> essentially eliminated for most scenarios by use of new formulations of high explosive, developed by the Department of Energy weapons laboratories. These formulations, called insensitive high explosive, have been used in all but one nuclear weapon to enter the stockpile since 1980...[88]

11.56 The Committee recognises that older nuclear weapon designs contain fewer safety features and that some of these weapons are probably still deployed.[89] The Committee has been unable to determine if any weapons which are not designed to be one point safe are likely to be on board warships visiting Australia. The additional hazard posed by older weapon designs will diminish as they are progressively withdrawn from service. It appears as if all will have been withdrawn by the middle of the 1990's.[90]

11.57 Very little detailed information appears to be publicly known about the design and safety features of British and French nuclear weapons.[91]

Points Made in Submissions

11.58 Submissions received by the Committee generally

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88. US, Departments of Defense and Energy, Nuclear Weapons Surety: Annual Report to the President 1984, p. II-7. The declassified part of the report does not identify the weapon which does not contain IHE. It appears as if it is the W88 warhead for the Trident II strategic missile: 'Nuclear Notebook', Bulletin of the Atomic Scientists, May 1988, vol. 44(4), p. 55. Retrofitting of weapons with IHE is possible only if the weapon design permits the replacement of the earlier HE with the bulkier IHE, as was the case with the B-61 bomb: US, H of R, Committee on Armed Services, Sub-committee on Procurement and Military Nuclear Systems, National Defense Authorization Act for FY 1988/1989 - H. R. 1748 - Hearings, 24 February 1987, p. 67 (Dr R. Barker, Department of Defense). There does not appear to be any indication that the nuclear warheads of Terrier missiles, ASROC's or SUBROC's have been retrofitted with IHE.
89. cf. supplementary submission from AIRAC, p. 5 (Evidence, p. 705).
90. See para. 11.33.
91. e.g. see UK, Parliamentary Debates (Commons), 6th series, vol. 128, 4 March 1988, Written Answers, col. 730: it is British Government policy not to comment on arrangements which exist to prevent unauthorised use of nuclear weapons.

acknowledged the presence of the various safety features built into nuclear weapons but sometimes suggested that these are not as reliable as claimed. For example, one submission stated that for a nuclear weapon to detonate:

> a sequence of electrical and mechanical procedures must be undertaken. None are immune to tampering. All can be accidentally activated, by operator error, by improper test procedures, or during simulations and war games. Electronic safety mechanisms can always be overcome by determined experts ... there seems to be no technical reason why a nuclear explosion should not occur by accident, or deliberately. Human error or human interference is the most likely cause.[92]

11.59 The Committee does not accept that in any practical sense it is correct to say that 'safety mechanisms can always be overcome'. Such statements appear to ignore the publicly available data on the sophistication of safety devices and procedures. The passage quoted also ignores the fact that simulations, war games, tests or other procedures which could give rise to operator error are not carried out during visits to Australian ports, and that weapons are held in safe storage during such visits (see below).

11.60 The Peace Squadron (Sydney) claimed that they had 'information about US weapons accidents where five out of six safety devices on nuclear weapons have failed', although no details were provided.[93] The Committee is otherwise aware of only one accident about which such a claim has been made. This related to a nuclear bomb dropped in 1961 when a B-52 bomber experienced structural failure during a flight over North Carolina.

11.61 The official view remains that the bomb was unarmed and that there was no chance of nuclear detonation, although the

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92. Submission from Scientists Against Nuclear Arms (WA) and the Medical Association for the Prevention of War (WA), p. 10 (Evidence, p. 796).
93. Submission from the Peace Squadron (Sydney), p. 6.

veracity of this view is a matter of dispute.[94] In any event, the type of weapon involved was not deployed by the United States Navy (and hence could not have been on a warship visiting an Australian port), was not in safe storage at the time, and is no longer in active service.[95]

Safe Storage Regulations

11.62 Accidents are less likely to occur to weapons when they are held in safe storage. Australia has no written agreement with the United States that there will be no handling of nuclear weapons in Australian ports.[96] Nor has it sought any such agreement.[97] The Department of Defence informed the Committee that it saw no need for a written agreement in view of the procedures that the United States is known to follow.[98] It also stated that there was no evidence to suggest that any of the NATO countries fail to observe fully all the safety procedures relating to their armaments while their vessels are in port.[99]

11.63 These procedures relate to both nuclear and non-nuclear weapons.[100] They stipulate that weapons must be in secure storage during port visits, and this precludes any handling of the

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94. G. Hanauer, 'The Story Behind The Pentagon's Broken Arrows', Mother Jones, April 1981, pp. 23-28; 'U. S. Nuclear Weapons Accidents', Strategic Digest, November 1981, vol. 11(11), pp. 931-32. For a well-documented view that the source of the 'five out of six switches' claim, Dr Ralph Lapp, has key parts of his information incorrect, see: R. L. Miller, Under the Cloud: The Decades of Nuclear Testing, (Free Press, New York, 1986), pp. 321, 520.
95. Note also the comment of the Center for Defense Information on the accident that 'as a result of the ... accident many new safety devices were placed on U. S. nuclear weapons and the Soviets were encouraged to do the same': 'U. S. Nuclear Weapons Accidents', Strategic Digest, November 1981, vol. 11(11), p. 932 (reprinted from CDI's Defense Monitor, 1981, vol. 10(5)).
96. Second supplementary submission from the Department of Defence, p. 26; Evidence, pp. 1252 and 1300.56 (Department of Defence).
97. Evidence, pp. 1252-53 and 1300.56 (Department of Defence).
98. Evidence, pp. 1253 and 1300.56-57 (Department of Defence).
99. Second supplementary submission from the Department of Defence, pp. 23-24 (Evidence, pp. 238.278-79).
100. Evidence, p. 1300.56 (Department of Defence).

weapons.[101] The Department of Defence holds copies of the United States and British instructions relating to storage of conventional explosives. It has obtained information informally which is sufficient to enable it to say with confidence that the instructions relating to nuclear weapons are more stringent.[102]

11.64 In response to questions put by the Committee, the Minister for Defence, the Hon Kim Beazley, stated:

> the US has confirmed to us that in all routine peacetime circumstances, US naval weapons are securely and safely stowed in an unarmed condition where they are protected from fire and electrical activity. The US Navy's safety procedures take full account of the risks arising from sources of electromagnetic radiation as well as unauthorised access being gained to nuclear weapons ... [T]he nuclear material in modern nuclear weapons is kept together with the other components of the weapon at all times. This does not however affect the possibility that a nuclear weapon accident might occur or that an accidental nuclear detonation might eventuate.[103]

The Committee accepts this assurance.

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101. Second supplementary submission from the Department of Defence, pp. 26 and 29 (Evidence, pp. 238.281 and 238.284). For discussion of the meaning of safe and secure storage, see Evidence, pp. 1254-55 (Department of Defence).

102. Second supplementary submission from the Department of Defence, pp. 29-30 (Evidence, pp. 238.284-85).

103. Letter from the Minister for Defence, 18 July 1988 (Evidence, p. 1257.01). See also Evidence, pp. 1255-57 and 1300.56 (Department of Defence). On separate storage, contrast the submission from the Department of Defence, p. 23 (Evidence, p. 28): 'it is normal practice to store arming mechanisms in a separate magazine from the weapons themselves', and as long as this separation is maintained accidental arming and nuclear fission cannot occur. In the earliest nuclear weapons, the fissile material was stored apart from the rest of the weapon, and only inserted as part of the arming process. Later weapons did not use the concept of insertable nuclear components as a safety device. The concept has been revived in the 1980's and development work done on it: see US, Departments of Defense and Energy, Nuclear Weapons Surety: Annual Report to the President 1984, p. II-22. It appears that no decision has been made to re-employ insertable nuclear components as a safety device in US weapons: S. Fetter, Towards a Comprehensive Test Ban, (Ballinger, Cambridge, Mass., 1988), p. 39.

11.65 The Committee considered that, in view of this, little would be achieved by seeking a formal written agreement relating to the storage of weapons during visits.[104] Even if such an agreement were could be obtained, it is unlikely that the United States would permit Australian officials to verify compliance by inspecting weapons storage.[105] The point was put to the Committee that the value of any agreement or condition on safe storage would be limited unless Australian authorities are able and prepared to monitor compliance.[106]

11.66 The Committee considered it important that weapons should be placed in safe storage in the vessel at a point clear of the Australian coast.[107] For example, an accident just outside Sydney Heads might affect almost as many people as one at a berth at Garden Island Dockyard.

11.67 The Committee noted, however, the Minister for Defence's statement (quoted above) that the storage arrangements applied 'in all routine peacetime circumstances', not just as ships enter port.[108] The Department of Defence also stated to the Committee

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104. New York City's draft nuclear weapon accident plan in relation to US Navy ships that may be homeported at Staten Island lists as one of the 'assumptions made in planning for emergencies' that 'it is Navy policy during normal peacetime conditions that naval weapons systems will not be armed in port or near New York Harbor': New York City, Mayor's Emergency Control Board, Staten Island Homeport Plan, (Draft, June 1988), p. 47. The need to make this assumption suggests that New York City was unable to obtain any formal written agreement from the US Navy relating to weapon arming. The statements in Evidence, pp. 1317-18 (People for Nuclear Disarmament) on this point are based on an earlier draft of the Staten Island plan.

105. Evidence, pp. 1254 and 1300.57 (Department of Defence). The Department of Defence told the Committee (p. 1300.57):

> in that the Australian Government respects the policy of the US to neither confirm nor deny the presence or absence of nuclear weapons on board visiting warships, we would not seek access to weapon magazines.

106. Letter from Mr P. Hayes, 10 February 1987, p. 1.

107. Evidence, pp. 216-17.

108. Letter from the Minister for Defence, 18 July 1988 (Evidence, p. 1257.01); Evidence, p. 1300.56 (Department of Defence).

that:

> Standard naval procedures provide that missiles and other such weapons should not be removed from their storage or prepared for launch until they are about to be used. For training purposes, dummy weapons and warheads are employed. The Department of Defence is confident that in all routine peacetime circumstances naval nuclear weapons are kept in an unarmed securely stowed condition. ... Given that naval nuclear weapons are always securely stowed in an unarmed condition, there is no need to consider securing them at particular distances from ports, or seeking agreements to do so.[109]

11.68 Both this and the quotation in paragraph 11.64 from the response of the Minister for Defence state that the storage conditions apply in 'all routine peacetime circumstances'. The concept was not defined. In chapter 2, the Committee noted that it had confined its inquiry to visits occurring at a time when neither Australia nor the country to which the warship belonged was engaged in hostilities. This approach, and the use of the concept of 'routine peacetime circumstances', were challenged in a submission from Mr Peter Hayes:

> why assume peacetime operations? Warships are made for crisis and war, not peacetime. 'Peacetime' is not a military concept, at least not an American military concept (it doesn't appear in the official U. S. DOD dictionary of military terms). Nuclear weapons and warships are built to be used in seconds, minutes and hours. 'Peacetime' in the nuclear

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109. Evidence, p. 1300.57 (Department of Defence).

era means permanent mobilization for war.[110]

11.69 The Committee notes that, contrary to this claim, 'peacetime' is a concept used by the United States Department of Defense,[111] and does appear in its official dictionary.[112] The concept plays a key role in the draft nuclear weapon accident plan prepared for Staten Island, New York.[113] Additionally, if weapons can quickly be moved from safe storage to readiness for

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110. Submission from Mr P Hayes, p. 3. See similarly P. Hayes and others, 'Nuclear Weapon Accidents: Are we ready?', Current Affairs Bulletin, September 1988, vol. 65(4), p. 27. Both sources refer to the official US system of defence readiness conditions (Defcons). The apparent inference is that, unless the phrase 'routine peacetime circumstances' can be defined in terms of Defcons, it lacks meaning, or at least lacks precision. There are five Defcons, ranging from Defcon 5 (normal peacetime position) to Defcon 1 (forces deployed for imminent combat): see generally B. G. Blair, 'Alerting in Crisis and Conventional War' in A. B. Carter and others, Managing Nuclear Operations, (Brookings Institution, Washington, 1987), pp. 77-113. It is not obvious how a statement intended for the public would gain in meaning or clarity by referring to the Defcon system, which is itself imprecise as far as the public are concerned. See for example S. D. Sagan, 'Nuclear Alerts and Crisis Management', International Security, Spring 1985, vol. 9(4), p. 100: 'it is difficult to outline with any degree of precision the preparations that take place under the five DEFCONs for three reasons': variations among US commands, threats faced, planned missions and weapon systems; 'the gradations of the system have been greatly altered over time' due to new communications and weapons systems, and new strategic threats; and 'most importantly, the precise details of the DEFCON system are, with good reason, kept highly classified'.

111. For an example chosen at random, see US, H of R, Committee on Armed Services, Defense Department Authorization and Oversight - Hearings on H. R. 1872, 8 March 1985, p. 282 (Prepared Statement of Lt Gen R. K. Saxer, Director, Defense Nuclear Agency): 'To increase weapon survivability and security once they [ie. land-based tactical nuclear weapons] leave peacetime storage, DNA is developing a secure and surviviable weapons container' (emphasis added).

112. US, Joint Chiefs of Staff, Department of Defense Dictionary of Military and Associated Terms, (JCS Pub 1, 1 June 1987, Washhington), p. 274. Although the word 'peacetime' is not defined, the phrases 'peacetime force material assets', 'peacetime force material requirement' and 'peacetime material consumption and losses' are defined. Moreover, the stated purpose of the dictionary is 'to supplement standard English-language dictionaries' (p. i), rather than to replace them.

113. New York City, Mayor's Emergency Control Board, Staten Island Naval Homeport Plan, (Draft, June 1988), p. 47: one of the assumptions on which the plan rests is that:

> it is Navy policy during normal peacetime conditions that naval weapons systems will not be armed in port or near New York Harbor, ... (emphasis added).

use, there is no need to remove them from storage in advance. This would appear, again contrary to Mr Hayes's claim, to reduce rather than increase the likelihood of nuclear weapon handling during any port visits which coincide with moments of international tension.

11.70 Mr Hayes cited no evidence of any United States practices or instructions indicating that the handling of nuclear weapons in an Australian port would occur during a time of heightened tension short of hostilities.[114] (In chapter 12, the reasons are set out why the Committee regards as unconvincing the hypothetical weapons handling scenario he advances.) Nor is the Committee aware of any evidence of this kind.[115]

Magazine Safety

11.71 There is no reason to assume that the possibility of a fire or conventional explosion in a nuclear weapon magazine is any greater that in a magazine used for conventional munitions. The concern for nuclear weapon safety might indicate that it is less.

11.72 Conventional magazine safety features include automatic spraying and flooding facilities (which can be remote controlled), carbon dioxide fire fighting systems and highly trained and

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114. Neither did Mr P. Gilding, who stated in his submission, (p. 8 (Evidence, p. 1341):

> If there were a developing crisis (which may not involve Australia and in fact may be opposed by Australia) it is possible there would be weapons handling in port if the ship were called to a trouble spot from Australian territory.

115. The reference by the Department of Defence to 'routine' peacetime circumstances was not intended to refer to differing levels of alert that forces might be placed on. Rather it was intended to address the case where a nuclear armed vessel might experience propulsion failure, non-nuclear accident, etc. requiring, for example, de-ammunitioning at sea prior to entering a port for dry-docking.

exercised crew.[116] Magazines on conventionally armed warships are often located below the ship's waterline, so flooding can take place even if there is a failure of the ship's pumping system.

11.73 The Committee is not aware of any publicly available data on fires or explosions in magazines, conventional or nuclear, aboard United States warships.[117] Due to the difficulty of concealing a fire that leads to an explosion it seems to be reasonable to suggest that the occurrence of such fires would become public knowledge. The absence of data is at least an indication that there have been few if any fires or explosions.

11.74 The Royal Australian Navy has been unable to find any record of accidents involving magazines holding conventional weapons in its ships while in port:[118] 'nor are any explosions known to have occurred in the magazines of conventionally armed warships for many years'.[119] The Department of Defence informed the Committee:

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116. Submission from the Department of Defence, p. 26 (Evidence, p. 31). See also Evidence, pp. 212-13 (Department of Defence). It should be noted that two warship types used by the Royal Australian Navy, the FFG and DDG, are of US design. As a result, the RAN has detailed knowledge of US magazine design and safety features as they relate to magazines for conventional weapons on these types of vessel: second supplementary submission from the Department of Defence, p. 29 (Evidence, p. 238.284).

117. cf. New York City, Mayor's Emergency Control Board, Staten Island Naval Homeport Plan, (Draft, June 1988), p. 36:

> There has never been an explosive accident involving weapons in storage aboard a modern [US] Navy warship. The only explosive occurrences for weapons in storage aboard Navy ships have been as a result of wartime hostilities.

No source is given for this statement. G. W. Schiele, 'Letting Our Bridges Burn', US Naval Institute, Proceedings, December 1988, p. 125 states:

> According to [US] Navy statistics, from 1973 to 1983 there were an average of 148 fires per year on ships and on land, with fire losses in each of those years averaging almost $19 million. ... Losses from shipboard fires in 1985 totaled $35 million.

The source of the statistics is not identified, nor is any breakdown given on the types of fires (e.g. on land, at sea, on ships undergoing refits, on ships in port) or on the cause or location of shipboard fires.

118. Supplementary submission from AIRAC, p. 5 (Evidence, p. 705). See also Evidence p. 596 (Senator Hamer); pp. 711-12 (AIRAC); p. 1257 (Department of Defence).

119. Evidence, p. 1300.58 (Department of Defence).

> Empirical evidence demonstrates that major fires in the magazines of modern warships simply do not happen. This is because of the effectiveness of the safety features designed and built into them.[120]

11.75 One indication of the safety of modern warship magazines is the incidents involving British ships during the 1982 Falklands campaign.[121] HMS Sheffield was hit by a missile, caught fire, burned for over four hours before being abandoned, and ultimately sank. HMS Glamorgan was similarly hit and the resulting fire took about three hours to bring under control. HMS Ardent and HMS Coventry were hit by bombs and sank, the former after burning for many hours. In none of these cases did the

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120. Second supplementary submission from the Department of Defence, p. 23 (Evidence, p. 238.279). See also Australia, Environmental Considerations of Visits of Nuclear Powered Warships to Australia, (May 1976), p. 16 (Evidence, p. 133):

> the risk of explosion of weapons is made extremely remote by elaborate safety features built into the design of weapons and weapon magazines and strict regulations for weapon handling. The efficacy of these arrangements has been demonstrated over the decades by the lack of any known explosion in peace time in the magazine of a warship in the fleets of any of the major powers.

The safety of warship magazines was also stressed to Committee members by RAN officers at a briefing in Sydney on 14 March 1988. Some submissions regarded the explosion aboard a USSR submarine in the Atlantic on 4 October 1986 as casting doubt on claims of magazine safety: e.g. submissions from Scientists Against Nuclear Arms (Tas), p. 2 (Evidence, p. 821); Mr K. Blake, p. 2. However, the explosion occurred during operational deployment, not a port visit; occurred to a ballistic missile, yet these are not stored in magazines in the same way as smaller nuclear weapons and are not brought into Australian ports; occurred to a liquid-fuelled missile, while the only weapons likely to be brought into an Australian port use (safer) solid fuel; and occurred in a Navy of whose operating safety standards litle is publicly known. Moreover, no radiation hazard from the weapon's warhead was reported to have resulted.

121. The details in the text are taken from D. Brown, The Royal Navy and the Falklands War, (Leo Cooper, London, 1987), pp. 141-44, 192-96, 198, 202, 209-10, 222-23.

ship's main magazines explode.[122] HMS Antelope was hit by a bomb which exploded during an attempt to defuse it. The ship caught fire and eventually the magazines exploded. On HMS Argonaut, an unexploded bomb penetrated the forward magazine, where two Seacat missiles detonated, starting a major fire.

11.76 A further indication of magazine safety is provided by the missile attack on the USS Stark in May 1987.[123] In the resulting intense fires, which lasted over 18 hours, temperatures were high enough to melt parts of the decking and superstructure. A principal fire main was severed. The forward missile magazine was flooded as a safety precaution and no weapons or ammunition exploded.

11.77 The Committee considered whether newer types of weapon storage arrangements might be less safe than traditional warship magazines. In other words, the Committee was concerned with what types of storage were considered to be 'safe' in the context of the understandings that exist regarding safe storage.[124]

11.78 From the published information it seems as if there are three broad types of nuclear weapon storage for surface ships. All also apply to conventional weapons/warheads. One involves the equivalent to traditional munitions magazines, in a well protected part of the ship and often below the waterline.[125]

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122. If the dubious claim is true that some British ships in the Falklands campaign carried nuclear weapons, the lack of any reported nuclear incident from the battle damage and losses can be seen as providing further evidence of the safety of these weapons. On the presence of nuclear weapons, see for example New Scientist, 24 March 1983, p. 834 for a claim that they were aboard both HMS Sheffield and HMS Coventry. For what now seems to be the more widely accepted view that they were not aboard any of the ships, see S. Gregory, 'The Command and Control of British Tactical Nuclear Weapons', Defense Analysis, 1988, vol. 4(1), p. 44.
123. US, H of R, Committee on Armed Services, Report on the Staff Investigation into the Iraqi Attack on the USS Stark, June 1987, p. 26.
124. Evidence, pp. 1254-55.
125. The way in which this can be used for a nuclear-capable missile such as ASROC can be seen from the diagrams in Jane's Weapon Systems 1987-88, (Jane's, London, 1987), pp. 512-13.

11.79 A second type of system involves armoured box launchers. These can be used for nuclear capable Tomahawk missiles. It would seem from the information available to the Committee that the weapons are stored in the self-contained launchers, which remain on deck: there is no separate magazine.[126] The Committee was told that storage within these box launchers is within the meaning of safe storage: the boxes provide a similar level of security to below-deck magazines.[127]

11.80 The third type of system, the vertical launch system (VLS), first became operational in 1986 for launching Tomahawk missiles.[128] The VLS is used on both surface ships and submarines,[129] and it is planned to extend the system to launch ASROC's. The system consists of a honeycomb of cells whose tops are almost flush with the open deck. An individual missile is shipped in a steel canister and the unit is loaded into a cell where it remains while on board. The canister serves as protection during shipping and as a vertical launcher rail when in the cell. Hatch covers close off the cell tops.[130] A deluge system is fitted, with individual controls for each canister in

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126. T. B. Cochran and others, Nuclear Weapons Databook, Volume 1: U.S. Nuclear Forces and Capabilities, (Ballinger, Cambridge, Mass., 1984), p. 264.

127. Evidence, p. 1255 (Department of Defence). See also US, General Accounting Office, Observations on Navy Nuclear Weapon Safeguards and Nuclear Weapon Accident Emergency Planning, (GAO/NSIAD-85-123, 29 July 1985), Appendix 1, p. 9: 'the armoured box launcher includes fire suppression systems that automatically activate ...'.

128. Jane's Weapon Systems 1987-88, (Jane's, London, 1987), p. 514. Unless otherwise indicated, all data on the VLS has been taken from this source. For a schematic diagram of an installed VLS see Aviation Week and Space Technology, vol. 127(19), 9 November 1987, p. 3.

129. The VLS on SSN-688 class submarines is external to the vessel's presssure hull: US, H of R, Committee on Armed Services, Subcommittee on Seapower and Strategic and Critical Materials, National Defense Authorization Act for FY 1988/1989 - H. R. 1748 - Hearings, 10 March 1987, p. 307 (Admiral B. DeMars).

130. The VLS has to be robust in order to ensure that when one missile is fired, missiles in adjoining cells are not affected by the heat and blast of the rocket motor. For a dramatic photograph of these effects as a missile is launched, see M. Hura and D. Miller, 'Cruise Missiles: Future Options', US Naval Institute, Proceedings, August 1986, p. 48.

the event of accidental motor ignition and a separate sprinkler system operates in other spaces in the cluster of cells.[131]

11.81 On the basis of the information provided to it, including some provided at an in camera hearing, the Committee considered box launchers and the VLS to be no less safe in the context of its inquiry than more traditional magazines. On the same basis the Committee was satisfied that the storage arrangements for theatre nuclear weapons launched from submarines' torpedo tubes are compatible with traditional magazine safety standards.

Effect on Magazine Safety of Dry-Docking the Vessel

11.82 The Committee notes that the issue of dry-docking a nuclear weapons capable warship was considered in late November 1983. The possibility was raised that HMS Invincible would undergo repair at Garden Island, Sydney. The British Government ultimately decided for operational reasons that it would not have the repair done in Australia.[132]

11.83 In response to debate on the issue, in February 1984 the Minister for Defence, Mr Gordon Scholes, announced that each request to visit for repairs involving a nuclear weapons capable vessel:

> would have to be considered on its own merits taking into account technical and safety factors, and the strategic and operational circumstances obtaining at the time.[133]

For example, a vessel's fire fighting and magazine flooding

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131. The fire protection system 'is pressurized with 64 gallons of fresh water at 225 pounds per square inch followed by up to 1,370 gallons of sea water per minute as required': S. B. Moorhead, 'The Latest in Ship Weapon Launchers - the Vertical Launching System', Naval Engineers Journal, April 1981, vol. 93(2), p. 95.
132. Senate, Hansard, 15 December 1983, p. 3831.
133. Defence News Release, No. 31/84, 26 February 1984, p. 2.

mechanisms might normally draw on sea water, and hence depend on the vessel being afloat. It would be necessary to determine that an alternative water supply (e.g. connection to shore fire-fighting pressure mains) was available and provided an adequate substitute.

11.84 In January 1989, the Minister for Defence responded to an inquiry from the Committee on whether guidelines existed to allow or preclude dry-docking of a nuclear weapons capable warship. The Minister stated:

> if the condition of a visiting allied warship deteriorated to the point that it needed to be docked, the Australian Government would make docking facilities available subject to the normal safety guidelines. ... The Royal Australian Navy's guidelines provide for the de-ammunitioning of warships, but also permit docking for external repairs without de-ammunitioning under particular conditions. Those conditions include the type of repairs involved, the likely duration of the docking, the location of the area under repair (in relation to the weapon magazines) and the fire-fighting facilities available to the dock. This approach is consistent with the Government's assessment of the safety standards of allied nuclear weapon technology and armament storage.[134]

11.85 The Minister's reply also indicated that docking for which de-ammunitioning would be required would be possible:

> for any docking requirements it would not be necessary on principle for allied warships to declare the nature of their armaments beyond an assurance that de-ammunitioning had occurred (perhaps at sea to a sister ship) should that be required.[135]

11.86 The Committee noted that this policy places visiting

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134. Letter from the Hon K. C. Beazley, 22 January 1989. See also, HR, Hansard, 11 October 1988, p. 1324.
135. ibid.

warships on the same footing as Australian warships, save for the location of de-ammunitioning (if required). The policy does not require disclosure of the presence or absence of nuclear weapons.

11.87 The Committee had no concern about the policy as it applied to a de-ammunitioned ship. By definition, the visit would not be one by a nuclear armed ship.

11.88 For a vessel that has not been de-ammunitioned, dry-docking may be possible without loss of safety. The nature of the repairs (e.g. to a rudder) may involve no disconnection of safety systems and no activities in or near magazines. With regard to fire safety, the Minister for Defence informed the Committee:

> all ships when dry docked are fitted out for fire-fighting. In particular, the ship's fire main is pressurised from a shore-supplied fire main. In the event of a fire in modern ships, the magazines may be flooded and sprayed directly through the fire main. In older ships, magazines are sprayed through the ship's fire main and flooded through bonnets which are fitted to the hull over the normal inlet point that allows flooding at sea. These bonnets are connected to, and pressurised by, the shore-supplied fire main.
>
> These normal fire-fighting precautions would not need to be varied in the case of nuclear weapons capable warships.[136]

11.89 The Committee also notes that the Treaty of Rarotonga, which establishes the South Pacific nuclear free zone and to which Australia is a party, does not restrict the dry-docking of nuclear weapons capable vessels.[137]

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136. Letter from the Minister for Defence, 11 April 1989.
137. ibid. See also HR, Hansard, 5 June 1986, p. 4622. For the text of the Treaty of Rarotonga, 6 August 1985, especially Article 5(2), see International Legal Materials, 1985, vol. 24, p. 1442. Australia ratified the Treaty on 11 December 1986.

11.90 The Committee RECOMMENDS that no dry-docking of nuclear weapons capable vessels be permitted unless either the vessel has been de-ammunitioned outside Australia or it can be guaranteed that the level of safety is at least as high as that for vessels berthed alongside a wharf, as is the normal practice.

Personnel Reliability

11.91 Concern was expressed to the Committee that errors or malicious acts by crew members dealing with nuclear weapons could pose a hazard.[138] Possibilities mentioned ranged from deliberate sabotage through drug or alcohol induced incompetence to simple human error. Reference was made to what was regarded by some as the large number of United States personnel assigned to duties related to nuclear weapons who have been found to be unreliable.

11.92 The issue of potentially unreliable staff was considered in a 1984 report to the United States President, which stated:

> Individuals assigned to designated positions are formally certified upon a favourable medical evaluation, an interview by the certifying official, and the acquisition of required security clearances. Once accepted for a nuclear weapons-related assignment, each person is continually observed/evaluated to assure that the highest reliability standards are maintained. There were 103,832 Department of Defense personnel certified in the program in 1984. Of that number only 3,766 or 3.63 per cent were decertified. Since 1975, the number of persons decertified annually has been relatively low and constant, averaging about

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138. e.g. see the submissions from the Manly Warringah Peace Movement, p. 2; Scientists Against Nuclear Arms (WA) and Medical Association for the Prevention of War (WA), p. 10 (Evidence, p. 796); the Victorian Government, pp. 2-3. See also Evidence, pp. 1199-1201 (Senator J. Vallentine).

4.5 per cent per year.[139]

11.93 The figures on staff removal from weapons programs can be seen as a cause for concern. In the view of the Committee, they are better seen as the application of very stringent standards to ensure that errors or deliberate malicious acts do not occur.[140] These standards are reinforced by stringent safety training and inspections, including inspections by an agency independent of the United States Navy.[141]

11.94 Equally important in the context of Australian port visits is the fact that nuclear weapons are in safe storage during the visits. This appears to the Committee virtually to

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139. US, Departments of Defense and Energy, Nuclear Weapons Surety: Annual Report to the President 1984, p. I-16. In the period 1975-1984 33% were decertified for drug abuse, 21% for psychological, behavioural or physical aberrations and 9% for alcohol abuse: see H. L. Abrams, 'Human Instability and Nuclear Weapons', Bulletin of the Atomic Scientists, January 1987, vol. 43(1), p. 36. See also 'Nuclear Notebook', Bulletin of the Atomic Scientists, July 1988, vol. 44(6), p. 55:

> During 1987, 2,524 nuclear workers lost their bomb credentials. Of these, 892 were bounced out of the program for alcohol or drug abuse (267 for cannabis use), and another 1,632 'decertified' for psychological or emotional instability, insubordination, criminal behavior, negligence of [sic] duty, or 'poor attitude'. At the end of 1987, 94,321 persons were in the PRP [Personnel Reliability Program], down almost 24,000 since 1979.

140. As an illustration of the thoroughness of the US Navy's procedures relating to nuclear weapons, see the detailed instructions in US, Department of the Navy, Loading and Underway Replenishment of Nuclear Weapons, (NWP 14-1 (Rev. C), August 1983). Most of the procedures detailed in this document are not directly relevant to Australian port visits, where nuclear weapons handling does not occur. But they indicate the extreme care taken to reduce to an absolute minimum the chance of human error in relation to the handling and storage of nuclear weapons.

141. e.g. see US, H of R, Committee on Armed Services, Defense Department Authorization and Oversight - Hearings on H. R. 1872, 13 March 1985, pp. 532-33 (Rear Admiral S. Hostettler), for a description of the training, inspections, etc. that are involved in a US Navy crew gaining and retaining their certification to handle nuclear armed Tomahawk missiles. On the nuclear safety rules as they apply in the US Pacific Command, see USCINCPACINST S8110.4C (8 May 1984), Appendix A ('Nuclear Safety Rules'). On the inspection system designed to ensure that the rules are adhered to, see US, Departments of Defense and Energy, Nuclear Weapons Surety: Annual Report to the President 1984, pp. I-16 - I-19: measures include short-notice inspections and surveillance of service-conducted inspections by the Defense Nuclear Agency.

eliminate the possibility of simple human error causing a nuclear weapon accident. It also greatly reduces the scope for malicious acts. The design of storage, fusing and firing procedures ensures that no one person can perform all the steps to bring about nuclear detonation (the 'two-man rule').[142]

11.95 For these reasons the Department of Defence considered the possibility of significant sabotage extremely implausible.[143] The Committee accepts this assessment.

THE ACCIDENT RECORD

Introduction

11.96 One way of assessing the effectiveness of the safety measures taken in the design and storage of nuclear weapons is to examine the accident record. The authors of many submissions

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142. T. B. Cochran and others, Nuclear Weapons Databook, Volume 1: U.S. Nuclear Forces and Capabilities, (Ballinger, Cambridge, Mass., 1984), p. 30. One type of device designed to prevent unauthorised use of a US nuclear weapon is a 'premissive action link' (PAL). This consists of mechanical and/or electronic coded locks. Units having custody of a weapon do not have the code; it would be received if the need arose from one authorised to to order use of the weapon: see generally D. Caldwell, 'Permissive Action Links', Survival, May/June 1987, vol. 29(3), pp. 224-26. The US Navy's limited use of PAL's is described in Vice Admiral G. Millar USN (Ret.), 'Who Needs PALs?', US Naval Institute, Proceedings, July 1988, p. 52:

> The Navy employs use-control devices such as the PAL on nuclear weapons stored ashore or during logistic moves, but not on nuclear weapons on board ships. ... The weapons [on ships] are in secure spaces under heavy guard ... with the weapons in the possession of U. S. personnel who have been strictly screened for reliability. The storage sites - the ships themselves - are well protected and secure. Some Army and Air Force weapons may be more accessible to elements intending mischief; PALs for those weapons are necessary. There does not seem to be such an urgent requirement for the Navy.

Another reason the US Navy does not use PAL's is due to the concern that communication difficulties might prevent the unlocking code from being received by a ship at sea: 'Accidental Nuclear War: A Rising Risk?', Defense Monitor, 1986, vol. 15(7), p. 2.

143. Evidence, pp. 1264-65 (Department of Defence).

referred to what they claimed were the large number of accidents that have occurred involving nuclear weapons, particularly those of the United States.[144] The Committee examined this claim critically in the light of the available information.

United States Definitions

11.97 United States nuclear weapon reporting criteria distinguish between accidents and incidents, a point not appreciated by many of those who made submissions. A nuclear weapon accident is defined by the United States Department of Defense as:

> An unexpected event involving nuclear weapons or their radiological components that results in:
> - A nuclear detonation.
> - Radioactive contamination.
> - The nonnuclear detonation or burning of a nuclear weapon or its radiological components.
> - The accidental or unauthorized launching, firing or use by U.S. Forces (or U.S. supported allies) of a nuclear weapon that can cause the outbreak of war.
> - Seizure, theft, loss (including jettisoning), or destruction of a nuclear weapon or its radiological component.
> - A public hazard, actual or implied.[145]

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144. e.g. see the submissions from the Victorian Government. p. 3; the Peace Squadron (Sydney), p. 6; Greenpeace Australia (NSW) Ltd, Part 3; Assoc Prof P. Jennings, p. 1; Scientists Against Nuclear Arms (Townsville), p. 2 (Evidence, p. 776); Albany Peace Group, p. 1; Inner City People for Nuclear Disarmament, p. 1; Concord, Burwood & District Peace Group, p. 2; Campaign for International Cooperation and Disarmament, p. 1; Balmain People for Nuclear Disarmament, p. 4; Mr R. Bolt, p. 16 (Evidence, p. 966); Scientists Against Nuclear Arms (WA) and Medical Association for the Prevention of War (WA), p. 9 (Evidence, p. 795); Action for World Development (Townsville Group), p. 1; Northside Peace Group, p. 1; Mrs L. Van Geloven, p. 6; Coalition Against Nuclear Armed & Powered Ships, p. 6 (Evidence, p. 1378); People for Peace, p. 1; Scientists Against Nuclear Arms (Tas), p. 2 (Evidence, p. 821); Ms A. Tubnor, p. 4; Friends of the Earth, p. 1; Prof W. J. Davis, p. 52 (Evidence, p. 499).

145. US, General Accounting Office, Nuclear Weapons: Emergency Preparedness Planning for Accidents Can Be Better Coordinated, (GAO/NSIAD-87-15, February 1987), pp. 13-14.

11.98 Nuclear weapon incidents are defined to include matters such as:

> unexpected events involving nuclear weapons, test and training weapons, dummy bomb units, nuclear weapon facilities, components or associated test and handling equipment that do not fall in the nuclear weapon accident categories.[146]

Absence of Accidental Nuclear Detonations

11.99 A recent review of United States Department of Defense documents by the General Accounting Office:

> showed that despite severe stresses imposed on nuclear weapons involved in accidents, there has never been an inadvertent US nuclear detonation.[147]

The United States stockpile averaged over 25,000 nuclear warheads

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146. ibid., p. 15. The category of incidents has, since 1974, been sub-divided into 'significant incidents' and 'incidents'. Prior to 1974, the former were part of the category 'nuclear weapon accident or significant incident'. As set out in US, Naval Weapons Evaluation Facility, Summary of Navy Nuclear Weapon Accidents and Incidents (1975, 1976 & 1977 Supplement), (NWEF Report 1070-2, Albuquerque, NM, 1978), p. 2, the definition of a 'nuclear weapon significant incident' (code named 'Bent Spear') is:

> An unexpected event involving war reserve nuclear weapons or nuclear components which does not fall into the category of a nuclear weapon accident but:
> 1. Results in evident damage to a nuclear weapon or nuclear component to the extent that major rework, complete replacement, or examination or recertification by the ... [Department of Energy] is required; or
> 2. Requires immediate action in the interest of safety or which may result in adverse public reaction (national or international) or premature release of information; or
> 3. Has such potential consequences as to warrant the informational interest or action of the Chief of Naval Operations (Naval Command Support Center).

147. US, General Accounting Office, Observations on Navy Nuclear Weapon Safeguards and Nuclear Weapon Accident Emergency Planning, (GAO/NSIAD-85-123, 29 July 1985), p. 4.

in each year from 1962 to 1983.[148] The safety record therefore rests on a large base and, for that reason, is statistically significant.

11.100 The absence of inadvertent nuclear detonation is also significant in view of what is known of the abnormal stresses experienced by some United States nuclear weapons. For example, in the most recent accident, which occurred in 1980:

> an Air Force Titan II missile exploded in an Arkansas silo. Though exposed to an explosion, the reentry vehicle containing a nuclear warhead was recovered intact and no radiological material was released.[149]

11.101 United States nuclear weapons were accidentally dropped from aircraft over Spain in 1966 and Greenland in 1968. Others in the 1950's were in severe aircraft fires, conventional explosions, and in one case were in a storage bunker into which an aircraft crashed.[150] A United States naval aircraft carrying a nuclear weapon was lost overboard from an aircraft carrier at sea in December 1965. United States nuclear weapons capable warships

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148. T. B. Cochran and others, Nuclear Weapons Databook, Volume 1: U.S. Nuclear Forces and Capabilities, (Ballinger, Cambridge, Mass., 1984), p. 15.

149. US, General Accounting Office, Nuclear Weapons: Emergency Preparedness Planning for Accidents Can Be Better Coordinated, (GAO/NSIAD-87-15, February 1987), p. 52. Although less well documented, it appears that on 4 October 1986 the liquid fuel in a ballistic missile on a Soviet submarine in the Atlantic exploded, but no nuclear detonation resulted: Jane's Defence Weekly, 11 October 1986, p. 759.

150. 'U. S. Nuclear Weapons Accidents', Strategic Digest, November 1981, vol. 11(11), pp. 924-30. This is a reprint of an article which first appeared in the Center for Defence Information's Defense Monitor, 1981, vol. 10(5). The article consists of an introduction and unclassified summaries on each of the 32 US nuclear weapon accidents, prepared by the US Department of Defense; and a commentary on each accident and conclusions, prepared by the independent, Washington-based Center for Defense Information. The US Defense Department material in the article is also incorporated in US, H of R, Committee on Appropriations, Subcommittee on Energy and Water Development, Energy and Water Development Appropriations for 1987 - Hearings, 17 March 1986, pp. 1469-87.

are reported to have been involved in collisions and fires.[151] In no case has nuclear detonation resulted.

United States - Less Serious Accidents

11.102 According to the most recent information on United States nuclear weapon accidents available to the Committee,[152] as of January 1986 there have been 32 accidents. Of these, 31 occurred before 1969 and the remaining one in 1980. As already noted, none of the 32 nuclear weapon accidents resulted in a nuclear detonation. However, 10 released radiological material in the immediate vicinity of the accident and two resulted in a broader dispersal of radiological material from the accident site.

11.103 The two most serious radiological releases both involved the detonation of the conventional explosive in the weapons. In none of the 32 reported accidents was there widespread airborne plutonium dispersal as a result of fire, although over half of the accidents did involve fire.[153] For some of these, the publicly available information does not make clear the extent of radiation dispersal, if any, or whether the fissile material in the weapon was plutonium.

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151. Stockholm International Peace Research Institute, World Armaments and Disarmament: SIPRI Yearbook 1977, (MIT Press, Cambridge, Mass., 1977), chapter 3; S. Gregory and A. Edwards, A Handbook of Nuclear Weapon Accidents, (Bradford School of Peace Studies, Bradford, 1988), chapter 4. See also paras. 5.38-5.39 above on non-nuclear accidents to nuclear powered warships. Many of these are also relevant to the issue of nuclear weapon safety as most of the nuclear powered vessels involved were also nuclear weapons capable, and therefore may have had nuclear weapons on board.

152. US, General Accounting Office, Nuclear Weapons: Emergency Preparedness Planning for Accidents Can Be Better Coordinated, (GAO/NSIAD-87-15, February 1987), pp. 14-16, 52-53. The text, paras. 11.102-11.106 is based on this source, unless otherwise indicated.

153. Figure taken from the accident summaries in 'U. S. Nuclear Weapons Accidents', Strategic Digest, November 1981, vol. 11(11), pp. 924-30. With some early models of nuclear weapons a capsule containing the plutonium or enriched uranium was kept apart from the weapon for safety purposes during most operations. In the reports of some accidents it is unclear if the nuclear capsule was involved in the fire or only the weapon, which in its safety state contained only natural (not enriched) uranium.

11.104 Where information is available it indicates that severe fires do not lead to plutonium dispersal.[154] For example, an aircraft carrying four nuclear weapons caught fire and crashed near Thule, Greenland in 1968. The conventional explosive in the four weapons exploded on impact, scattering the plutonium into the fire. A small amount of plutonium became airborne but the total amount of the plutonium dispersed in this way outside the immediate crash site was considered of no biological significance.[155]

11.105 The accidents resulting in plutonium dispersal all occurred before 1969.[156] This fact, and the limited number and scope of the earlier accidents, have been used by some commentators to argue that even the older nuclear weapons which incorporate less safety features are nonetheless sufficiently safe so as to preclude the need to continue nuclear testing in

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154. e.g. S. Glasstone (ed.), The Effects of Nuclear Weapons, (Rev. edn., USAEC, Washington, 1962), p. 667, which is based on access to classified information and which notes:

> In the few instances in which aircraft containing nuclear weapons have burned, the fissionable material melted and was left on the ground as slag. In this condition, oxides will form on the surface and may become airborne if disturbed, e.g., by the wind, to become an inhalation hazard.

155. H. L. Gjorup and others, 'Investigation and Evaluation of Contamination Levels', USAF Nuclear Safety, 1970, vol. 65(1) part 2, pp. 59-60. A further example, referred to in submissions, involved a BOMARC missile at McGuire Air Force Base, New Jersey in 1960. The missile's fuel caught fire and the warhead was destroyed in the fire, although the high explosive did not detonate. Contamination was limited to an area immediately beneath the weapon and an adjacent elongated area about 100 ft (30 m) long, caused by drain-off of firefighting water: 'U. S. Nuclear Weapon Accidents', Strategic Digest, November 1981, vol. 11(11), p. 931. This report does not state positively that the fissile material in the warhead was plutonium. Controversy arose in 1985 over whether the area of contamination had been understated: e.g. New York Times, 10 July 1985, p. B2, 'Old Missile Site at McGuire Is Still Tainted, Kean Says'. The US Defense Department maintained its view as to the size of the area contaminated.

156. US, Departments of Defense and Energy, Nuclear Weapons Surety: Annual Report to the President 1984, p. 1-6.

order to enhance weapon safety.[157] The point is made in the context of some United States authorities' claims that continued nuclear testing is needed, in part, for this reason, and that therefore a complete nuclear test ban is undesirable.

11.106 The majority of the 32 accidents involved weapons systems no longer in the United States inventory, and occurred during Air Force flights,[158] a point seldom acknowledged by those making submissions.[159] Only three of the accidents related to the Navy. None of the Navy accidents involved a ship while in port or near civilian populations, and none released radioactivity or resulted in severe weapon damage. None of the 32 accidents occurred in circumstances which would arise during a port visit to Australia.

United States - Incidents

11.107 The United States Navy reported 630 nuclear weapon incidents between January 1965 and December 1985, of which 266 involved an actual nuclear weapon.[160] Sixty-six of the incidents involving a nuclear weapon occurred on Navy surface ships in port but none of these involved damage to nuclear components. None of the Navy nuclear weapon accidents or incidents resulted from ship

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157. e.g. J. C. Mark, 'The Purpose of Nuclear Test Explosions', and Paul C. Warnke, 'A Nuclear Test Ban and the Prevention of Nuclear Weapon Proliferation', both in J. Goldblat and D. Cox (eds.), Nuclear Weapon Tests: Prohibition or Limitation?, (OUP, Oxford, 1988), pp. 36 and 327 respectively. In the same context, see also S. Fetter, Toward a Comprehensive Test Ban, (Ballinger, Cambridge, Mass., 1988), p. 58: 'Although the degree of nuclear safety in early designs [of US nuclear weapons] was not as high as it is now, there was an acceptable margin of safety'.
158. 'U. S. Nuclear Weapons Accidents', Strategic Digest, November 1981, vol. 11(11), p. 922.
159. e.g. Scientists Against Nuclear Arms (Tas), p. 2 (Evidence, p. 821) stated in referring to these accidents: 'It must be emphasised that ... all accidents are, prospectively, a possible cause of a major disaster in Australian waters'.
160. The figures presented in Evidence, p. 215 by the Department of Defence suggest that the total of 630 is made up of 2 accidents and 628 incidents.

collision.[161] None occurred in Australian ports or waters.[162]

11.108 The full details of these accidents and incidents are not publicly available. From information that is publicly available,[163] it appears that the majority of incidents can fairly be described as trivial.[164] Some apparently involved matters such as scratched paint or a bent fin on training weapon simulators and flat tires on nuclear weapons carriers.[165] Others involved false

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161. cf. US Congress, Joint Committee on Atomic Energy, Subcommittee on Military Aplications, Proliferation of Nuclear Weapons - Hearing, 10 September 1974, p. 18 (E. R. La Rocque, Rear Admiral USN (ret.)): minor collision in harbour in Malta, in which a US destroyer was hit 'right on the spot where we had some nuclear weapons'. Either this was so trivial that it was not included in Navy records as a nuclear weapon incident, the publically disclosed records are incomplete, or the incident happened before 1965.
162. Senate, Hansard, 14 November 1986, p. 2360.
163. The main sources of information are US, Naval Weapons Evaluation Facility, Summary of Navy Nuclear Weapon Accidents and Incidents 1965 through 1972, (NWEF Report 1070, Albuquerque, NM, 1973); the 1973/1974 Supplement to the Summary, (NWEF Report 1070-1, Albuquerque, NM, 1975); and the 1975, 1976 & 1977 Supplement, (NWEF Report 1070-2, Albuquerque, NM, 1978). The Summary and Supplements were all released under the US Freedom of Information Act, but with extensive deletions having been made in order to protect classified information.
164. Note also that the reported totals include a number of occurrences involving conventional versions of nuclear weapons. They were not required to be reported. They were included, however, as 'the equipment involved is also used with nuclear weapons and a similar accident/incident involving a nuclear weapon could have serious results': US, Naval Weapon Evaluation Facility, Summary of Navy Nuclear Weapon Accidents and Incidents 1965 through 1972, (NWEF Report 1070, Albuquerque, NM, 1973), p. 1.
165. Evidence, p. 215 (Department of Defence); Senate, Hansard, 16 September 1986, p. 481 and 24 September 1986, p. 754. A list of 7 nuclear incidents during 1976-77 was reportedly released by the US Defense Nuclear Agency: M. Kunstel and J. Albright, 'Vandals at Robins Damage Nuclear-Armed Bomber', Atlanta Journal and Constitution, 5 February 1978, incorporated in US, H of R, Committee on Appropriations, Subcommittee on Military Construction Appropriations, Military Construction Appropriations for 1979 - Hearings, 23 February 1978, p. 157-59. Three of the incidents related to the US Navy: 'a Navy unit stored a weapon for 10 days outside the approved storage boundaries, but within a military base'; 'a Navy unit tipped on its side a container with a nuclear weapon in it, damaging the container, but not the weapon'; and 'a Navy unit said slight damage was done to a weapon when a crane operator swung the weapon into a barge during loading operations. No hazard to personnel was reported'. None of these incidents is relevant to warship visits to Australian ports.

alarms caused by faulty monitoring equipment.[166]

11.109 Viewed in this way, the United States Navy's safety record is much less serious than mere citation of the number of incidents would suggest. Yet most of the submissions that referred to the number of incidents recorded appeared not to be aware of the basis of the record-keeping.

11.110 The significance of the number is further reduced from the perspective of port visits to Australia if what is known of the causes of the incidents is taken into account. One commentator noted in relation to the United States Navy's nuclear weapon safety record:

> The major causes of accidents and incidents are personnel error and equipment failure. ... The most frequent type of accident [sic] involves the flooding of nuclear weapons by improper activation of sprinkler systems, rough seas, etc. Other incidents occur during handling and transportation, storage, in assembly or disassembly during maintenance operations, or during testing operations. Some incidents reportedly involve the actual or technical 'inadvertent release' of a nuclear weapon.[167]

11.111 The Committee notes that, of all these causes, only a few of those relating to storage can occur when the weapons are

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166. e.g. US, Naval Weapons Evaluation Facility, Summary of Navy Nuclear Weapon Accidents and Incidents (1975, 1976 & 1977 Supplement), (NWEF Report 1070-2, Albuquerque, NM, 1978), p. 4:
> During 1974 one DULL SWORD [ie. reported nuclear weapon incident] was caused by faulty radiac equipment in which the alarm sounded when no radiation was present. In 1975 four such incidents were reported ... No incidents were reported in 1976 that were caused by the malfunctioning of radiac equipment. However, in 1977 two such incidents occurred ... .

167. I. Y. Lind, 'Summary of Navy Nuclear Weapon Accidents and Incidents 1965-1977', (mimeo, Honolulu, 1986) pp. 4-5. In this comment, the term 'accident' is clearly not being used with the meaning defined by the US Navy (quoted above at para. 11.97).

in secure storage during a port visit,[168] and those that could occur, such as flooding, do not lead to a radiation hazard. Many submissions which referred to the United States safety record failed to appreciate this. For example, one submission referred to events likely to make an accident possible in an Australian port as being:

> moving nuclear weapons between ships in or near ports; helicopter airlift of nuclear weapons; dropping of missiles by mistake; shipping of nuclear weapons back to the U.S. by aircraft from aircraft carriers in port.[169]

All these activities are inconsistent with the safe storage in which nuclear weapons are held during visits to Australian ports.

British Accident Record

11.112 Official information is less readily available on

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168. The breadth of the US Navy's category of 'storage' for incident reporting purposes should be noted. The category used in US, Navy Weapons Evaluation Facility, Summary of Navy Nuclear Weapon Accidents and Incidents 1965 through 1972, (NWEF Report 1070, Albuquerque, NM, 1973), is defined (at p. 28) to include:
> accidents/incidents that occur while the weapon or component is in permanent storage, such as in a magazine or igloo; or temporary storage, such as on a transport vehicle overnight. Accidents/ incidents that occur during transportation or other movement when the vehicle or equipment is temporarily stopped (rest stops in convoy, step control in a handling system, pauses during strike down, etc.) also would fall into this category.

169. Submission from Greenpeace Australia (NSW) Ltd, p. 31. See also the submission from Mr R. Bolt, p. 16 (Evidence, p. 966), which noted that the weapon which appeared to be the most accident-prone was ASROC, and said that ASROC's are frequently carried by US warships visiting Australia. It seems that one major reason why ASROC is the most accident-prone is because it 'is handled more frequently than other surface-launched weapons and is large, heavy, and awkward to handle on a ship that is pitching and rolling': US, Navy Weapons Evaluation Facility, Summary of Navy Nuclear Weapon Accidents and Incidents (1973/1974 Supplement), (NWEF Report 1070-1, Albuquerque, NM, 1975), p. 98. The name of the weapon to which this extract refers was deleted on security grounds from the copy released under the US FOI Act. However, according to I. Y. Lind, 'Summary of Navy Nuclear Weapon Accidents and Incidents 1965-1977', (mimeo, Honolulu, 1986), p. 3, the weapon referred to is the ASROC. Whichever weapon is being referred to, this reason given for the high incident rate is not relevant to visits to Australian ports, when the weapons are in safe storage.

accidents or incidents relating to British nuclear weapons than to those of the United States.[170] In 1982, the British Government said that there had 'never been any incident involving a British nuclear weapon leading to its loss or to the dispersal of radioactive contamination'.[171] In 1987, a British Parliamentary question asked how many incidents there had been in the previous ten years involving nuclear warheads, 'in which the accidental discharge of radioactive material was narrowly averted'. The response was that there had been none in that period involving United States or United Kingdom weapons in the United Kingdom.[172]

Conclusions Based on Accident Records

11.113 The Committee acknowledges that, as a matter of strict logic, the fact that a particular type of accident has not occurred in the past does not prove that it will not happen in the future. The Committee, however, regards the United States Navy's nuclear weapon safety record as having considerable significance. The record is based on a large number of weapons over a long period of time in a wide variety of circumstances,

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170. One unofficial list of incidents involving British nuclear weapons, Stockholm International Peace Research Institute, World Armament and Disarmament: SIPRI Year Book 1977, (MIT Press, Cambridge, Mass., 1977), p. 77, lists only 5 incidents, none involving nuclear weapons of the kinds likely to be aboard a British warship visiting Australia. S. Gregory and A. Edwards, A Handbook of Nuclear Weapon Accidents, (U. of Bradford School of Peace Studies, Bradford, 1988), pp. 156-60, list 17 alleged incidents, most involving aircraft or bases and none of relevance to port visits to Australia. In assessing the accuracy of these lists, it should be noted that both state that HMAS Hobart carried missiles with nuclear warheads in the late 1960's. Even the most elementary research would have indicated that it has never been suggested that Australia was at any time a nuclear weapon state.

171. UK, Parliamentary Debates (Commons), 6th series, vol. 28, Written Answers, 23 July 1982, col. 340. See also ibid., vol. 119, Written Answers, 17 July 1987, col. 676; and vol: 128, 23 February 1988, col. 134: there has never been an accident involving damage to, or release of radioactivity from, a nuclear weapon in the UK, and neither has there been any malfunction of systems associated with such a weapon which could have posed a hazard to servicemen or to members of the public.

172. UK, Parliamentary Debates (Commons), 6th series, vol. 123, Written Answers, 30 November 1987, col. 439.

often much more demanding than those encountered during a port visit.

11.114 The Committee concludes that the known accident/incident records of the United States and British Navies do not demonstrate that a risk arises during port visits by vessels from these navies of sufficient magnitude to warrant contingency planning for a nuclear weapon accident.

11.115 However, as noted in paragraph 2.8, officers within the Department of Defence have prepared a draft document outlining possible procedures which might be required to respond to a nuclear weapon accident in an Australian port. The draft has no formal status or official approval, and the Committee has not had access to it.

11.116 The Committee considers that it would be useful for work to continue on this document, and that the necessary Departmental decision-making procedures be carried out to give the document official status and approval.

11.117 Accordingly, the Committee RECOMMENDS that the Department of Defence continue work on the current unofficial draft document outlining possible procedures for responding to a nuclear weapon accident in an Australian port, with a view to producing an officially approved document. The document should then be made available to the public, in the interests of better informing the community on appropriate response procedures.