and the passengers disembarked. The skipper stopped the engines and used a carbon dioxide fire extinguisher to fight the fire. The fire was extinguished almost immediately.

There was extensive smoke and fire damage to the insulation in the engine room, and the electrical wiring and control cables in the vicinity of the port engine, but there were no injuries to the passengers and crew.

Safety issues identified included:

- the standard of maintenance by the authorised engine representative
- the provision of fire-detection and fire-extinguishing systems for enclosed engine room spaces in restricted limit passenger vessels.

Safety recommendations were made to the Director of Maritime Safety, the General Manager of SGS New Zealand and the owner of the *Esprit de Mer* to address these issues and to ensure the timely notification of accidents and incidents.

***Esprit de Mer***

# Contents



# Figures

## Abbreviations

| | |
|---|---|
| $CO_2$ | carbon dioxide |
| kW | kilowatt |
| m | metre(s) |
| mm | millimetre(s) |
| MSA | Maritime Safety Authority of New Zealand |
| nm | nautical mile |
| psi | pounds per square inch |
| SSM | Safe Ship Management |
| t | tonnes |
| UTC | co-ordinated universal time |

## Glossary

| | |
|---|---|
| flash point | the lowest temperature at which, during heating, inflammable vapours are formed on the surface of oil which shortly flare up in the presence of a flame |
| auto-ignition temperature | the temperature at which oil ignites by itself, i.e. without the presence of a flame. |

## Data Summary

**Vessel Particulars:**

| | |
|---|---|
| Name: | *Esprit de Mer* |
| Type: | restricted passenger |
| Limits: | enclosed waters |
| Safe Ship Management company: | SGS M&I |
| Length: | 15.86 m |
| Breadth: | 4.43 m |
| Weight: | 11.5 t |
| Built: | 1987 in Auckland |
| Propulsion: | 2 x Cummins VT 555-M-BC diesel engines driving 2 Briski 3B fixed-pitch propellers |
| Service speed: | 26 knots |
| Owner/operator: | Milford Deep Underwater Observatory |
| Port of registry: | Milford Sound |
| Crew: | 2 |

| | |
|---|---|
| **Date and time:** | 30 June 2004 at about 1530[1] |
| **Location:** | Milford Sound |
| **Persons on board:** | crew: 2<br>passengers: 7 |
| **Injuries:** | crew: nil<br>passengers: nil |
| **Damage:** | extensive fire damage to the port side of the engine room including electrical wiring and the engine control cables being melted |
| **Investigator-in-charge:** | Captain Doug Monks |

[1] All times in this report are New Zealand Standard Time (UTC +12 hours) and are expressed in the 24-hour mode.

# 1 Factual Information

## 1.1 Narrative

1.1.1 The Milford Deep Underwater Observatory owned the restricted limit passenger vessel *Esprit de Mer* and used it to ferry staff and visitors between the ferry terminal in the Freshwater Basin, Milford Sound, and the Milford Deep Underwater Observatory in Harrison Cove (see Figure 1). On Wednesday 30 June 2004 at about 1000, the *Esprit de Mer* was used to transfer the manager, the skipper and one other staff member from the ferry terminal to the observatory, a distance of about 2.5 nm. Once there, the boat was moored and the staff, including the skipper, prepared the observatory for visitors.

1.1.2 At about 1130, the skipper brought the manager back to the ferry terminal. The skipper then returned alone to the observatory. At about 1300 the skipper returned to the ferry terminal with observatory visitors who had visited the observatory as part of an extended cruise around the Sound on board another tourist vessel. The *Esprit de Mer* waited at the ferry terminal until 1400 when it made a scheduled shuttle run to the observatory. There were no passengers so the skipper was alone on this trip.

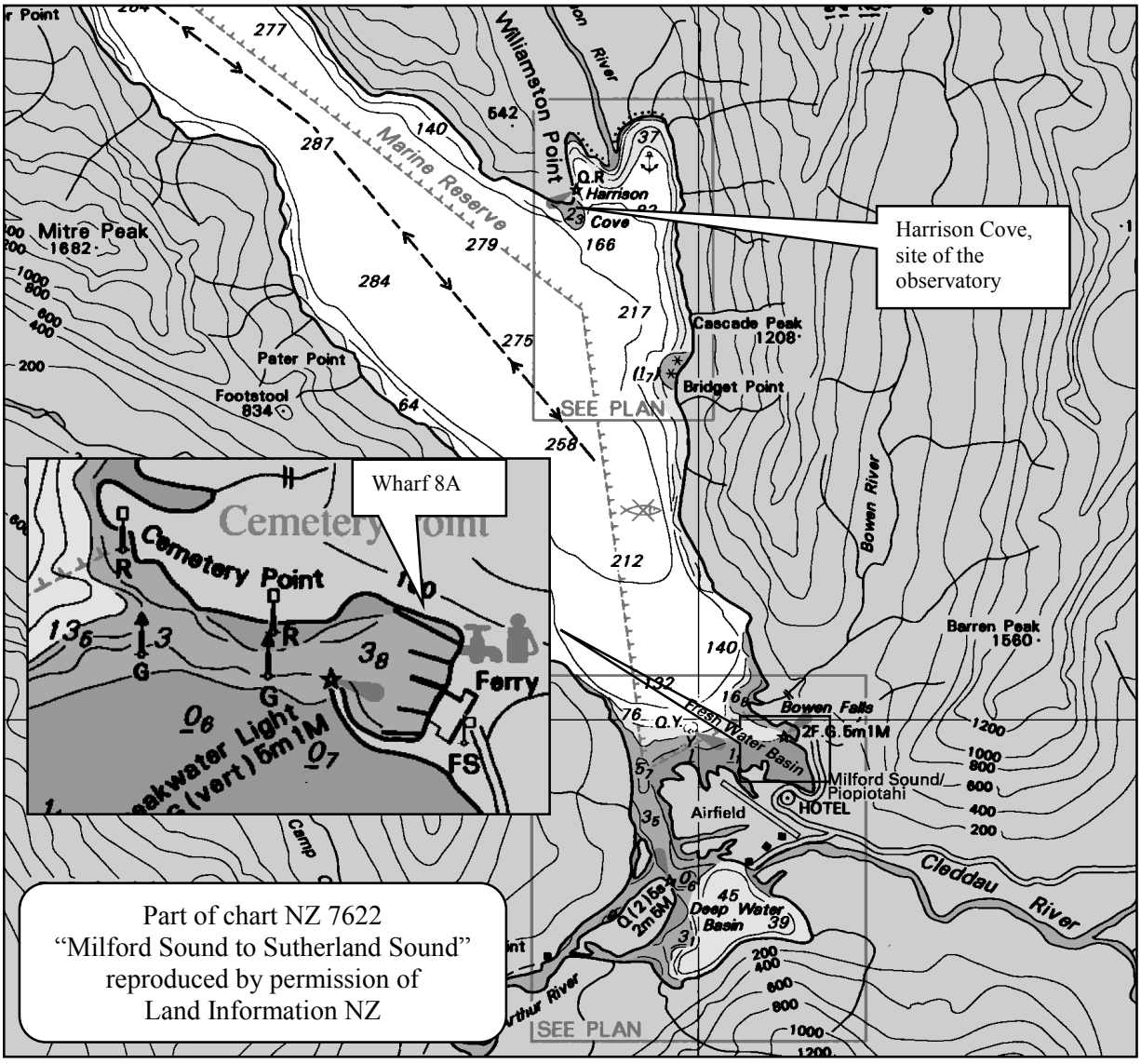



**Figure 1**
**Part of chart NZ 7622 Milford Sound to Sutherland Sound**

1.1.3 The observatory closed at 1515, and shortly afterward the skipper, the other staff member and 7 passengers headed back to the ferry terminal in the *Esprit de Mer*.

1.1.4 At about 1530, as they were almost alongside wharf 8A, the skipper noticed smoke coming from an engine room ventilator on the port side. The other staff member quickly made the mooring lines fast and rigged the gangway for the passengers to disembark. The skipper stopped the engines and carried a $CO_2$ fire extinguisher from close to the steering position to the aft starboard engine hatch. He removed the carpet from above the hatch and felt the hatch, which was warm but not unduly hot, so he tentatively lifted the hatch. The engine room was full of thick black smoke, through which he could see a small amount of flame at the after-end of the port engine. He directed a $CO_2$ fire extinguisher towards the flames and discharged the entire cylinder before closing the hatch.

1.1.5 After a short while, the skipper lifted the hatch and could no longer see any flames. He then partly discharged an aqueous-film-forming foam extinguisher into the space to ensure that the fire was totally extinguished.

1.1.6 During this time, the other staff member had gone ashore to the tourist centre, and returned with 2 additional fire extinguishers.

1.1.7 About an hour later, they again checked the engine room and found no sign of fire and that the space had cooled, so they opened all 3 engine room hatches to ventilate the space. Once the engine space was clear, the skipper was able to enter and assess the damage, and close the fuel and sea valves. A high-level bilge alarm was sounding, but on checking the watertight compartments, the skipper found them dry and concluded that the alarm was due to an electrical short circuit caused by the insulation on the alarm wiring having melted in the fire. The skipper disconnected the batteries, isolating the alarm. They then left the boat for the night.

1.1.8 The next day the owner had a local professional photographer record the condition of the engine and engine room. Later that day, engineers and an electrician were summoned from Invercargill and Te Anau to assess the damage and start repairing the boat. The engineers dismantled the port turbocharger and took it and the accompanying pipework to Invercargill.

## 1.2 Vessel information

1.2.1 The *Esprit de Mer* was built in 1987, in Auckland, to a standard Markline design. It was constructed of glass-reinforced plastic, 13.42 m in length and had a beam of 4.43 m.

1.2.2 In the early 1990s the boat was lengthened to 15.86 m.

1.2.3 The boat was fitted with 2 Cummins VT 555-M-BC 8-cylinder "V" configured diesel engines and propelled by 2 fixed 3-bladed propellers.

1.2.4 At the time of the fire, the *Esprit de Mer* was required to comply with Maritime Rules, Part 40A design construction and equipment – passenger ships which are not SOLAS ships. Appendix 3, section 3.3 itemised the fire-fighting equipment required to be carried on restricted limit ships. These rules are based on the length of ship and the number of passengers that it may carry. At the time of the fire the *Esprit de Mer* was equipped with 2 portable fire extinguishers, a fire hose and nozzle, a fire axe and 2 fire buckets; this was 2 portable fire extinguishers less than that required by Part 40A.

1.2.5 Milford Deep Underwater Observatory bought the *Esprit de Mer* in 2000 in order to transport staff and patrons between the ferry terminal and the observatory.

1.2.6 The boat was under SGS M&I Safe Ship Management (SSM) system and had a valid SSM certificate that had been issued on 16 August 2002. The certificate was valid until 30 June 2005 subject to periodic audits and inspections. It was certified to operate in the enclosed waters of Milford Sound, with the proviso "Fair weather conditions apply", and to carry not more than 50

passengers. The survey checklist completed at the time showed that the boat had a total of 2 portable fire extinguishers; one $CO_2$ and the other foam.

## 1.3 Personnel information

1.3.1 The skipper went to sea in 1996, when he worked for a Kaikoura whale-watching company. He sat and passed a commercial launchmaster certificate in November 1999. He moved to Milford Sound in 2002 as an observatory host, which required him periodically to skipper the *Esprit de Mer* as part of his duties.

1.3.2 The other staff member on board the boat at the time of the fire was employed as an observatory guide in 2002. He held no maritime qualifications. He used the *Esprit de Mer* to travel between Milford Sound and the observatory. During these trips he assisted the skipper with the mooring lines. At other times the skipper manned the boat alone.

## 1.4 Description of the engine

1.4.1 The 2 Cummins VT 555-M-BC propulsion engines were turbocharged and each developed 175 kW. The turbochargers were mounted at the after-end of each engine.

1.4.2 Turbochargers were used to increase the power output and efficiency of an engine by compressing the air flowing into the engine and so allowing more fuel to be used, resulting in more power being developed from each cylinder. A turbocharger consists of an exhaust-gas-driven turbine wheel and an air blower or compressor wheel separately encased, but mounted on a common shaft. Exhaust gases passed through nozzles in the turbine housing, causing the turbine to rotate; this turned the shaft, which rotated the compressor wheel. At service speed, the turbocharger shaft rotated at about 30,000 revolutions per minute and the turbine casing was at about the same temperature as the exhaust, which at service speed was about 450°C.

1.4.3 Because of the high revolutions and temperatures experienced in turbochargers, the shaft bearings required constant lubrication. On the Cummins VT 555-M-BC, lubrication was taken directly off the engine's lubrication system, which used 15W-40 lubricating oil at a pressure of between 45 and 85 pounds per square inch (psi). The feeder pipe between the engine lubrication gallery on the right side of the engine and the turbocharger was a flexible stainless steel braided pipe. The lubricating oil entered the top of the turbocharger casing between the turbine and the air blower.

1.4.4 The engine lubricating oil was Mobil Delvac MX 15W-40, which had a flash point of 240°C.

**Figure 2**
**Turbocharger heat boot**

1.4.5 A heat boot covered the turbine casing of the turbocharger to retain the heat and reduce the risk of people being burned if they came into contact with it. The boot had a glass fibre cover and a wire mesh inner with glass fibre wadding between the 2 (see Figure 2).

1.4.6 Before the photographer attended the vessel, the skipper of the boat removed the heat boot from the turbocharger so that the pipes near the turbocharger were more readily visible. Later, the heat boot was loaded onto the back of the engineers' utility vehicle with the turbocharger and ancillary pipes to be taken to Invercargill.

## 1.5 Engine Maintenance

1.5.1 The engines were originally fitted with T50 turbochargers, but in 2000 these became obsolete and were replaced by Holset BHT 3V turbochargers. The lubricating feeder pipes, however, appear to have remained unchanged.

1.5.2 On 9 June 2004, Industrial Equipment Services Limited, a Cummins-authorised representative from Invercargill, sent 2 apprentice engineers to Milford Sound to carry out planned maintenance on the engines of the *Esprit de Mer*. They removed 2 cylinder heads, the fuel pumps and turbochargers from each engine and took them back to Invercargill for refurbishment. On 18 June the same apprentice engineers returned to Milford Sound and refitted the engine parts. When the engines were test run, the starboard turbocharger was discovered to be defective. An inner seal had blown, allowing lubricating oil to enter the exhaust gas turbine casing and thence into the exhaust, causing excessive smoke from that exhaust. The starboard turbocharger was again removed and returned to Invercargill. An exchange turbocharger was dispatched to Milford Sound where it was fitted by the staff of Milford Deep Underwater Observatory on 22 June 2004 and had worked satisfactorily since then.

1.5.3 The apprentice engineers indicated that when they completed refitting the engine parts on 18 June they did not replace the turbocharger heat boot, but left it for the boat staff to do. The manager of Milford Deep Underwater Observatory said that the heat boots were in place before the boat returned to service.

1.5.4 At the time of the accident, the senior apprentice engineer had been working for Industrial Equipment Services Limited since 1997 and had been training as an apprentice for 4 years; he was due to sit his last paper to complete his apprenticeship in about 3 months. The other apprentice engineer had been working in engineering for about 5 years and was in the third year of his apprenticeship.

1.5.5 The turbocharger lubricating oil feeder pipes were of a standard design for this engine and consisted of an outer stainless steel braided casing with an inner heat-resistant plastic pipe. There was a straight connection at one end and right-angle on the other end.

1.5.6 The inlet fitting on the T50 turbocharger lubrication feeder was straight, onto which the right-angle connection of the lubricating oil feeder pipe fitted. When the turbochargers were changed in 2000, the new Holset units had a right-angled inlet fitting, onto which it appears the engineer connected the right-angle connection of the lubricating oil feeder pipe. The 2 right-angles together resulted in an unnatural twist in the pipe (see Figure 3).

1.5.7 During the removal and replacement of the turbochargers in June 2004, the apprentice engineer remembered detaching the lubricating oil feeder pipes at the turbocharger, leaving them attached at the engine end. He could not recall if, when he reassembled them, the degree of twist in the pipe was the same as it had been prior to dismantling.

1.5.8 A hose expert indicated that the inner pipe of this type of braided hose was not susceptible to heat damage at temperatures below about 260°C, and should not deteriorate with age. However, he said that the inner pipes were vulnerable to torsional stress. Vibration was liable

to cause fatigue within the strands of the outer stainless steel braid, causing them to break and possibly create wear on, or even puncture, the inner pipe.

1.5.9 From the photograph in Figure 3 the hose expert observed that a water-cooling hose passed over and was bearing on the turbocharger lubricating oil feeder pipe.

1.5.10 No specifications for the original hose were available, but for similar braided hoses the minimum bend radius ranged between 57 mm and 89 mm. The "pig tail" bend in the turbocharger lubricating oil feeder pipe appeared to be less than this recommended minimum.

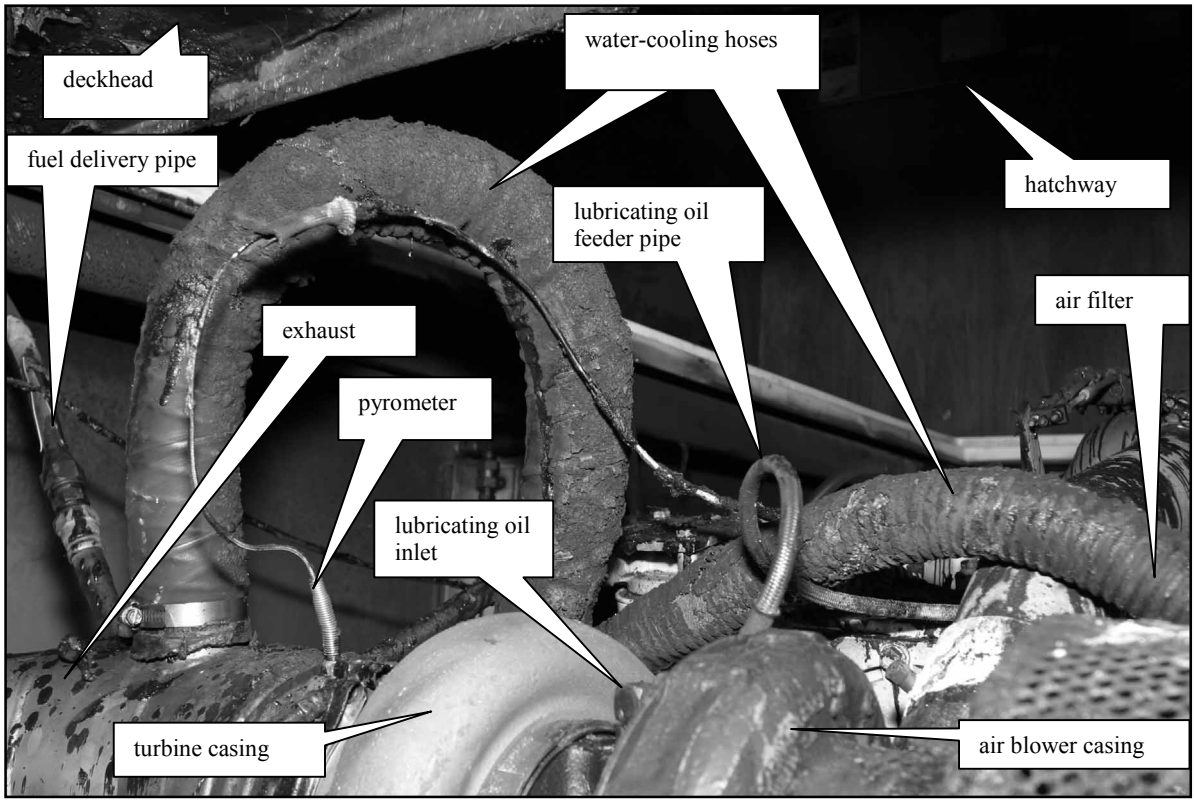



**Figure 3**
**After-end of the port engine the day after the fire and before the turbocharger was dismantled; the turbocharger heat shroud having been removed**

## 1.6 Fire damage

1.6.1 The fire damage was limited to the immediate area above and around the port turbocharger. The plastic insulation material on the deckhead, burned, melted and dripped over the port engine. Above the engine, extending forward from above the turbocharger, there was a large hatchway. The after-end of the hatch cover and the adjoining part of the deckhead showed the heaviest charring (see Figures 4 and 5). The insulation on electrical wiring and the plastic casing of the control cables running above the engine melted, causing short circuits and control failures. Rubber water-cooling hoses showed signs of fire but were still intact. Plastic lamp covers and gauge glasses on the aft bulkhead of the engine room were melted, which would indicate that the temperature had risen to about 140°C in that area.

**Figure 4**
**Deckhead above the port engine**

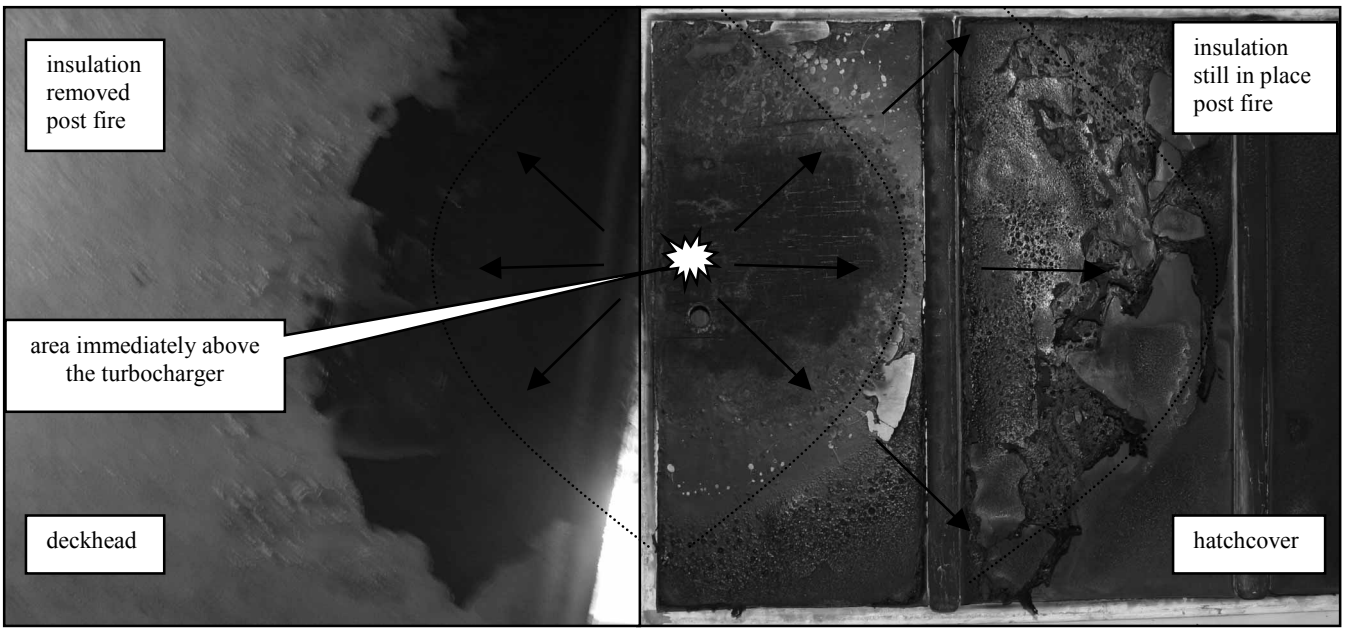


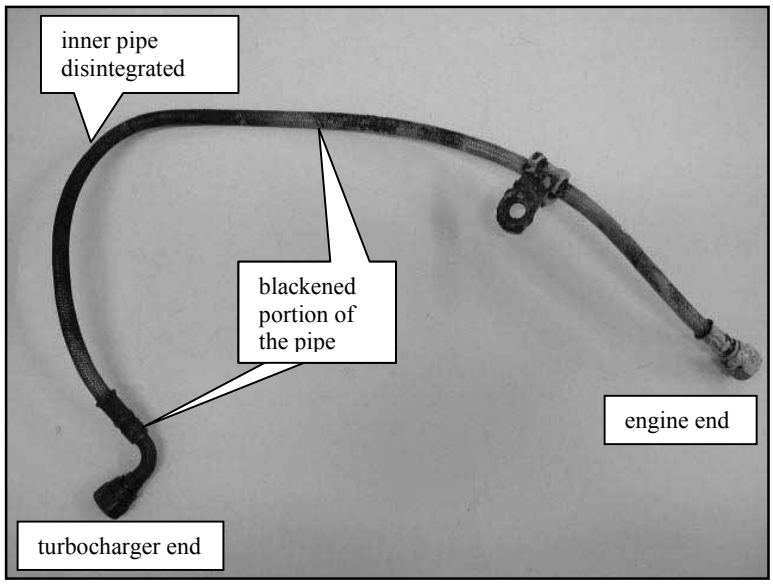

**Figure 5**
**Composite photograph from below looking up at the deckhead and the hatch cover above the port engine. Note: charring radiating away from the position above the turbocharger**

## 1.7 Post-accident testing

1.7.1 The fuel delivery pipe, which consisted of a bent copper pipe attached to a length of neoprene hose, and the turbocharger lubricating oil feeder pipe from the port engine were sent to a materials' performance specialist for inspection and leak tests.

1.7.2 The specialist found that the bend in the copper fuel delivery pipe had not been formed using an appropriate pipe-bending tool, which resulted in the pipe being kinked at the bend. To test for leaks, compressed air at about 6 Bar was applied to the pipe with the kinked area immersed in water to make any leaks visible. No leaks were found.

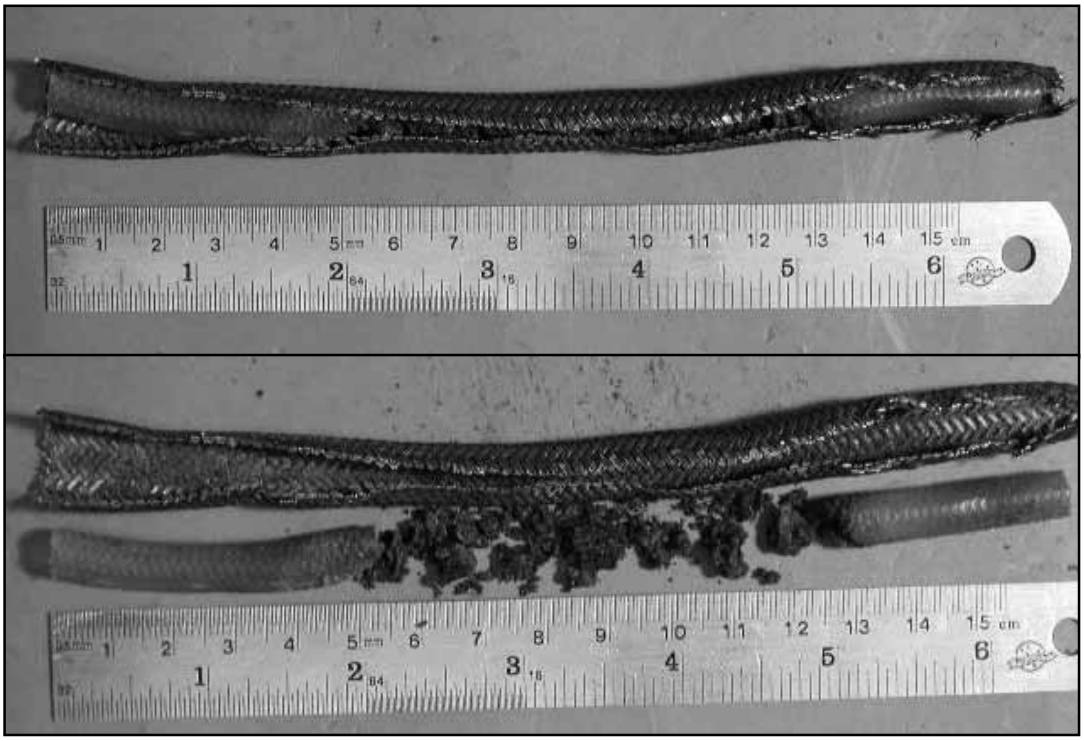
1.7.3 Visual inspection showed that the stainless steel braided outer casing of the lubricating oil feeder pipe was blackened over about half of its length extending from the right-angle fitting. The remainder still had a painted finish (see Figure 6). The pipe, although flexible, was relatively firm except for an area about a third of the length from the right-angled connection where it was soft and considerably more flexible. A leak test, similar to that used for the fuel delivery pipe, was carried out and on this occasion air escaped freely from the soft portion of the pipe.




photograph courtesy of MPT

**Figure 6**
**Lubricating oil feeder pipe for the port turbocharger**

1.7.4 The stainless steel braid was cut to expose the inner pipe, which was found to be disintegrated and charred along about 80 mm of its length in the area of the soft portion of the pipe (see Figure 7). The fragments were microscopically examined and found to be glassy with spherical pores, indicating thermal breakdown. The intact ends of the pipe on either side of the fragmented section were charred and for a further 10 mm back the pipe exhibited melting. For about 40 mm from the charred ends, the pipe was its original colour, flexible and largely in its original condition.



photograph courtesy of MPT

**Figure 7**
**Turbocharger lubricating oil feeder pipe examination**

1.7.5 Lubricating oil has a flash point of between 210°C and 257°C, and the technical data sheet showed that Delvac MX 15W-40 had a flash point of 240°C. The auto-ignition temperature of lubricating oils was not required to be specified in technical data sheets and so was usually excluded from the technical information. Consequently, precise data was difficult to ascertain. However, the United States National Fire Protection Association 921: A Guide for Fire and Explosion Investigation Chapter 22 Motor Vehicle Fires indicated that lubricating oil had an auto-ignition temperature of between 260°C and 371°C.

1.7.6 After the fire, the turbochargers were checked; they were found to be serviceable and were subsequently reinstalled on the engines by a qualified engineer from Industrial Equipment Services Limited. New lubricating oil feeder pipes and the port side fuel delivery pipe were manufactured and fitted. Electrical wiring and the engine control cables were replaced as necessary. After the engines were reassembled the engineer was requested to check all other components for leakage, including fuel filter, lubricating oil filter and high-pressure fuel pipes that could have been the source of fuel for the fire. No leaks were found.

## 1.8 Accident notification

1.8.1 The day after the fire, the staff of the observatory started to clean the melted plastic deposits from the engine. Later that day, engineers removed the port turbocharger and the corresponding lubricating oil feeder pipe and fuel line. They also removed the starboard engine lubricating oil feeder pipe. However, prior to removing the turbocharger, a local professional photographer was engaged to take comprehensive photographs of the port engine and surrounds.

1.8.2 The Commission was not notified of this accident until about 1100 on Friday 2 July 2004, almost 44 hours after the event. By that time, cleaning had commenced and the relevant parts of the engine had been removed, making investigation of the site difficult. Once notified, the Commission required the owner of the *Esprit de Mer* to cease all work until the scene could be inspected.

1.8.3 The sequence of the notification of the fire started with the skipper completing the Commercial Vessel Accident & Incident Report Form (MSA 12307) the next day, Thursday. He then sent it to his SSM company, which in turn sent it to the Maritime Safety Authority (MSA) office in Bluff. MSA Bluff sent it to the MSA head office in Wellington. The form was sent by facsimile between each location and during one of the transmissions an attached sheet containing the skipper's description of the accident was lost.

1.8.4 The Maritime Transport Act 1994, section 31 requires the master of any New Zealand ship or foreign ship in New Zealand waters to report a mishap, accident or incident to the MSA as soon as practicable. If due to death, injury or other good reason the master of a ship is incapacitated, the operator should provide the necessary notice to the Authority. Late notification of accidents and incidents was not uncommon in New Zealand.

1.8.5 The Maritime Transport Act 1994, section 60 requires the Director of Maritime Safety to advise the Transport Accident Investigation Commission, as soon as practicable, of accidents or incidents that are notified to the Authority.

1.8.6 Overseas administrations, including the United States, Canada and the United Kingdom, differed in their requirements for accident reporting but the terms, "immediately", "as soon as possible", or "within 24 hours" were used to emphasise the necessity of accidents being reported promptly. Follow-up reports giving a detailed description of the occurrence were usually required after a number of days. Delays in reporting were admissible, but were the exception rather than the rule, and the burden of proof that the delay was reasonable was placed on the person responsible for reporting. Australian legislation was more prescriptive, requiring accidents and incidents to be reported within 4 hours and a detailed report submitted within 72 hours. Failure to report carried a maximum penalty of imprisonment for 6 months.

1.8.7 Communications had improved significantly over recent years with satellite and cellular communication systems making almost instant contact possible from most areas of the world.

# 2 Analysis

2.1 The delay in the Commission being notified of the occurrence resulted in the scene of the fire being corrupted before it could be properly examined. Consequently, it was difficult to establish the precise cause of the fire.

2.2 Having just experienced a fire, the skipper might well have considered the next morning a reasonable time to fulfil his duty to report the accident "as soon as practicable", although he would almost certainly have been able to report as soon as the fire had been extinguished.

2.3 A single point of contact for accident reporting at the Authority would have removed the delay caused by the form being relayed through 2 other offices on its way to the MSA head office.

2.4 The term "as soon as practicable" was vague and subject to different interpretations. However, modern communications make it possible for accidents to be reported almost immediately.

2.5 The photographs taken the morning after the fire were the only contemporaneous evidence available to investigators. The photographs enabled the pattern of the fire to be analysed and the relative position of the ancillary pipes and components close to the turbocharger to be identified. Had these photographs not been available to the Commission it would have been impossible to establish the cause of the fire.

2.6 The burn pattern on the deckhead and hatchway above the port engine confirmed that the fire was centred in the vicinity of the port turbocharger. Turbochargers and exhaust manifolds were notorious for being the ignition sources of numerous engine room fires. Temperatures of up to 600°C, and on this engine about 450°C at service speed, could be expected at the turbocharger.

2.7 The photograph in Figure 3 showed that the turbocharger lubricating oil feeder pipe had an unusual “pig tail” twist just forward of the turbocharger. The way the 2 right-angle bend connections had been joined appears to have caused the pipe to be twisted into a sharper arc than was recommended for similarly constructed stainless steel braided pipe. In comparison, the new lubricating oil feeder pipe fitted after the fire had a straight connection at the end attached to the turbocharger fitting and the right-angled end attached to the oil gallery of the engine, resulting in a smooth, twist-free lead to the pipe (see Figure 8).

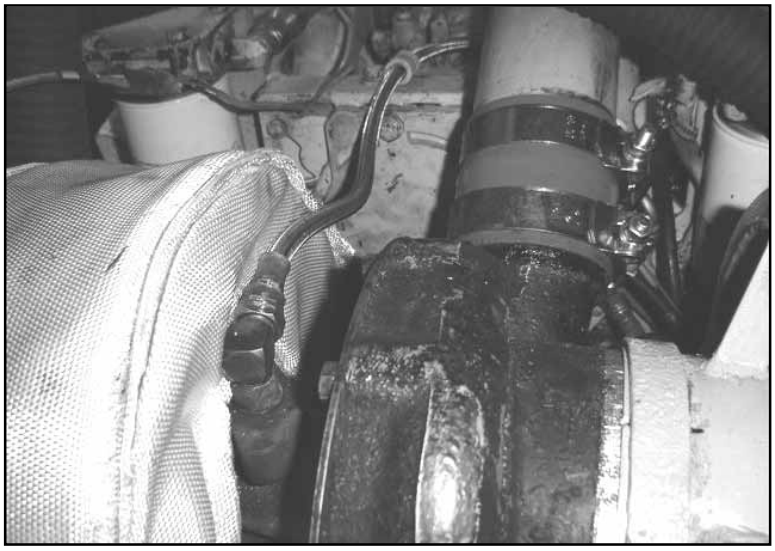


**Figure 8**
**Turbocharger lubricating oil feeder pipe fitted following the fire**

2.8 The twisted lubricating oil feeder pipe was subject to heat and vibration. The water-cooling hose that was resting on it would have increased that vibration. It is possible that some of the strands of the stainless steel braid became brittle, broke and rubbed on the inner pipe, causing it to puncture.

2.9 There were no records of the turbocharger lubricating oil feeder pipes having been replaced during the engines' lives and so they were likely to be the original ones and therefore 17 years old. The age of the pipe possibly resulted in the inner pipe becoming less flexible, eventually cracking, although the unburnt part of the inner pipe was found to be in a serviceable condition.

2.10 Once the inner pipe had become compromised, hot lubricating oil would have squirted or sprayed through the braided outer casing at a pressure of up to 85 psi. On contact with the turbine casing or the exhaust manifold at a temperature in excess of 450°C, the lubricating oil would have been heated above its auto-ignition temperature, causing it to ignite.

2.11 The inner pipe of the lubricating oil feeder pipe was found to be burnt about one third of the way from the right-angle end. This position corresponds with the area where the pipe had its sharpest arc. The pattern of the burning on the horseshoe-shaped water-cooling pipe (see Figure 3) suggests that the fuel for the fire sprayed from near the centre of the engine towards the after port side of the engine, further supporting the premise that lubricating oil was the fuel of the fire. When the engines were reassembled after the fire, no other components were found to be leaking, reinforcing the contention that the source of the fire was among those components removed from the engine. The only component that failed during testing was the lubricating oil feeder pipe.

2.12 Forensic examination found that the turbocharger heat boot was contaminated by both diesel and lubricating oil, however the quantities could not be determined. Nevertheless, it can be seen from Figure 2 that black marks spread across the forward port corner of the boot. This area was very wet and oily to the touch, indicative of substantial contamination by lubricating oil.

2.13 The representatives of the engineering company that was responsible for maintenance on the *Esprit de Mer* suggested that the heat boot was not stained when its engineer attended the boat after the fire and that contamination was likely to have occurred when on the back of the utility vehicle on the return trip to Invercargill. Although this was possible, the Commission considered that the pattern of staining on the heat boot was more likely to be caused by lubricating oil squirting from the turbocharger lubricating oil feeder pipe.

2.14 The fire started as the boat was berthing, allowing the skipper to stop the engines in short order, thus stopping the flow of lubricating oil to fuel the fire. Had the fire occurred at any other part of the journey, the skipper may have been less able or inclined to stop the engines as quickly, thus lubricating oil would have continued to fuel the fire.

2.15 Had the fire managed to take a stronger hold, it would have been difficult to fight the fire as the only access into the engine room was from above. In line with existing Maritime Rules, new vessels of more than 15 m in length were required to be fitted with a fixed fire extinguishing system in a machinery space. However, as the *Esprit de Mer* was an existing vessel when the rule came into force, it was not required to have such a system. The boat was constructed of glass-reinforced plastic over plywood, a highly flammable combination, which would have increased the likelihood of a fire becoming established.

2.16 The boat had less than the number of portable extinguishers required by Maritime Rule Part 40A, Appendix 3.3. The number of portable extinguishers had been noted during the SSM company's inspection in June 2002, but had not been raised as a deficiency. The less than required number of portable fire extinguishers did not contribute to the cause of the fire but might have had serious consequences had the fire managed to establish itself.

2.17 The apprentice engineers who conducted the engine work on the *Esprit de Mer* had experience but were not fully qualified. It would have been prudent for a qualified engineer to accompany them to supervise the work.

2.18 When rebuilding the engines in June 2004, the apprentice engineer probably replaced the turbocharger lubricating oil feeder pipes in a similar way to how he had found them. The degree of twist in the pipe would have depended on the relative directions of the right-angle fittings and the lead of the pipes when he tightened the securing nuts. He possibly did not recognise the danger of leaving a twist in the pipe.

# 3 Findings

Findings are listed in order of development, not in order of priority.

3.1 The most probable cause of the fire was the failure of the turbocharger lubricating oil feeder pipe on the port engine. Lubricating oil under pressure would then have sprayed over the turbocharger or exhaust pipe, which were above the oil's auto-ignition temperature, and so ignited the oil.

3.2 The supply of fuel for the fire ceased as soon as the port engine was stopped.

3.3 The turbocharger lubricating oil feeder pipe appeared to have been left torsionally stressed when it was fastened to the reinstalled turbocharger on 18 June 2004.

3.4 A water-cooling pipe resting on the turbocharger lubricating oil feeder pipe probably increased vibration in it.

3.5 The burn pattern on the deckhead and hatchway above the port engine showed that the fire was centred about the port turbocharger.

3.6 The materials used in the construction of the boat would not have inhibited a fire had it been able to establish itself.

3.7 The Maritime Rules in force at the time of the accident did not require fire-detection or fixed fire-extinguishing systems to be fitted on existing enclosed limits vessels of more than 15 m in length. The *Esprit de Mer* was not fitted with either.

3.8 There was less fire fighting equipment on the boat than required.

3.9 The delay in receiving the notification of the accident seriously compromised the accident investigation and the ability to determine the exact cause of the fire.

# 4 Safety Actions

4.1 In response to the preliminary report, the General Manager of SGS New Zealand sent a memorandum to all the company surveyors reminding them to ensure that all vessels were fully equipped in all respects to at least the minimum requirements specified in the Maritime Rules. This message would be further addressed and reinforced at training seminars during 2005.

# 5 Safety Recommendations

Safety recommendations are listed in order of development, not in order of priority.

5.1 On 13 January 2005, the Commission recommended to the General Manager of Milford Deep Underwater Observatory that he:

5.1.1 consider fitting a fire-detection and fixed fire-extinguishing system to the vessel. (083/04)

5.1.2 ensure that the *Esprit de Mer* meets the requirements of Maritime Rules Part 40A. (084/04)

5.2 On 27 January 2005, the General Manager of Milford Deep Underwater Observatory replied:

> We will be installing the two fire extinguishers as soon as they can be sent to us, and regarding the fire detector, we need a little time to sort this out. The fitting of it would have to happen when the vessel goes to Bluff for its survey which is going to happen this coming June.

5.3 Following an engine room fire on a passenger ferry (TAIC occurrence report 03-201, ***Harbour Cat*** in Auckland Harbour), the Commission recommended to the Director of Maritime Safety that he:

> 033/03 When conducting any review of Maritime Rule 40A, undertake a cost benefit analysis to consider any existing restricted limit passenger ships with totally enclosed engine spaces to be fitted with a fire detection system and a remotely operated fire extinguishing system in the engine space(s).
>
> Where a cost benefit is demonstrated as positive, consider drafting an amendment to Maritime Rule 40A for the Minister's consideration.
> Any amendment of the rule to be phased so that existing passenger vessels above 15 m, or carrying more than 36 passengers to be fitted with this equipment first.

The Director of Maritime Safety replied to the preliminary safety recommendation, which was subsequently adopted essentially unchanged as the Commission's final safety recommendation. That reply dated 28 August 2003, was:

> Subsequent to my letters of 27 June and 13 August 2003 regarding the preliminary recommendations, there has been further discussion between our staff as to the intent of these recommendations proposed by the Commission. On the basis of these discussions, the MSA would be prepared to accept both recommendations subject to a robust cost benefit study being conducted.

On 10 January 2005, the Maritime Safety Authority indicated that the cost benefit analysis recommended in 033/03 was in progress and that it expected it to be completed by the end of March 2005.

Safety recommendation 033/03 is equally relevant to this accident, and while no further recommendations relating to the provision of fire-detection and fire-extinguishing systems on existing restricted limit passenger vessels have been made, the Commission reinforces its concern.

5.4 On 13 January 2005, the Commission recommended to the Director of Maritime Safety that he:

5.3.1 draft an amendment to the Maritime Transport Act 1994 for the Minister's consideration, to require masters or operators to report accidents to the head office of the Maritime Safety Authority within specified timeframes. Initial notification should be within 4 hours and a completed accident report within 3 days. (087/04)

5.3.2 instigate and promote a single point of contact for masters or operators to notify the Authority of accidents and incidents. Such a point of contact should be capable of receiving notifications by telephone, facsimile or email. (095/04)

5.3.3 require Safe Ship Management companies to include in vessel operation manuals clear, unequivocal directions to masters and operators that accidents should be reported directly to the head office of the Maritime Safety Authority at the earliest possible opportunity. (088/04)

5.5 On 2 February 2005, the Director of Maritime Safety replied:

> 087/04 The Maritime Safety Authority cannot accept this recommendation in its current form. As per our letter of 17th December in response to the preliminary recommendation (which is identical to the final recommendation), we do not support setting arbitrary time constraints for the reporting of accidents, as this may not reflect the reality of the situation many Masters find themselves in after an accident occurs.
>
> Section 31 of the Maritime Transport Act 1994 requires mishaps, accidents and incidents to be notified to the authority "as soon as practicable" by the Master.
>
> The current arrangement allows the Master of the vessel to focus on the primary responsibility of ensuring the safety of life, environment and property after an accident rather than being distracted by prescriptive reporting requirements specified within the legislation. This is particularly so with smaller operators, to whom any amendment to the MTA94 would apply equally to those operators who may have larger resources available.
>
> We do, however, appreciate that there is some confusion within industry as to the interpretation of "as soon as practicable" for the reporting of incidents. For this reason the Maritime Safety Authority will be communicating with industry providing guidance as to what would be reasonably expected in reporting of accidents. This communication will occur when we implement recommendations 088/04 and 095/04 which we consider acceptable in an amended form.

088/04 The Maritime Safety Authority accepts the intent of this recommendation, i.e. that accidents are reported to MSA at the earliest opportunity.

We are currently considering how best to improve the current reporting practice of industry, which may include utilising the Rescue Co-ordination Centre as the focal point for all accident reports, as this facility is manned on a "24/7" basis.

For this reason, while MSA accepts the recommendation, the reporting point may not be the Head Office of MSA as originally specified by the Commission.

095/04 This recommendation is acceptable to the Maritime Safety Authority.

5.6 On 13 January 2005, the Commission recommended to the General Manager of SGS New Zealand that he:

5.6.1 ensure that the Safe Ship Management manuals for all vessels under his jurisdiction contain clear and concise instructions of how accidents are to be reported. (090/04)

5.7 On 2 February 2005, the Shipping Product Manager of SGS New Zealand replied:

It has been noted that in the procedures section of some of our older SSM manuals the requirement to report accidents an incidents to SGS M&I only (and not to the MSA) is stated. An advice (for inclusion in the SSM manual) will be sent to all our clients to ensure they are aware of the requirement to report accidents and incidents to the MSA.

Furthermore, if MSA choose to designate a more specific point of contact for accident and incident reporting, SGS M&I would be happy to circulate advice to their clients to facilitate this and thus improve current procedures.

Approved on 26 January 2005 for publication

Hon W P Jeffries
**Chief Commissioner**

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Transport Accident Investigation Commission
P O Box 10-323, Wellington, New Zealand
Phone: +64-4-473 3112 Fax: +64-4-499 1510
E-mail: reports@taic.org.nz Website: www.taic.org.nz

Price $ 22.00 ISSN 0112-6962