

SECTION 5. DEATH AND INJURY OF PERSONNEL

5.1 As a consequence of the fire in HMAS WESTRALIA on 05 May 1998, there were a total of 10 casualties sustained:

- a. four fatalities;
- b. five documented injured; and
- c. one injured for whom treatment documentation was not raised.

5.2 All five documented injured were transferred to hospital ashore, and are likely to recover with no long term physical sequelae.

5.3 Additionally, there were a number of personnel who suffered stress reactions that rendered them to a greater or lesser extent ineffective for varying periods of time.

5.4 This Section summarises matters for the public record in relation to the deaths and injuries. Clinical matters that must remain private are included in Volume 16. All conclusions and recommendations relating to the casualties are included in the public section, however in one instance, the detail leading to a conclusion is omitted to protect the privacy of the individual.

Medical Screening

5.5 At the time of the incident, all 10 casualties were fit for sea service, nine being Medical Category ONE (1), and one Medical Category THREE (3).

5.6 Four months before the incident, one of the casualties had been diagnosed with a condition that made him prima facie unfit for sea.[ABR 1991, Vol 1, paras 7-146 to 7-149 and Chap 7 Annex P] He was accordingly subject to Interim Medical Survey which made him unfit for sea. The stated diagnosis had the potential to be open to differing clinical interpretations.

5.7 Despite one setback, he had sufficiently improved so as to be assessed by FBWHC as fit to return to sea and he was so made on 22 Apr 98. The member was keen to return to sea.

5.8 On the day of the fire, the member became a casualty, was hospitalised and subsequently, on 18 May 98, made, again, unfit for sea. The injury that the member suffered was of a similar nature to the prior condition. However, it cannot be conclusively established whether the prior condition caused or aggravated the injury suffered. Nevertheless, the Board was concerned to clarify the matter of whether this member should have been to sea.

5.9 In a submission to the Board, SMO FBWHC contended that, to the extent that such a determination could be achieved, the member was cured and therefore fit for sea.

5.10 The Board recognises that it is not in a position to establish the exact diagnosis of the prior condition or the member's clinical state at the time he was made fit for sea. As the Board is unable to determine that his injury on 05 May 98 was related to the prior

condition, and conscious of the fine judgement often called for in the practice of medicine, the Board accepts the decision.

Personnel in MMS at Outbreak of Fire

5.11 The evidence indicates that there were nine personnel in the MMS and tiller flat at the outbreak of the fire; these personnel, their location and final disposition are shown below.

	Location/Last Seen	Escape/Location of Body Outcome
LEUT Walters	Forward middle plates amidships	Escaped via port ladder and Workshop No injuries
MIDN Pelly	Aft middle plates amidships between DAs	Port side middle plates at base of ladder Deceased
POMT Francis	Bottom plates between BME	Escaped via port ladder and Workshop Smoke Inhalation
POMT Hollis	Forward middle plates starboard side	Escaped via port ladder and Workshop Smoke Inhalation
POMT Smith	Bottom plates between BME	Port side middle plates Deceased
LSMT Meek	Aft middle plates starboard side	top plates on port ladder landing Deceased
LSMT Smith	Forward middle plates starboard side.	Escaped via port ladder and Workshop Smoke Inhalation
ABMT Carroll	Port side middle plates.	Port side middle plates at base of ladder Deceased
ABBM Noles	Tiller Flat	Escape ladder to fridge flat No injuries

Fatalities

Cause of Death

5.12 The autopsy reports state that, in each case, death was due to acute smoke inhalation.[E20] The Forensic Pathologist stated in evidence that the key characteristics were the appearance of the body and the high carboxyhaemoglobin (COHb) saturation levels.[T78] The autopsy reports state that, in each case, there was a marked cherry-red colouration to the skin, and there was marked sooting of exposed areas of skin. COHb saturation was in excess of 70% in three of the cases, and 59% in the other. Additional toxicology was negative.

Time of Death

5.13 Dr Cadden stated that, in his opinion, incapacitation would have occurred in approximately five minutes, and death within five to 10 minutes, after the development of a 'fierce fire'. He emphasised that all would have been dead well before the CO₂ drench was activated.[T79]

Pathophysiological Effects of Carbon Monoxide

5.14 The process to death by carbon monoxide toxicity starts with the inspiration of carbon monoxide into the lung and its absorption through the alveoli into the circulation where it binds to the oxygen-carrying molecule in the blood, haemoglobin, to form a complex called carboxyhaemoglobin (COHb). The carbon monoxide molecule has an affinity to haemoglobin that is approximately 200 times that of oxygen, and once the COHb complex has been formed, the haemoglobin molecule ceases to be an effective transporter of oxygen. Death is caused when the overall oxygen carrying capability of the blood is reduced to a level where insufficient oxygen is delivered to the tissues (in particular the brain and heart) to sustain life.

5.15 The pathophysiological impact of carbon monoxide on an individual is measured by the COHb saturation, which is expressed as a percentage of the haemoglobin in the blood that is bound to carbon monoxide. The fatal saturation level of COHb appears to vary widely, however it is generally agreed that levels of 50% are incompatible with life. The wide variety of post mortem levels recorded in the literature (from below 40% up to 80%) appears to relate principally to the rapidity of build up of carbon monoxide concentration in the atmosphere breathed. Individuals who are exposed to rapidly increasing and extremely high concentrations of carbon monoxide will show very high levels of post mortem COHb since they continue to absorb large quantities between incapacitation and cessation of respiration.[E424]

5.16 The very high levels of COHb saturation in each of the fatalities and the nature of the fire propagation support Dr Cadden's opinion of the time of death and that the four died of acute carbon monoxide toxicity prior to the activation of the CO₂ drench.

Conclusion

5.17 All the deaths resulted from carbon monoxide toxicity prior to the activation of the CO₂ drench, and probably within 10 minutes of the outbreak of the fire.

Circumstances of Death

5.18 In each case, death resulted from a failure to escape from the MMS. All personnel who escaped from the MMS survived.

5.19 While some speculation is of necessity involved in an assessment of the circumstances of the death of each member, there are a variety of clues available that assist in coming to reasonable conclusions regarding this matter. Importantly, possible factors that may have contributed to the outcome can be suggested.

5.20 Each body was removed from its place of rest (and the MMS) prior to photographing by the coroner's staff. However, there is evidence as to the location and

disposition of them prior to being moved. Dr Cadden noted in his evidence that the extrication of the casualties from the MMS did not affect his ability to judge the cause or timing of death.[T80]

Conclusion

5.21 The Board is of the opinion that the assessment of the circumstances of the deaths has not been inhibited by the fact of the bodies being moved prior to examination by Coroner's staff.

ABMT Carroll

5.22 ABMT Carroll was supervising the refamiliarisation of AB Liddell into his billet of 3rd Hand. He had been despatched into the MMS to lay out fire hoses after the initial fuel leak.

5.23 AB Carroll was tending a 90 l AFFF trolley mounted extinguisher on the port middle plates at the time of the outbreak of the fire. Evidence was given by LEUT Walters [T611] that he went straight to his extinguisher but to what extent he fought the fire is unclear.

5.24 AB Carroll was found on the middle plates slumped between the Port Diesel Alternator (forward end) and the Evaporator. Evidence was given that the body posture gave the appearance that AB Carroll had been protecting MIDN Pelly.[T672] Life was certified extinct by LEUT AJ Eggerling (MO SUCCESS) at 1312.

Conclusions

5.25 The Board finds that Able Seaman Phillip John Carroll S155254 Date of Birth 17 June 1974 died accidentally from acute carbon monoxide poisoning due to smoke inhalation in the MMS of HMAS WESTRALIA off the coast of Western Australia in the vicinity of Perth at approximately 1045 on 5 May 1998.

5.26 AB Carroll was not suffering from any pre-existing condition or intercurrent illnesses that could have affected his escape or survival.

5.27 The Board is of the view that AB Carroll continued to fight the fire for a time after its commencement. The Board believes he would have been aware that MIDN Pelly was in the MMS, both by seeing her and through her attachment to the 3rd Hand. The Board concludes that AB Carroll, having given up firefighting, probably searched for MIDN Pelly and, having found her, attempted to assist her from the MMS before being overcome by fire fumes.

LSMT Meek

5.28 LS Meek was in the MMS apparently laying out fire hoses after the initial fuel leak.

5.29 LS Meek was last positively sighted by WO Bottomley when he exited the MMS before the fire started moving from the port to starboard sides of the aft middle plates, forward of the DAs.[T267] His presence at the base of the port ladder during the escape of personnel was noted by LSMT Smith,[T1244] and POs Francis and Hollis both

believed he was, or could have been, there when they escaped. LSMT Smith stated that he heard LS Meek call out 'Everyone get out'. [T1244] LSMT was also reported by the I/C SMETs, LS Page, to have said that LS Meek had pushed him up the ladder, and that he would not have got out had LS Meek not done this. [T2422]

5.30 There is some evidence that there may have been a sighting of LS Meek in the MMS shortly after the outbreak of the fire. LS Bromage had just entered the MMS from the fridge flat and gave detailed evidence that he sighted somebody in a sitting posture at the top of the port ladder leading from the middle plates to the top plates as he was standing at the top of the platform just inside the fridge flat door to the MMS. In his statement, LS Bromage identified the person as LS Meek, but in questioning he agreed that that realisation may have come to him later. [E133B, T2024] There were no signs of life, although he admitted he only observed him for a 'split second'. [E133B, T2025] In questioning, he described the person's posture, and this description matched that in which LS Meek was found later by Hose Team 3. [T2024, T486-7, T760]

5.31 LS Bromage stated that he passed the information to CPO Jenkins at Aft DC sometime after the ship went to Emergency Stations. [E133B, T2025] CPO Jenkins' evidence accords with this, [E39A, T3970] although he disagreed with LS Bromage's account of the actual conversation. [T3971] CPO Jenkins stated that he passed this information discretely to HQ1, possibly around the time of the CO₂ drench. [T3971-2] He also stated that the initial entry on the Aft DC Board of 1206 for LS Meek's discovery was not the first time the discovery of a missing person had been reported to him and emphasised that the earlier report was not recorded at Aft DC, but was passed to HQ1, and 'HQ1 would have put that in the [DC] board'. [T565]

5.32 PO Edmonds stated that in HQ1 he received a report at 1108 of a casualty on the top plates, and that he believed that this was a report of LS Meek. [E157, T2320] He reiterated in evidence that he believed the time was 1108, as this was on the incident board, [T2320] however it is noteworthy that the incident board records the time as '08' without the hour designator and with the location as middle plates. [E128] The report was not recorded on the perspex table in HQ1. [E129] PO Edmonds' evidence is consistent with that of LS Bromage and CPO Jenkins, however LCDR Crouch believed that the first report of a fatality came from one of the Hose Teams after the CO₂ drench. [T2965] There is no evidence that this report from LS Bromage, if it did indeed arrive in HQ1, was passed to command.

Conclusion

5.33 The Board notes there is some evidence that LS Meek may have been seen at the top of the port ladder in the MMS by LS Bromage, viewing from the fridge flat door, after the fire erupted and before the CO₂ drench. This information was not positively passed to HQ1 until after the CO₂ drench had occurred. The Board finds it hard to understand how such a sighting could have occurred from a distance in conditions of poor visibility caused by thick smoke and very low light.

5.34 LSMT Meek was discovered on the landing at the top of the port side ladder leading from the middle plates to the top plates. He was in a sitting position, with his back against the inboard/forward ladder rail corner adjacent to the exhaust uptake for the Port Main Engine. [T487] In order to allow effective firefighting to occur, he was moved by the Hose Team to a location adjacent to the bottom of the ladder leading from the fridge flat

landing.[E50A] Life was certified extinct in this location by LEUT A Eggerling (MO SUCCESS) at 1255.

Conclusions

5.35 The Board finds that Leading Seaman Bradley John Meek S147321 Date of Birth 16 July 1972 died accidentally from acute carbon monoxide poisoning due to smoke inhalation in the MMS of HMAS WESTRALIA off the coast of Western Australia in the vicinity of Perth at approximately 1045 on 5 May 1998.

5.36 LS Meek was not suffering from any pre-existing condition or intercurrent illnesses that could have affected his escape or survival.

5.37 The Board is unable to determine exactly where LS Meek was on the outbreak of the fire. It is of the view that, by the time the fire enlarged, he had made his way to the bottom of the port ladder to the top plates and stood there assisting LSMT Smith, and POs Francis and Hollis to make their way up that ladder. At some time after the last of those three exited, he also attempted to make his way up the ladder, probably after realising he was becoming incapacitated, but became overcome by fire fumes at its top, where he collapsed. The Board is of the view that the burns sustained by LS Meek occurred certainly after the onset of unconsciousness and probably after his death.

MIDN Pelly

5.38 MIDN Pelly was a Supply Officer under training, undertaking her first sea posting. She had been tasked to be attached to the 3rd Hand for familiarisation.

5.39 MIDN Pelly was last seen standing on the aft middle plates, forward of and midway between the two DAs.[T267, T1460]. At the time she was standing still observing events, apparently somewhat overwhelmed by them.[T3465]

5.40 MIDN Pelly was discovered on the middle plates slumped between the Port Diesel Alternator (forward end) and the evaporator. Evidence was given that the body postures gave the appearance that ABMT Carroll may have been protecting MIDN Pelly.[T672] Life was certified extinct by LEUT A Eggerling (MO SUCCESS) at 1312.

5.41 The Board has heard of concerns being raised that MIDN Pelly should not have been permitted to enter the MMS at the time of the initial fuel leak, and that when she was seen within the MMS, she should have been ordered out. In considering this issue, the Board has been mindful of the following factors:

- a. previous fuel leaks in WESTRALIA had been a common occurrence, and had been handled without incident, and therefore there was some confidence that this incident would be similarly well handled;
- b. the initial fuel leak, which was not the source of the fire, had been managed promptly and effectively, with shutting down of PME and isolation of fuel supply;
- c. the occurrence of a second fuel leak, which was the source of the fire, within four minutes of the first could not have been foreseen;

- d. the deterioration of the incident to a major fire occurred within seconds, and the attention of all in the MMS was diverted from all else to first aid firefighting;
- e. the emergency evacuation alarm in the MMS, which was activated by LCDR Crouch, had become unserviceable as a consequence of the fire; and
- f. at the time first aid firefighting was abandoned, others within the space attempted to locate MIDN Pelly.

5.42 Additionally:

- a. WO Bottomley gave evidence that he had briefed MIDN Pelly to stay in the MCR if a hazardous situation developed;[T3453-4] and
- b. WO Bottomley also gave evidence that she appeared overwhelmed by the activity surrounding her at the time of the initial leak, and offered the opinion that she may have been unaware of the seriousness of the situation that had developed.[T3454]

Conclusions

5.43 The Board finds that Midshipman Megan Anne Pelly L154029 Date of Birth 8 December 1975 died accidentally from acute carbon monoxide poisoning due to smoke inhalation in the MMS of HMAS WESTRALIA off the coast of Western Australia in the vicinity of Perth at approximately 1045 on 5 May 1998.

5.44 MIDN Pelly was not suffering from any pre-existing condition or intercurrent illnesses that could have affected her escape or survival.

5.45 The Board is of the view that MIDN Pelly probably attempted to escape the fire by moving aft between the DAs, this being the logical means of escape for one unfamiliar with the space. Being unable to find an escape ladder (there was none), she may have either made an attempt to return forward or alternatively may simply have stayed aft in the hope that the smoke might not affect her. In either event, the Board is of the view that AB Carroll, who was aware she was in the MMS, found her and led her back towards the port escape ladder before both were overcome by the fire fumes.

5.46 The Board finds that no blame for MIDN Pelly's presence in the MMS can be attached to anyone. That she was there is of profound regret, however the occurrence of a second fuel leak causing a major fire could not have been foreseen, and the initial leak was being effectively dealt with.

POMT Smith

5.47 POMT Smith was the Assistant Engineering Officer of the Watch (under training).

5.48 PO Smith was located on the bottom plates between BMEs at the outbreak of the fire, working on the fuel leak on PME. He was in the company of PO Francis. Upon the outbreak of the fire, he proceeded forward, to port and then aft along the outboard side

of the PME, slightly behind PO Francis. He was felt by PO Francis to be pushing him up the ladder to middle plates.[T1488]

5.49 POMT Smith was found on the middle plates, port side, slightly forward of the base of the ladder leading to the top plates lying supine, with the head outboard. Life was certified extinct by LEUT A Eggerling (MO SUCCESS) at 1308.

Conclusions

5.50 The Board finds that Petty Officer Shaun Damian Smith S138258 Date of Birth 27 November 1968 died accidentally from acute carbon monoxide poisoning due to smoke inhalation in the MMS of HMAS WESTRALIA off the coast of Western Australia in the vicinity of Perth at approximately 1045 on 5 May 1998.

5.51 PO Smith was not suffering from any pre-existing condition or intercurrent illnesses that could have affected his escape or survival.

5.52 The Board is of the view that PO Smith may have attempted to assist AB Carroll to fight the fire from the port side of the middle plates. Of the three engineering staff who perished, PO Smith was the least familiar with the space, having joined WESTRALIA on 27 Apr 98. It is conceivable that, he became disorientated in his efforts to escape, and so was unable to find the port ladder before being overcome by fire fumes.

Injured

5.53 There were five documented injured. On four of these, appropriate medical documentation (Form PM377, Field Medical Card) was raised on board. There was one casualty for whom no formal contemporaneous record was kept.

5.54 The injured suffered burns to the left hand (two), smoke inhalation (four), and stress reaction (two). All of them demonstrated some degree of emotional distress following hospitalisation.

5.55 Evidence presented to the Board indicated that a number of additional personnel had minor smoke inhalation but did not obtain treatment at any stage.[T291, T967, T2001, E173, T2961-2]

Summary of Treatments Provided

5.56 Treatment of the smoke inhalation cases was uniformly with oxygen by mask. Two of the initial three smoke inhalation casualties had intravenous lines inserted, one with difficulty, and the third case declined to have a cannula inserted. None of the casualties was given any intravenous medication other than analgesia in one case. Apart from the case of smoke inhalation who presented later, none of these cases was given nebulised salbutamol.

5.57 The casualty with the minor burns received no specific treatment for this injury, as it was overshadowed by the severity of his smoke inhalation. Treatment of the more severe burn case was cooling by water followed by the application of a moist dressing.

5.58 The casualty with significant burns required analgesia in the form of penthrane by inhalation, and parenteral morphine (two doses). He was also given prophylactic prochlorperazine prior to the morphine.

5.59 The two cases of stress reaction were treated by supportive care. One was given oxygen therapy in the initial stages and a single dose of prochlorperazine.

Casualty Management Protocols

5.60 Mass casualty management protocols are contained in the RAN Advanced Clinical Manual (RAN MISCPUB 0157), and are formulated so that, where the numbers of skilled medical personnel are limited, casualties are efficiently provided all modalities of treatment to ensure an optimal outcome. The management of smoke inhalation involves the use of oxygen, and the provision of an intravenous line with dextrose 5% infusion. The administration of intravenous corticosteroids (dexamethasone) and nebulised salbutamol follows.[E474]

5.61 Of the smoke inhalation casualties evacuated ashore, only two had intravenous infusions, and one did not. The fluids used included both Hartman's and 'glucose' (presumably dextrose). None received intravenous steroids or nebulised salbutamol. The smoke inhalation casualty treated on board received oxygen and nebulised salbutamol.

Conclusion

5.62 There were some deficiencies in the provision of specific treatment for the smoke inhalation casualties as compared to laid down protocols. These deficiencies did not in the event adversely affect the clinical outcome, and were contributed to by the relative lack of medical officer or sailor supervision of the casualties at RASCO.

Recommendation

<p>5.63 Training of all medical personnel should be based on casualty management protocols.</p>
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Standard of Medical Treatment

5.64 The medical treatment of all casualties was of a high order, considering the circumstances of the number of casualties exceeding the normal ship's medical staff capability.

5.65 In his evidence, Dr P Mark from SJOGHM complimented the ship on its clinical management of casualties on board. He noted that there were no deficiencies in treatment provided, and that all casualties arrived in a satisfactory condition. He commented particularly on the difficult circumstances in which treatment would have been provided. One of the two intravenous lines was serviceable on completion of the medevac, and Dr Mark also offered the opinion that the lack of a medical escort during the medevac had no substantial impact on the patients' care.[T3225]

5.66 The three initial casualties commented on their satisfaction with the medical treatment provided on board, and commended the SMET members.[E109, E124A, T1275] LS Nunn also expressed his satisfaction.[T1356] PO Hollis praised the SMET members

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and in particular LS Page. They displayed professionalism, and calmed and reassured him.[E124A] PO Francis praised LS Page for they way she looked after the injured.[E109]