ASSESSMENT OF THE RESPONSE FROM TRANSPORT CANADA TO MARINE SAFETY RECOMMENDATION M05-01

STRUCTURAL FIRE PROTECTION AND FIRE-EXTINGUISHING SYSTEM

Background

On 04 August 2002, the *Statendam* embarked passengers in Vancouver, British Columbia, for a week's cruise to Alaska and return. Prior to departure, the diesel generators were prepared, in order to be started and paralleled on to the 6.6 kV switchboard. Soon after diesel generator No. 2 was started, a low cylinder oil flow condition shut down the generator. The other diesel generators were then started and, with four of them running in parallel, the vessel departed Vancouver.

The vessel was brought up to its full speed and diesel generator No. 2 was restarted and put back on line. After it had been running for about 18 minutes, the generator's electrical protection system sensed a fault and immediately tripped its circuit breaker and lock out relay. Without informing the chief engineer of this trip, one of the engineers reset the lock-out relay. Within a few minutes, diesel generator No. 2 had been restarted and brought back on line.

A few minutes later, the electrical protection circuits sensed an overload condition for diesel generator No. 2 and the bus-tie breaker of the switchboard. This was followed by tripping of various 6.6 kV consumers and the 440 V switchboard. The circuit breakers for all but one of the diesel generators also opened. As a consequence, the vessel lost all propulsive power and most hotel services.

After some time, one of the diesel generators was restarted; however, an attempt to close the bus-tie breaker produced an overload condition and it tripped. A second attempt to close the breaker was successful and the other diesel generators were progressively started up and paralleled. The vessel got under way again, slowly accelerating as more diesel generators were put on line. Diesel generator No. 2 was then restarted and allowed to parallel itself automatically. A few seconds later, a loud bang was heard, following which the bus-tie breaker and breakers for four of the diesel generators tripped off the board. The vessel was again without propulsion power and without most of its hotel services.

The main circuit breaker for diesel generator No. 2 was found to have suffered a catastrophic failure, caused in all likelihood by a direct internal short circuit across two (or three) phases.

Approximately three minutes after the diesel generators tripped, smoke was reported in the switchboard room and the fire detection system in the wheelhouse indicated a fire in the same compartment. Smoke was also detected in the engine control room. The source of the smoke was traced to burning electrical cables located in the cable space beneath the floor plates. The fire in the control room was promptly put out.

Concurrent with firefighting in the control room, a fire team entered the main switchboard room to fight the fire. The source of the heat was located in the console containing the circuit breaker for diesel generator No. 2, in the cabinets immediately adjacent, and in the consoles above and below. The fire was eventually put out. The vessel returned to Vancouver under tow.

Switchboard rooms contain cables, switchgear, and associated equipment, which may routinely be conducting electrical power of 30 MW or more. As demonstrated by this occurrence, in the event of a catastrophic failure of a circuit breaker—either directly, or consequently as a result of the failure of other switchgear—the resulting arc has the potential to release enough thermal energy to establish a fire in uninsulated contiguous compartments.

Structural fire protection is the primary method of containing heat within a compartment; however, current International Convention for the Safety of Life at Sea (SOLAS) requirements for structural protection around main switchboard rooms do not address the fire risk inherent in electrical systems that transmit high levels of power. As a result, the *Statendam* had no fire/thermal insulation between the main switchboard room and the engine control room one deck above. The failure of the main breaker resulted in a high energy electrical discharge from which the associated radiant heat transmitted through the steel deckhead, igniting electrical cables in the engine control room.

Board Recommendation M05-01

Given that current and future vessels built without adequate structural fire protection and fire-extinguishing systems for spaces containing and transmitting high levels of energy will continue to place crews and passengers at undue risk, the Board recommended that:

> The Department of Transport submit a paper to the International Maritime Organization requesting a review of requirements for structural fire protection and fire-extinguishing systems to ensure that the fire risks associated with compartments containing high levels of electrical energy are adequately assessed, and that the provisions of the International Convention for the Safety of Life at Sea (SOLAS) dealing with structural fire protection and fixed fire-extinguishing systems are addressed.
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> M05-01

Response to M05-01

In its 22 July 2005 letter, Transport Canada (TC) provided the following comments:

- While TC is in agreement with the Findings as to Causes and Contributing Factors, the Department's concern lies more with the actions of the ship's personnel and their possible lack of coordination of the vessel's electrical system that led up to destruction of the No. 2 generator circuit breaker and resulting fire.

- TC is of the opinion that the safety and goal of the recommendation would be better served by the Department's active participation at the International Maritime Organization (IMO) committees and sub-committees.

- The IMO initiative, Passenger Ship Safety (formally termed as Large Passenger Ship Safety), will include issues for discussion such as structural fire protection and fire-extinguishing systems. In addition, electrical training is being discussed in a holistic manner.

- TC believes that the TSB should prepare an information paper on the issue and TC would submit it to the IMO Fire Protection Sub-Committee at the next meeting in January 2006.

Board Assessment of Response to M05-01

While SOLAS specifies the requirements for providing fire-retardant insulation and structural fire protection between compartments based on the likelihood of the compartments becoming a source for a fire, the fire potential of 6.6 kV switchboard rooms has not been considered. The Board is concerned that this places some existing vessels at risk, while others may be built with insufficient structural fire protection around 6.6 kV switchboard rooms. It was also found that the switchboard room did not have an independent connection to the vessel's fixed CO_2 smothering system. Providing the switchboard room with such a system, or its own independent connection to the main CO_2 smothering system, would have provided an effective and safer firefighting alternative.

TC agreed to submit an information paper (as drafted by TSB staff) to the IMO Fire Protection Sub-Committee that will call for a review in order to ensure that the fire risks associated with compartments containing high levels of electrical energy are adequately assessed and addressed by the provisions of SOLAS. The paper was submitted to IMO and dated 04 October 2005. The response is therefore considered to be **Fully Satisfactory**.

Next TSB Action: M05-01

The IMO Sub-Committee discussions/subsequent actions to address the safety deficiency will be monitored.