CHAPTER 8

CURRENT PLANNING - GENERAL ISSUES

DISCHARGE OF RADIOACTIVE WASTES

8.1 Australian contingency plans for visiting nuclear powered warships deal with the possibility of radioactive waste discharge as well as the possibility of reactor accidents. The sources of radioactive wastes from naval nuclear reactors were described in chapter 4. The United States Navy's apparently excellent record since the early 1970's on waste discharges was discussed in chapter 5. The United States Navy considers that there is no need for monitoring for waste discharges during port visits of the type made to Australia.[1]

8.2 The United States has provided an assurance with respect to its warships visiting foreign ports that:

> No effluent or other waste will be discharged from the ship which would cause a measurable increase in the general background radioactivity of the environment.[2]

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1. 'U. S. Navy Statement on the Safety of Operations of U. S. Nuclear Powered Warships', January 1987 (Evidence. p. 238.242). The US Navy does, however, conduct environmental monitoring in locations where repair or maintenance on reactors is carried out: ibid.
2. 'Standard Statement', para. 2(a) (Evidence, p. 1078). The Department of Defence told the Committee that 'no discharge of radioactive waste is permitted in Australian waters': Evidence, p. 238.291. The Committee noted that Australian legislation prohibiting the discharge of radioactive waste does not apply to visiting warships. The Committee asked the Department to explain its statement in the light of this. In doing so, the Department referred to the 'Standard Statement', not to any Australian prohibition: Evidence, p. 1300.50. No exact figure has been set to define what would constitute the 'measurable increase' referred to in the 'Standard Statement': ibid.

The United Kingdom has provided a similar assurance.[3]

8.3 Compared to a reactor core meltdown, the harm caused by an accidental discharge of radioactive waste would be minimal, as noted in chapter 4.[4] This, taken together with the safety record and the assurances from the United States and the United Kingdom, suggests that there is little need to continue monitoring specifically for waste discharges.

8.4 The Committee considers, however, that the monitoring for radioactive waste discharges should continue in those places where reactor accident monitoring is required. It provides useful reassurance, and also an independent check if allegations are made that there has been a discharge of radioactive waste. The cost is relatively modest.[5]

REACTOR ACCIDENTS - ADEQUACY OF CURRENT CONDITIONS OF ENTRY

Introduction

8.5 In the previous chapter the Committee accepted that the reference accident used by the Department of Defence provided an appropriate basis upon which to evaluate the need for planning for nuclear powered warship visits. In this chapter the Committee considers whether plans are needed for individual ports. It also deals with issues relating to the detail of the current contingency planning, focusing primarily on matters dealt with in Commonwealth documents and hence common to all ports receiving visits. In the next two chapters, the focus is mainly on the

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3. UK 'Standard Statement', para. 2(a) (Evidence, p. 1300.16).
4. Para. 4.30.
5. Department of Defence, Environmental Radiation Monitoring during Visits of Nuclear Powered Warships to Australian Ports: Requirements, Arrangements and Procedures, (May 1988) indicates what resources are required for routine monitoring.

details of the plans relating to individual ports.

Purpose of Visits

8.6 The six conditions under which entry is currently permitted to visiting nuclear powered warships are set out in full in paragraph 2.20. Condition (a), that the purpose of visits is not to be for fuel handling or reactor repairs, is briefly considered in paragraphs 2.58-2.59, and found to be appropriate.

Liability, Indemnity and Assurances

8.7 Condition (b) refers in part to arrangements covering liability and indemnity. The Committee has not made recommendations on these matters. In part this is because the Committee regards aspects of the present arrangements as adequate. In part it is because comprehensive treatment of the issues involved would take the Committee well beyond its terms of reference.

8.8 Relevant material on liability and indemnity is, however, set out in Appendix 4. As this material indicates, an Australian seeking damages for radiation exposure for injuries alleged to have been caused by radiation following a reactor (or weapon) accident occurring on a visiting warship is subject to essentially the same rules in relation to matters such as the level and burden of proof as one seeking compensation from a local defendant for radiation or chemical exposure in, say, the work place.[6]

8.9 It might be argued, for example, that these legal rules of general application are inadequate to cope with the special difficulties facing a person seeking to prove that exposure many years before to a low level of radiation or a toxic substance caused their present injury. This broad issue of possible law reform lies well beyond the scope of the Committee's inquiry.

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6. Foreign States Immunities Act 1985.

8.10 As an alternative, it might be argued that a special set of procedural/evidentiary rules should apply where the injury allegedly arose from an accident involving the reactor (or nuclear weapon) on a visiting warship. The result would be to place a person seeking compensation in relation to a radiation accident involving a visiting warship in a more advantageous position that one in an similar accident involving, say, the Commonwealth's reactor at Lucas Heights or a work-place accident involving a private employer. Tentatively at least, the Committee can see no justification for such discrimination.

8.11 The other element of condition of entry (b) is the requirement for 'provision of adequate assurances relating to the operation and safety of the warships while they are in Australian waters'.

8.12 The Department of Defence regards the standard statements of assurances[7] from the United States and United Kingdom as meeting this requirement.[8] The assurances relating to the non-discharge of radioactive waste, and to the independent review of the reactor safety aspects of design, crew training and operating procedures have already been referred to.[9] The assurances relating to accident notification, salvage responsibility, radiation monitoring, and compensation are referred to below.[10]

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7. These statements are set out in full in Evidence, pp. 1078-79 (US) and p. 1300.16 (UK).
8. Evidence, pp. 183-84 (Department of Defence). Other information from the US Government can also be regarded as providing assurances. See for example 'U. S. Navy Statement on the Safety of Operations of U. S. Nuclear Powered Warships', January 1987 (Evidence, pp. 238.241-43); the annual USN environmental monitoring reports relating to US nuclear powered warships (see Evidence, pp. 238.295-316 for an extract from the report for 1984); and testimony over the years by US Navy officers before US Congressional Committees (e.g. US, H of R, Committee on Science and Technology, Subcommittee on Energy Research and Production, Nuclear Powerplant Safety Systems, 24 May 1979, pp. 888-917 (Admiral H. G. Rickover)). Other relevant information has also been made available by the UK authorities, either publicly or in confidence to Australian authorities.
9. See para. 4.29 and para. 4.36, footnote 39.
10. See paras. 8.105, 9.91, 10.103 and Appendix 4, para. A4.7.

8.13 A key element in the assurances is the statement that reactor safety aspects of design, crew training and operating procedures 'are as defined in officially approved manuals'.[11] The statements of assurances also certify that the safety precautions and procedures followed in connection with nuclear powered warship operations in their country of origin will be strictly observed in foreign ports.

8.14 The Committee recommends in paragraph 9.55 that additional assurances be sought relating to multi-reactor vessels. Subject to this, the Committee regards the statements of assurances as fulfilling that part of condition of entry (b) which requires adequate assurances relating to operation and safety. The Committee can see no advantage in attempting to have the assurances made part of a formal agreement between Australia and the country to which the warship belongs.

8.15 A further issue examined by the Committee was whether it is satisfactory to rely on assurances rather than on the sort of inspection and safety assessments required by many countries for visits by nuclear powered merchant ships.[12] The Committee considers that it is. Assurances rather than inspections are accepted for visits by conventional warships.[13] As far as the Committee was able to discover, no country currently receiving visits by nuclear powered warships requires a formal safety assessment or inspection as a condition of entry.

Controls on Navigation

8.16 No issues were put to the Committee relating to conditions (c) and (d), which require navigational controls on the visiting warship and on other shipping in the vicinity.

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11. US 'Standard Statement', para. 1 (Evidence, p. 1078). See similarly the UK 'Standard Statement', para. 1 (Evidence, p. 1300.16).
12. See para. 3.37 on these requirements.
13. See para. 3.38.

Condition (c) does not distinguish between movement of vessels in ordinary circumstances and movement following an accident. Strictly interpreted, condition (c) would prohibit the movement of an accident-stricken vessel at night or during conditions where visibility is poor. The Committee assumes that the condition is not intended to apply to vessel removal following an accident. The wording, however, could usefully be clarified to put the matter beyond doubt.

8.17 The Committee noted that the British safety plan for Liverpool requires provision of tugs to escort visiting nuclear powered submarines in some circumstances, as a precaution against collision and stranding.[14] No equivalent provision is made in either the Australian conditions of entry, the Commonwealth documentation covering visits, or the plans for specific ports.

8.18 However, the Department of Defence told the Committee:

> In Australia, tug services are requested for all movements of visiting warships. Additionally, visiting NPWs are provided with escort vessels.[15]

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14. UK, Ministry of Defence, Liverpool Special Safety Scheme for Visits to Liverpool by Nuclear Powered Submarines, (April 1986), paras. 26 and 36. See also NZ, Atomic Energy Committee, New Zealand Code for Nuclear Powered Shipping, (AEC500, 1981 edn.), para. 2.3: 'nuclear-powered submarines are to be accompanied by surface escort vessels (provided by the appropriate Port authorities) whenever they move within the harbour'.
15. Evidence, p. 1300.56 (Department of Defence). It is conceivable that a visiting nuclear powered warship at anchor could experience difficulties due to the onset of stormy weather, dragging anchor, etc. Tugs do not stand by around the clock so as to be in a position to provide assistance in such cases. AIRAC suggested in 1984 that anchor drag was a particular problem for submarines at one of the approved anchorages at Darwin: AIRAC, 'Review of Safety and Monitoring Arrangements for Visits by Nuclear Powered Warships', p. 4 (Evidence, p. 755). The VSP(N) responded by stating, in part, that 'prudent seamanship dictates that in the event of a navigationally hazardous situation developing, the (submarine) would weigh and re-anchor ...': quoted in AIRAC, 'Follow-up Actions on Report of Visits to Hobart/Darwin/Brisbane', p. 4 (Evidence, p. 764). The inference from this, and from the use of escort vessels/tugs for nuclear powered vessels entering and leaving ports, is that prudent seamanship would equally ensure that a tug was placed on stand-by if it was likely to be required by a vessel at anchor due to the onset of bad weather, etc.

8.19 The Committee also noted that the British safety plan for Liverpool requires that 'hazardous cargo of any description is not to be dealt with at adjoining berths during the stay in port' of a nuclear powered submarine.[16] Again no equivalent provision is made in either the Australian conditions of entry, or the plans for specific ports.

8.20 The Committee understands, however, that the Department of Defence considers a provision on hazardous cargo unnecessary in plans relating to nuclear powered vessel visits. This is because the necessary safety is provided by the individual port authorities' general controls on use of berths for hazardous cargo. Under these controls, the vessel carrying the hazardous cargo would not be permitted to use a berth in the vicinity of one being used by a visiting nuclear powered vessel. The Committee, however, lacked firm evidence that controls were in place and were observed at all ports receiving visits where adjacent hazardous cargo handling might occur.[17]

8.21 Accordingly, the Committee RECOMMENDS that: either the Visiting Ships Panel (Nuclear) obtain confirmation that, for each port receiving visits, adequate controls exist to prevent hazardous cargo being dealt with in the vicinity of visiting nuclear powered warships; or that a provision to prevent this be added to the general conditions of entry.

Vessel Removal

8.22 Condition (e), capability to remove the vessel following

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16. UK, Ministry of Defence, Liverpool Special Safety Scheme for Visits to Liverpool by Nuclear Powered Submarines, (April 1986), para. 37(a).
17. The issue of hazardous-cargo vessels at Darwin's Iron Ore Wharf when a nuclear powered warship is berthed at the Stokes Hill Wharf has been examined. The conclusion was that 'the distance between the wharves is in excess of 400 m and the presence of such vessels whilst an NPW is berthed at Stokes Hill is not considered to present an unacceptable hazard': letter from the Director, Nuclear Plant Safety Unit, AAEC to the Secretary, VSP(N) 25 June 1981.

an accident, raised no issues of principle. However, the precise wording of the condition, the ability to give practical effect to it, and its contribution to mitigating the effects of an accident all proved contentious. These matters are addressed in chapter 9.

Operating Safety Organisation

8.23 Condition (f) requires that an operating safety organisation must exist for the port being visited. A widespread view in those submissions that addressed the point was that condition (f) should be amended to require additionally that an approved accident contingency plan exist. This raises two issues: whether there is a practical need to have a plan, and, if so, whether the condition of entry should formally require that the plan be in existence.

EXTENT OF THE NEED FOR ACCIDENT PLANS

Introduction

8.24 It was noted in chapter 6 that both the United Kingdom and the United States appear to take the view that no specific accident contingency planning is required for ports receiving the occasional, goodwill-type, visits from nuclear powered warships that are made to Australia.[18] It was noted in chapter 5 that there has never been any accident, incident, event or happening involving damage to a United States or British naval reactor core during a port visit that resulted in any significant release of radiation.

8.25 Taken together with what is known about the safety features of the design and operation of visiting nuclear powered

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18. See paras. 6.4 and 6.24.

warships,[19] these points could lead to a possible conclusion that the current accident contingency planning is redundant.

8.26 This conclusion was not advocated in any government or non-government submission to the Committee. For this reason, and because the Committee regarded a safety-oriented approach as prudent, the Committee rejected the conclusion that no contingency arrangements were necessary.

8.27 The following sections of this chapter discuss the extent to which the Committee considers that contingency arrangements should be required. In reaching its conclusions, the Committee did not investigate the question of the cost of formulating, maintaining and carrying out the arrangements.[20]

Ports and Anchorages for which Arrangements are Required

8.28 The area that would be affected by the reference accident on a visiting warship is limited. The area may, for a particular berth or anchorage, contain neither residents nor temporary population such as workers, tourists, etc. The primary purpose of contingency planning is to protect people from the consequences of a reactor accident. Where there are no people, there is logically no need to have any contingency arrangement to protect population in the event of an accident.

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19. See chapter 4 in the context of discussing the differences between land-based and naval reactors.
20. But see Evidence, p. 1033 (ARL): cost to the Australian Radiation Laboratory of its role in monitoring is about $5,000 to $10,000 per year. In the 1985-86 financial year ANSTO was allocated $50,000 for 'warship monitoring - fares, travelling allowance and freight': Department of Resources and Energy, Estimates of Expenditure 1985-86: Explanatory Notes, (August 1985), p. 77. In the following year, when fewer visits occurred, the corresponding amount was $25,000: Department of Resources and Energy, Estimates of Expenditure 1986-87: Explanatory Notes, (August 1986), p. 72. Other costs are incurred for equipment purchase, training, salaries, etc. On the possible costs imposed by the requirement that there be navigational controls on other shipping during nuclear powered warship movements, see the submission from the Victorian Government, p. 4.

8.29 The Committee accepts this logic. The characteristics of the area visited, not simply the fact of a visit, should also govern the need for contingency arrangements.

8.30 The key question then becomes what characteristics does a berth or anchorage have to have in order that no operating safety organisation or plan is needed. In the Committee's view, this may best be answered not with a single set of characteristics, but by a sliding scale. For example, as the size of the potentially affected population decreases, the need for specific contingency planning may be reduced. The general police or emergency services procedures may, for example, be considered adequate to evacuate a small number of people, and hence specific and detailed provision in a port safety plan may be unnecessary.

8.31 It is necessary, in the Committee's view, to distinguish between the requirement for specific port safety plans for nuclear powered warship visits, and the requirement that adequate safety arrangements exist for the visits. The latter requirement may, in the geographical and other circumstances of a particular port, be able to be met to a greater or lesser extent by safety plans not specifically directed at nuclear powered warship visits. It may also be able to be met in some circumstances in the absence of any plan at all, by relying on the general capability of police and other emergency personnel.

8.32 The Department of Defence has acted in a way that accords with this view. Visits to an anchorage at Jervis Bay have taken place without a specific contingency plan. As the anchorage used was at least 2.2 kilometres from the nearest permanent public habitation,[21] the normal emergency plan for the naval base, HMAS CRESWELL, was considered adequate by the Depart-

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21. The anchorage is about 1.5 km north east of the jetty at HMAS CRESWELL, about 2.5 km from Jervis Bay Village, and about 3 km south east of Hyam Point. The anchorage is in NSW, not ACT, waters. The waters are subject to RAN control, however, under the Control of Naval Waters Act 1918.

ment.[22] Similarly, visits took place without a specific contingency plan to an anchorage near Albany which was at least 2.2 kilometres from the nearest permanent residence. The adoption of the general features of the Gage Roads/HMAS STIRLING arrangements was considered sufficient by the authorities.[23]

8.33 It could be argued, however, that this view on the need for a specific plan has not been adopted consistently. For example, there is no permanent habitation within 2.2 kilometres of any of the anchorages used in Gage Roads off Fremantle. There is minimal likelihood of many people being temporarily in the area as it is almost entirely water.[24] Nonetheless a specific contingency plan has been prepared for these anchorages.

8.34 Before making detailed comments on the current contingency arrangements, the Committee wishes to state what it regards as a basic principle. This is that the contingency arrangements for all ports receiving visits should be based on consistent application of a common standard. In applying the standard to different ports, allowance of course has to be made for different geography, population density, etc. Regard has also to be given to whether the State/Territory responsible for a particular plan

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22. Second supplementary submission from the Department of Defence, p. 13 (Evidence, p. 238.268). See also Department of Home Affairs and Environment, Visits by Nuclear Powered Warships to Australian Ports: Report on Radiation Monitoring during 1983, (DHAE, Canberra, 1984), p. 11, in respect of a 36-hour visit in 1983 by USS Sea Dragon to Jervis Bay:

> The Emergency Planning Zone perimeter for the vessel at the designated anchorage encompassed only Commonwealth property and the only buildings within the Zone were those associated with the Royal Austrlian Naval College. The standing emergency arrangements and procedures at the College for fire protection were considered to be adequate for emergency response within the College and provision was made at the Lucas Heights Research Laboratories of the Australian Atomic Energy Commission in Sydney for emergency personnel and equipment to be available on call.

23. Second supplementary submission from the Department of Defence, p. 12 (Evidence, p. 238.267).
24. Western Australia, State Emergency Service, Western Australian Port Safety Scheme for the Visits of Nuclear Powered Warships to Fremantle and Cockburn Sound, (1986), para. 924.

has chosen to create a plan that is more extensive than that required by the common standard. However, after allowing for these matters, if a plan is deemed necessary for Gage Roads, then a plan should also exist for Jervis Bay and Albany.

Emergency Planning Zones - Basic Features

8.35 One method of evaluating the characteristics of berths and anchorages that may lead to a requirement for plans to be in place is by use of emergency planning zones. The figure of 2.2 kilometres in the three examples in the previous section derives from the size of the second of the standard emergency planning zones currently used by Australian planners. The Committee examined whether the sizes of these zones are appropriate, both because they form a key element in the current plans and because they provide a basis for deciding for which places plans are required.

8.36 Three concentric emergency planning zones have been formulated, centred on the vessel and based on the predicted consequences of the reference accident.[25] They are used for both berth assessment and accident response purposes.[26] Use of zones in this way is an orthodox method of planning for radiation accidents.[27]

8.37 The Department of Defence described the zones as follows:

> Zone 1. A designated area close to the NPW within which protective measures will be implemented automatically upon notification of a reactor accident and within which the port or

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25. Submission from the Department of Defence, p. 5 (Evidence, p. 10).
26. OPSMAN 1 (2nd edn.), Chapter 4, Annex B, para. 1 (Evidence, p. 93).
27. e.g. see International Atomic Energy Agency, Basic Safety Principles for Nuclear Power Plants: A Report by the International Nuclear Safety Advisory Group, (Safety Series No. 75-INSAG-3, IAEA, Vienna, 1988), para. 275.

dockyard authorities or, in the case of an emergency, the designated Operations Officer, can exercise full control over all personnel. For planning purposes Zone 1 should be approximately 600 metres in radius. There would be no restriction on workers, etc, entering the Zone in the normal course of their duties, provided their presence, functions and whereabouts are known to the authorities and they are subject to immediate control. Residence of members of the general public would, except in unusual circumstances, be excluded from Zone 1, but residence of official personnel, night watchmen, etc, might be acceptable on condition they would be evacuated from the area immediately if an emergency were to arise.

Zone 2. Represents the area at risk from inhalation hazards, ie, the plume exposure pathway, and includes Zone 1. The zone boundary represents the limit at which it may be necessary to implement protective measures to prevent radiation doses from inhalation from exceeding the individual dose criteria. Generally, the countermeasures would be less urgent than in Zone 1 and priority would be given to downwind sections where the hazards would be greatest.

Zone 3. Represents the area at risk with respect to ingestion hazards, ie, foodstuffs, milk, water and agricultural contamination, and includes Zones 1 and 2.[28]

Zone Sizes - 'Standard' Zones

8.38 The sizes of these Zones are derived from the current reference accident, taking into account what radionuclides would be released from that accident, the rate of leakage to the atmosphere, atmospheric dispersion mechanisms, and the meteorological characteristics of the ports. It would be possible to determine specific values for these factors based on the characteristics of each class of visiting vessel and of each port visited. If this were done, the size of the Zones would vary from

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28. Submission from the Department of Defence, pp. 5-6 (Evidence, pp. 10-11). The same text is set out in ANSTO, 'Basis of Berth Assessment', (August 1986), para. 2 (Evidence, p. 259).

port to port, and according to the type of visiting vessel.

8.39 In practice, the Department of Defence and the Australian Nuclear Science and Technology Organisation (ANSTO) have used the same values for all currently-approved ports and vessel types, with two exceptions (discussed below). Using these 'standard' values, the calculated maximum zone sizes are: Zone 1 - 600 metres; Zone 2 - 2.2 kilometres; and Zone 3 - several kilometres.[29] Two points should be made regarding these Zone sizes.

8.40 First, the application of the same values to different ports results in extra-safe values being applied in respect of some situations. For example, the planners assume that there could be a period of extreme atmospheric stability, and hence that any radioactive plume would remain concentrated rather than dispersed. It should be explained that plume concentration presents a greater hazard than dispersal. Exposure to radiation at doses exceeding the emergency reference levels will occur most rapidly if the plume remains concentrated.[30] Widespread dispersal by strong winds minimises or eliminates the possibility of individuals being exposed to such doses.

8.41 Atmospheric stability is less likely at, say, Gage Roads off Fremantle than at, say, Hobart.[31] Measured on this factor alone (and hence artificially), what is safe for the latter becomes even safer for the former. On the same one-dimensional (and hence artificial) basis considering only reactor power

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29. OPSMAN 1 (2nd edn.), Chapter 4, Annex B, para. 6 (Evidence, p. 94). Contrast ANSTO, Radiation Monitoring Handbook for Visits by Nuclear Powered Warships to Australian Ports, (ANSTO, Lucas Heights, NSW, 1985), p. 5 (Evidence, p. 299): with respect to the inhalation hazard, 'persons outside zone 1, up to several kilometres from the NPW, could ... be at risk from exposure to radioiodines' (emphasis added). This appears to be incorrect as it is inconsistent with all the other information received by the Committee from ANSTO and the Department of Defence.
30. Evidence, p. 1297 (ANSTO). See also Evidence, p. 238.288 (ANSTO).
31. Department of Defence, The Environmental Impact of Visits by Nuclear Powered Warships to Australia, (July 1974), paras. 204 and 220.

levels, a visit by a submarine is safer than that of a cruiser. The plans cater for the size of reactor aboard the latter, and hence include an added margin of safety when the smaller reactor of some visiting submarines is present.

8.42 Secondly, for the purpose of responding to an accident that has actually occurred, the boundaries and circular shape of Zones 2 and 3 are not fixed. The actual sizes and shapes of the Zones will vary inwards from these maximums according to the severity of the accident and the meteorological conditions existing at the time. They will be determined by measurement of radiation and contamination levels following an accident.[32]

8.43 The Zone sizes set out above are practical rather than theoretical maximums. Safety-oriented assumptions are made by the planners as to the degree of atmospheric dispersion that could take place. While it is highly unlikely that all these assumptions would be exceeded together in practice, it is not physically impossible.[33] The Committee was given no reason to regard the assumptions as anything other than adequately safety-oriented.[34]

Zone Sizes - 'Non-Standard' Zones

8.44 There are at present only two places for which Commonwealth planners[35] have used other than 'standard' values. These are the approved berth at Macquarie Wharves, Hobart and one of the approved anchorages at Gage Roads off Fremantle.[36] The

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32. Submission from the Department of Defence, p. 6 (Evidence, p. 11). The submission refers to Zones 1 and 2 but clearly this is a typographical error: see OPSMAN 1 (2nd edn.), Chapter 4, Annex B, para. 5 (Evidence, p. 94).
33. Evidence, p. 238.288 (Department of Defence); p. 411 (ANSTO).
34. cf. the Committee's conclusion in paragraph 3.14 that planning should not be based on the worst physically possible case.
35. See para. 8.50 for the variation made by Tasmanian planners in relation to the primary anchorage in the Derwent near Hobart.
36. The anchorage is that marked 'D' on the chart reproduced in Evidence, p. 1128.

parameter relating to vessel removal time has a 'standard' maximum value of 24 hours.[37] This value has been altered to three and a half hours for the Hobart berth,[38] and two hours for the Gage Roads anchorage.[39] For the Gage Roads anchorage, the parameter relating to reactor size has also been altered to permit the anchorage to be used by vessels having a reactor power output greater than 100 Mw(t).[40]

8.45 The effect of altering these parameter values is to alter the size of the Zone 2 used in each case for emergency planning. For the berth at Hobart, the Zone 2 size is reduced to

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37. OPSMAN 1 (2nd edn.), para. 201 (Evidence, p. 49). The period of 24 hours has been chosen as a time limit so as to avoid a second period of continuous atmospheric inversion. Under this condition the air remains extremely stable, and therefore airborne contaminants remain concentrated while they drift slowly away from their source. This condition is expected to be most intense on calm cloudless nights - hence the value of setting a time limit that avoids the possibility of two nights exposure. See Department of Defence, The Environmental Impact of Visits by Nuclear Powered Warships to Australia, (July 1974), para. 129; submission from ANSTO, Addendum, p. 5 (Evidence, p. 383); Evidence, p. 1297 (ANSTO). Note that the berth that was once approved at Melbourne had a vessel removal time specified of 5 hours: OPSMAN 1 (original edition, 1981), Chapter 3, Annex B. The berth at Melbourne is no longer approved for use by visiting nuclear powered warships.
38. Second supplementary submission from the Department of Defence, p. 7 (Evidence, p. 238.262). See also the Hobart Safety Scheme, paras. 320 and 325(b). A part of the requirement is that the removal 'proceed away from the berth at a minimum speed of 3 knots [5.56 km/h]': letter from the the Director, Regulatory Bureau, AAEC to the Secretary, VSP(N), 18 April 1985, (AAEC (SP)/R7, Supplement 1, Addendum 1), p. 2. This speed is calculated on the basis that, once the vessel is more than 5 km from the wharf, radiation from it will no longer make a significant contribution to the total doses received by those in the vicinity of the wharf. These doses are the critical ones in the overall assessment of the berth: ibid., p. 1.
39. Evidence, p. 443.469 (ANSTO). See also the WA Port Safety Scheme, para. 925. In the second supplementary submission from the Department of Defence, p. 7 (Evidence, p. 238.262) the time is stated as 3 hours, but this is incorrect.
40. The only vessels currently visiting within this category are the US Nimitz-class aircraft carriers.

1.2 kilometres from the 'standard' 2.2 kilometres.[41] The effect of reducing the removal time allowed at Gage Roads is also to reduce the size of Zone 2. But this reduction is more than offset by the effect of the increase in the reactor-size parameter, so that the net effect is to increase the Zone 2 size to 3.5 kilometres.[42] In neither place has the alteration of parameters led planners to alter the size of Zone 1.

Appropriateness of the Zone Sizes

8.46 No detailed argument based on the reference accident was put to the Committee that the 'standard' Zone sizes were too small. In contrast, the implications of ANSTO's revised accident model[43] were that the Zone sizes might well be able to be reduced by a considerable amount without sacrificing safety.

8.47 The reasons were set out in paragraphs 7.21-7.25 why the Committee considers that its inquiry should, in resolving questions of this kind, refer to the current reference accident rather than the revised accident model. On this basis, the Committee considers that the 'standard' Zone sizes are appropriate.

8.48 The acceptability of the variations used for the berth at Hobart and the anchorage at Gage Roads depends on whether the

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41. Hobart Safety Scheme, paras. 320 and 325(b). Using 'standard' parameter values for this berth, the 1973 berth assessment concluded that the number of people for whom countermeasures would be required following a reference accident was too large to be acceptable, and unrestricted use of the berth could not be recommended: ANSTO, Assessment of Berths for Operational Use by Nuclear Powered Warships in Australian Ports: Supplement No. 1: Macquarie Wharf and Anchorage, Hobart, (AAEC (SP)/R7, Supp. 1, September 1973), p. 6. As indicated in Addendum 1 to this assessment (18 April 1985), p. 2, the effect of reducing the time allowed for vessel removal is to reduce considerably the number of people for whom countermeasures could be required following a reference accident at the berth.
42. Evidence, p. 238.288 (Department of Defence); p. 443.469 (ANSTO).
43. See para. 7.17 for a description of this model.

requirement of vessel removal within the reduced time allowed can be met in practice. The subject of vessel removal is discussed in chapter 9. The conclusion reached there is that the shorter removal times are feasible.[44] Therefore, the Committee considers the Gage Roads anchorage and Hobart berth variations acceptable.

8.49 The Committee noted that it would be possible to specify shorter vessel removal times for berths or anchorages where the 24-hour limit currently applies. Provided assurances could be obtained that the shorter times could be met, Zone 2 sizes could be reduced in the same way as has been done for the berth at Hobart.

8.50 This has been done by the Tasmanian authorities with respect to the primary anchorage in the Derwent near Hobart. Although the berth was assessed using 'standard' values and found to be suitable, the Hobart Safety Scheme proceeds on the basis that a three and a half hour removal time applies.[45] This reduces the area in which planning for countermeasures such as evacuation is required (ie. the Zone 2) to 1.2 kilometres. It also simplifies the Hobart Safety Scheme, as planning parameters are the same for the berth as for the primary anchorage. On the other hand, the reduced time allowed for vessel removal places greater stress on the arrangements for early-warning monitoring and post-accident vessel removal.

8.51 The fact that 'standard' parameters have not been varied in this or some other way at places other than one of the Gage

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44. See paras. 9.78 and 9.80.
45. Hobart Safety Scheme, paras. 320 and 325(b) and Chapter 8, Annex C.

Roads anchorages and at Hobart reflects a choice by planners.[46] The Committee does not regard the differing approaches taken at different ports as a matter for criticism.

8.52 A further issue relates to the size of Zone 1. It may not be immediately obvious why, where alteration of a parameter value leads to an alteration in the size of Zone 2, there is no corresponding alteration in the size of Zone 1. However, the basis of calculating the size of Zone 1 is not the same as for Zone 2, and as a result the size of the two Zones are not directly linked.

8.53 The size of Zone 2 is determined by the time taken for a person to receive an exposure to radiation in excess of the emergency reference level at a given distance from the reference accident.[47] The size of Zone 1 reflects the fact that it is an area in which immediate protective measures such as evacuation will be taken. These measures will be taken before the results of post-accident monitoring are known.

8.54 The 600 metre radius of Zone 1 has been chosen so as to allow at least an hour following the reference accident for the fact of a radiation leak and its significance to be determined, for radiation monitoring to be started, and for the activation of

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46. For example, 'standard' parameters have been used in relation to the approved berths at Darwin. The population distribution within Zone 2 is such that the criteria for berth approval can be met, using the 'standard' 24-hour vessel removal time. This results in a Zone 2 of 2.2 km. Had the authorities wished to have a smaller Zone 2, and hence reduced the area in which planning for protective measures would be required, they could have examined the feasibility of allowing a maximum of less than 24 hours for vessel removal. If an assurance could have been obtained from the RAN that a vessel removal time of, say, three hours was feasible, the size of the Zone 2 could have been reduced considerably.
47. See the graphs contained in ANSTO, 'Visits by Nuclear Powered Warships: Revised Accident Model', (June 1986), figs. 1-3 (Evidence, pp. 1300.26, 1300.30-31). Although the graphs have been drawn to illustrate the differences between the current refernece accident and the revised accident model, they also illustrate the way in which receipt of a radiation dose at the emergency reference level is related to the duration of exposure and the distance from the source of the radiation.

the emergency organisation. Only if the maximum time allowed for vessel removal were to be set at less than 1 hour would reduction in vessel removal time affect the size of Zone 1.

Extent of Planning Required

8.55 To summarise the discussion so far, the Committee has accepted that there should be contingency arrangements for at least some of the places that nuclear powered warships might visit in Australia; that the extent and nature of the arrangements should be determined by the characteristics of each place visited; and that the planning Zones currently used provide an appropriate measure of the types of responses required at differing distances from the accident site.

8.56 It follows from this that the Committee accepts that the accident response measures identified as appropriate for each Zone define the degree of organisation and planning required for that zone. For example, in the case where no people are within 2.2 kilometres of a berth or anchorage, there is no need to contemplate measures to protect against the inhalation hazard. If no people are expected to be in an anchorage's Zone 1, there is no need to contemplate measures to achieve immediate evacuation of the Zone.

8.57 Where there are eventualities, defined by reference to one of the Zones, that need to be taken into account the question arises whether a formal written plan is required in all cases to cater for them. The Committee does not consider that this is required. In some situations the eventualities that would have to be catered for would be too simple to require specific planning. An example would be the evacuation of a handful of people, which could be achieved under general police or emergency services procedures.

8.58 In other situations, the eventualities could be avoided

by measures put in place for the duration of the visit. For example, if the only people likely to be in Zones 1 and 2 are recreational land-users, it might be more practical to exclude them from the area during the visit. This would avoid the need to consider protective measures if an accident occurred. Specific visit operational orders can be used to achieve this result without any need for a standing plan.[48]

8.59 Visits are only permitted to approved berths and anchorages. The criteria for approval give the result that berths and anchorages are not used where population distribution and related factors are such as would prevent effective evacuation from Zones 1 and 2.[49] In other words, situations in which effective, workable plans would be difficult to devise are avoided by withholding berth or anchorage approval.[50] However, if the most difficult situations are avoided and there is no need for plans for the simplest situations, it can be argued that there is a middle range of situations where the actions required would be sufficiently complex to benefit from planning.

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48. On the role of Visit Operation Orders/Instructions, see para. 2.34.

49. Submission from the Department of Defence, pp. 6-7 (Evidence, pp. 11-12) sets out the criteria, which operate by reference to doses of radiation to the thyroid gland due to exposure to radioactive iodine.

50. This has occurred with respect to Sydney. A 1978 study found:

> The suitability of the berths proposed for nuclear-powered warships in Sydney Harbour rests on an ability to
> . Remove a stricken vessel from the proposed berths clear of Sydney Heads within four hours of a Reference Accident
> . Evacuate residents nearest to the berths within two hours of a Reference Accident.

NSW, Report of the Interdepartmental Committee on Visits of Nuclear-Powered Warships to New South Wales Ports, (March 1978), para. 6.1. An additional constraint was the lack of an appropriate remote anchorage to which a vessel could be removed following an accident: Australia, Visits of Nuclear Powered Warships to New South Wales Ports, (September 1977), para. 54. While all these constraints were in theory able to be overcome by suitable accident contingency planning, the implementation of the required planning would have imposed severe practical problems and allowed little margin for the unexpected. As a result, the decision was made that the proposed berths should not be approved: second supplementary submission from the Department of Defence, p. 5 (Evidence, p. 238.260).

8.60 Alternatively, it can be argued that the berth and anchorage assessment criteria should be altered so as to prevent visits in this middle range of situations. This alternative would exclude several of the berths presently used: for example the Zone 2, the area at risk from inhalation hazards, for the approved berth at Darwin's Stokes Hill Wharf takes in much of the city's central business district. The Committee sees no need to prevent visits to berths and anchorages which, with appropriate accident contingency planning, can accommodate visits safely.

8.61 This still leaves the question of whether the existence of a plan for what the Committee has referred to as berths or anchorages in the middle range of risk should be made a formal condition of entry.

8.62 At present the responsibility for the preparation of an effective safety plan lies with the relevant State or Territory government in respect of ports under their control.[51] The Commonwealth encourages the preparation of plans,[52] and provides technical advice and other assistance where required.[53] In addition, the Natural Disasters Organisation, an agency within the Defence Portfolio, has the responsibility for confirming that a completed safety plan is in existence.[54]

8.63 The existence of an effective port safety plan is not a

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51. OPSMAN 1 (2nd edn.), paras. 322 and 402 (Evidence, pp. 67 and 69).
52. Second supplementary submission from the Department of Defence, p. 4 (Evidence, p. 238.259).
53. OPSMAN 1 (2nd edn.), para. 403 (Evidence, p. 69).
54. Second supplementary submission from the Department of Defence, p. 14 (Evidence, p. 238.269). Contrast OPSMAN 1 (2nd edn.), para. 314(b)(1) (Evidence, p. 64) where the NDO's function is listed as 'confirming the availability of the Port Safety Organisation', rather than of the plan for the port. It appears that, while OPSMAN 1 only imposes its stated requirement, the requirement to confirm the existence of a plan arises from the arrangements under which the Natural Disasters Organisation operates.

formal condition of entry.[55] The Committee understands, however, that the Visiting Ships Panel (Nuclear) does not currently approve visits unless it is satisfied that the visit could take place safely.[56] In practice, this means that, for those ports which the VSP(N) considers a specific plan to be necessary, visits will not be approved unless an appropriate plan exists.

8.64 The Committee considers that this practice should be put on a formal basis. Accordingly, the Committee RECOMMENDS that an additional condition of entry be introduced. This should require the existence of a specific safety plan for those ports where the Visiting Ships Panel (Nuclear) considers that a specific plan is necessary to ensure safety in the event of an accident.

8.65 If the lack of State/Territory plans were to impede essential Commonwealth Government requirements, the Commonwealth should implement its own plan using its powers under the Constitution.

REMOTE ANCHORAGES

Criteria

8.66 With the exception of Jervis Bay, the approval of berths and anchorages at each port has been accompanied by the approval of one or more remote anchorages to which a vessel can be removed following an accident. (As noted above, visits to Jervis Bay are made only to an anchorage remote from civilian residential areas.) The Department of Defence's criteria for remote anchorage

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55. Second supplementary submission from the Department of Defence, p. 4 (Evidence, p. 238.259).
56. Contrast the first supplementary submission from the Department of Defence, section 6B (Evidence, p. 238.251):

> Were further NPW visits to be made to Victoria, it would be a matter for the Victorian authorities to decide what depth of planning it should undertake ... [for the visits].

approval are that the anchorage should:

> (a) have complete isolation from all populated areas for a radius of 1.5Km;
>
> (b) be surrounded by a further zone 5Km in radius, from which the population could be evacuated if desired; and
>
> (c) be outside normal navigation routes.[57]

The basis for the size of these two zones was provided to the Committee by ANSTO.[58]

Adequacy of the Criteria

8.67 No detailed or documented argument was put to the Committee that the criteria used for assessing the suitability of remote anchorages were incorrect or inappropriate. However, it appears that the 1.5 kilometre radius of the isolation zone was and is intended to be 1.6 kilometres.[59]

8.68 The Committee RECOMMENDS that the zone of complete isolation around a remote anchorage be specified as 1.6 kilometres.

8.69 The Committee was told by ANSTO that the 5 km zone of possible evacuation is now recognised as giving a very wide margin of safety. A 1987 assessment considered in detail the possible doses resulting over 10 days from the continuing leakage of radionuclides from the reactor containment to the atmosphere

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57. Submission from the Department of Defence, p. 7 (Evidence, p. 12); ANSTO, 'Basis of Berth Assessment', (August 1986), para. 7 (Evidence, p. 260).
58. Evidence, pp. 433.466-68 (ANSTO).
59. The appropriate distance was in the early 1970's regarded as 1 mile: Department of Defence, The Environmental Impact of Visits by Nuclear Powered Warships to Australia, (July 1974), para. 154. In the explanation ANSTO provided to the Committee a distance of '1.6 km (1 mile)' is used for the exclusion zone: Evidence, p. 443.467.

following the reference accident.[60] Conservative (ie. safety-oriented) assumptions were made.

8.70 The result of the assessment:

> suggests that evacuation might be required by the NHMRC recommendations [on emergency reference levels] out to 1.6 km or so, if no action were taken to reduce the rate of release of radioactive material from a stricken vessel at a remote anchorage, but not out to 5 km, and thus supports the 1972 decision that an exclusion zone of 1 mile and a low population zone of 3 miles would provide adequate protection from exposure to airborne material.[61]

DIVISION OF RESPONSIBILITIES BETWEEN GOVERNMENTS

8.71 Under present arrangements, the responsibility for different aspects of contingency planning is allocated to either Commonwealth or State/Territory authorities.[62] The plans relating to visits to specific ports, and the Commonwealth's umbrella document, OPSMAN 1, set out the division explicitly and in

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60. ANSTO, 'Visits by Nuclear Powered Warships: Radiological Consequences of Releases from Remote Anchorages', (August 1987). This assessment also considered the effects of releases over a 20-day period and canvasses an alternative scenario in which leakage is from the (primary) containment to adjacent machinery compartments. On some vessels at least, these compartments are designed to act as secondary containment (see para. 4.63 above). The scenario hypothesises that a warship commander might wish to vent the machinery spaces to the atmosphere in a single 'puff', so as to reduce the radiation hazard to crew having a need to enter. From the assessment it can be seen that the scenario can be safely accommodated within the existing remote anchorage criteria, save in the unrealistic case where the voluntary release is made in an instantaneous way and at a time when the wind speed, direction, etc are least favourable to safety. In this worst-case situation some evacuation could be required beyond 5 km from the vessel: ibid., p. 3 and Appendix, paras. 9-10.
61. Evidence, p. 443.468 (ANSTO). The reference to the 1972 decision appears to be to the decision formally reported in Department of Defence, The Environmental Impact of Visits by Nuclear Powered Warships to Australia, (July 1974), para. 154.
62. See para. 2.32.

detail.[63]

8.72 The authors of a few submissions criticised what they saw as confusion over the division of responsibilities between the authorities.[64] However, the examples provided were based on inquiries made to State officials in respect of ports that do not receive visits. No examples of confusion of roles or responsibilities in the contingency plans for ports currently receiving visits were brought to the Committee's attention.[65]

8.73 The governments of the Northern Territory and of the States which currently receive visits indicated to the Committee that they considered the present division satisfactory.[66] Similarly, none of the Commonwealth agencies who made submissions to, or appeared before, the Committee indicated that the division of responsibilities operated to prevent effective contingency arrangements.

8.74 During visits to Tasmania and Western Australia, members of the Committee examined the way the divided responsibilities would be exercised. They found no basis on which to conclude that the division of shared responsibilities between Commonwealth and State authorities would cause problems in the event of a reactor

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63. e.g. OPSMAN 1 (2nd. edn), paras. 306-308, 315-323, 402-403 (Evidence, pp. 62, 64-68, 69); WA Port Safety Scheme, Part 2; Brisbane Port Safety Plan, paras. 316-334; Darwin Port Safety Plan, Chapter 7; Hobart Safety Scheme, Chapter 5. See also HMAS STIRLING Sub-Plan, paras. 1301(5)-(8) and Annexes A-C.
64. e.g. submissions from Illawarra People for Nuclear Disarmament, pp. 1-2; Australian Nuclear Free Zones Secretariat, p. 4.
65. When Senator Vallentine appeared before the Committee she asserted that in the WA Port Safety Scheme there were 'contradictions' in the setting out of duties under the Scheme: Evidence, pp. 1226-27. Senator Vallentine undertook to provide details to support this claim. However, in providing follow-up information she did not identify any specific provisions of the Scheme which were contradictory: letter from Senator J. Vallentine, 19 August 1988.
66. Submissions from the Northern Territory Government, p. 2; the Tasmanian Government, p. 5. The submissions from the Queensland and Western Australian Governments did not suggest that they regarded the division as unsatisfactory.

accident. Commonwealth authorities appreciate the necessity of maintaining good relations with their State or Territory colleagues so as to ensure contingency planning operates effectively.[67]

CURRENCY OF BERTH AND ANCHORAGE APPROVALS

8.75 An approved berth or anchorage may cease to comply with berth assessment criteria due to changes in the use made of adjacent land. The Committee was concerned that there seemed to be no mechanism to ensure that relevant changes in land use were drawn to the attention of the Visiting Ships Panel (Nuclear).[68] This creates the risk that use would inadvertently be made of a berth or anchorage which no longer met the assessment criteria.

8.76 The Committee considers that some formal mechanism should be put in place to ensure that this does not happen. The simplest mechanism appears to be to employ the local land-use planning system. The fact that an approved berth or anchorage exists and the area covered by its emergency planning Zone 2 would be noted on the local land-use plan. Provision would be made for the Visiting Ships Panel (Nuclear) to be notified automatically when a building or development application affecting the area was lodged with the planning authority.

8.77 The Committee did not investigate the practicality of

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67. Second supplementary submission from the Department of Defence, p. 15 (Evidence, p. 238.270).
68. Evidence, pp. 414-15, 1284-91. The Department of Defence told the Committee that the VSP(N) had set up a procedure under which each port receiving ship visits was checked every 18 months to ensure that it continued to meet berth assessment criteria (p. 1288). The Department also said that only rarely would an approval be affected by subsequent land development, and that in one case where this has happened, Townsville, steps have been taken by the VSP(N) to both reassess the port and to ensure that no visit occurs until its continuing suitability is confirmed: Evidence, p. 1300.43 (Department of Defence).

this mechanism in any detail. It may be that it is not possible or practical in respect of one or more ports. In this case, and if no alternative mechanism can be used, the Committee considers that the possibility of changed land use should be investigated before each visit. For berths and anchorages at ports where visits are expected to be rare, it may be more cost-effective to inspect before each visit than to use the town planning mechanism.

8.78 Accordingly, the Committee RECOMMENDS that use be made of local land-use planning procedures to ensure that any change in land use that would affect an approved berth or anchorage is automatically notified to the Visiting Ships Panel (Nuclear). Where this method, or an effective substitute, is not possible or practical, approved berths and anchorages should be reassessed by the Visiting Ships Panel (Nuclear) before each visit to ensure changed land use has not affected their status.

8.79 The Committee is aware that changes in land-use have raised questions as to the continuing validity of the original berth assessments for Port Adelaide and Townsville. The Committee RECOMMENDS that no visits by nuclear powered vessels take place to either Port Adelaide or Townsville until the berths have been re-assessed to ensure that changed land use has not affected their status.

AVAILABILITY OF INFORMATION ABOUT PLANNING

Availability of the Plans

8.80 The current contingency arrangements are set out in a series of Commonwealth documents, in addition to the individual port safety plans. The documents were briefly described in chapter 2. It was noted that relevant Commonwealth documents are

available on enquiry to members of the public.[69] The Committee considers it essential that this availability continue. The Committee would not object to charges being levied for the supply of copies of the documents, provided the level of charges is no higher than that necessary to cover the cost of copying and handling.

8.81 Of the four State/Territory plans, the Queensland plan relating to Brisbane, and the Western Australian plan for Cockburn Sound/Gage Roads are publicly available. The plans for Darwin and Hobart are not. In contrast, emergency plans devised by State and Territory authorities for other major accidents and for natural disasters are generally available for public inspection.[70]

8.82 The Committee is not aware of any publicly stated reason why the Darwin plan has been withheld. The Tasmanian Government has provided two grounds in respect of the Hobart plan: that the plan contains confidential telephone numbers and confidential details of the Police Department and other organisations;[71] and that details of the plan would be misrepresented by those opposed to visits.[72]

8.83 In relation to the first ground, the Committee considers that any reasonable concern that knowledge of the contents of plans could be misused by hoaxers or others could readily be met by the release of an edited version of the plan. Telephone numbers, passwords and similar operational details could be

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69. See also Evidence, p. 1300.49 (Department of Defence): the relevant Commonwealth 'documents are unclassified and publicly available. Subject to resources they should be disseminated widely.'
70. Evidence, p. 1300.45 (Department of Defence).
71. Tasmania, Assembly, Debates, 30 September 1986, p. 2869. See also ibid., 22 July 1986, p. 2223.
72. Tasmania, Assembly, Debates, 9 December 1987, pp. 5488-89 and 25 August 1988, p. 2487.

masked out.[73] With regard to the second ground, the Committee considers that a secret plan is more open to be misrepresented than one that is available to the public.

8.84 The Committee notes that, according to a media report on 4 October 1988, the Tasmanian Minister for Emergency Services has stated that a brochure would be distributed to the public before the next visit to Hobart by a nuclear powered warship.[74] The brochure would detail what action to take in the event of a reactor accident. The Committee cannot comment on the extent to which the proposed brochure is an adequate substitute for a publicly available plan for Hobart, as the brochure is not yet available.

8.85 The Committee RECOMMENDS that, where there is a State/Territory contingency plan relating to nuclear powered warship visits to a particular port and the plan is not publicly available, the Commonwealth should:

(a) advise the State/Territory that it is desirable that the plan be publicly available;

(b) allow a reasonable time for editing the plan so as to remove any sensitive information (such as passwords or telephone numbers) which might otherwise inhibit its release; and

(c) withhold approval for visits to any port for which the plan is not publicly available after this time.

8.86 The Committee regards the question whether copies of a

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73. As noted in Chapter 2, the copy of the Hobart Safety Scheme that was provided to the Committee had the security-sensitive details removed. This does not prevent the reader from evaluating the overall adequacy of the scheme. Nor does it prevent local residents, etc. from understanding what might be expected of them in the unlikely event that an accident occurs.

74. 'State nuclear mishap plan "inadequate"', Mercury (Hobart), 4 October 1988. See also Tasmania, Assembly, Debates, 5 October 1988, p. 3169: Ministerial undertaking to have details of the plan published.

plan should be available without charge as one to be decided by the government responsible for the plan. Any access charges, however, should relate to the reasonable costs of copying and handling only.

8.87 Two submissions criticised paragraph 801 of the WA Port Safety Scheme,[75] which provides:

> No information in respect of any aspect of the Port Safety Scheme may be released to the public or the media without the authority of the Chairman, State Counter Disaster Advisory Committee.[76]

8.88 As the WA Port Safety Scheme is publicly available, this paragraph is not in fact being used to prevent access. Given that this is the case, the Committee considers that the wording of paragraph 801 could be modified, so as to remove the basis for any perception that the authors of the Scheme are intent on preventing public access to it.[77]

Availability of Information Relating to Accidents and Planning

8.89 Judging by the submissions received by the Committee, few of those interested in the issues relating to ship visits were aware of all the relevant Commonwealth documents. While a number of submissions referred to the 1976 Environmental

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75. Submissions from Scientists Against Nuclear Arms (WA) and Medical Association for the Prevention of War (WA), pp. 6-7 (Evidence, pp. 792-93); Mr K. G. Blake, p. 3.
76. Because of the nexus between the two plans, this statement also is made in the HMAS STIRLING Sub-Plan, para. 1315(1).
77. cf. the wording of the equivalent paragraph, 1201, in the Hobart Safety Scheme: 'During the visit of an NPW no aspect of the Safety Scheme that has not previously been released to the public is to be divulged'. A better method might be to separate out the security-sensitive information into a separate annex or annexes, and indicate that only these need to be kept confidential. This was in fact done with the copy of the Hobart Safety Scheme that was provided to the Committee. The two sections containing this type of information were deleted from the copy provided. An alternative method is to indicate by marginal annotation on a paragraph-by-paragraph basis which information may not be divulged.

Considerations document, few gave any indication that they had seen ANSTO's 1985 Radiation Monitoring Handbook, the annual reports of radiation monitoring relating to nuclear powered warship visits, or OPSMAN 1. Many concerns put to the Committee were not based on full information of the details of current arrangements.

8.90 The Committee hopes that one result of its inquiry will be to increase awareness of these documents, which contain much information essential to an overall understanding of the procedures, precautions and plans that relate to visits. The Committee considered, however, that more could usefully be done to increase the public's opportunity to have access to the relevant documentation.

8.91 Accordingly, the Committee RECOMMENDS that the Visiting Ships Panel (Nuclear) ensure that a set of the Commonwealth planning documents is placed in each State and Territory Library, and, outside capital cities, in the main public library of each port approved to receive visits from nuclear powered warships. Further, the deposited material should be kept up to date.

8.92 Late in its inquiry, the Committee was told by the Department of Defence that it was preparing public information documents on warship visits for wide distribution, and that media releases are issued for each visit by a nuclear powered warship.[78] The Department also told the Committee that it supported the concept of making appropriate officers available for public presentations on visits by allied warships.[79]

8.93 The Committee regards activities of this kind as

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78. Evidence, p. 1300.49 (Department of Defence). As new documents are written or existing ones extensively rewritten, they are reproduced in microfiche form for wide distribution to libraries. See OPSMAN 1 (2nd edn.), para. 323 (Evidence, p. 68) on the issuing of media releases by the Department.
79. Evidence, p. 1300.49 (Department of Defence).

constructive. The Committee would wish to encourage both Commonwealth and State/Territory authorities to do more to ensure that knowledge of the procedures, precautions and plans relating to visits is widely available. One useful step would be to include in media releases relating to specific visits an indication that information kits have been deposited in a library at the port.

Distribution of Information Leaflets

8.94 The Committee considered whether further steps should be required to ensure that those who may be required to take protective measures following an accident are informed beforehand of what may be involved. The Committee's attention was drawn to a one-page information leaflet issued by the New Zealand civil defence authorities in connection with the visit by the nuclear powered USS Haddo to Auckland in 1979.[80] A number of submissions suggested that some type of leaflet should be distributed locally prior to each nuclear powered warship visit.[81]

8.95 Leaflet distribution to residents is not relevant to all ports currently receiving visits.[82] Only Darwin and Hobart have significant numbers of people resident within Zone 2, which is the limit of the area of inhalation hazard following the reference accident. For approved anchorages at Gage Roads off Fremantle for example, the Zone 2's are almost entirely water and there are no residents.[83]

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80. The leaflet is reproduced in Evidence at p. 1170.
81. Submissions from B. Lebbing, p. 1; Ms S. Taylor, p. 1; Senator J. Vallentine, p. 12 (Evidence, p. 1055); H. H. Somer, p. 4. See also, with respect to land-based reactor accidents, International Atomic Energy Agency, Planning for Off-Site Response to Radiation Accidents in Nuclear Facilities, (Safety Series No. 55, IAEA, Vienna, 1981), p. 59:
> a simple information leaflet or brochure should be prepared and distributed in advance, and periodically to residents close to the [nuclear] facility ... outlining some basic aspects of the emergency response plan and simple straightforward emergency instructions.
82. Evidence, p. 1300.46 (Department of Defence).
83. WA Port Safety Scheme, para. 924.

8.96 The response, if any, required in Zone 2 is determined by the results of monitoring after the accident. It would be difficult to set out in leaflet form beforehand useful advice to members of the general public on how they should respond. The 1979 Auckland leaflet to which the Committee was referred relates only to evacuation, etc. from a 600 metre zone (ie. the equivalent of Zone 1 in the Australian plans). This reflects the fact that New Zealand plans were based on more limited accident consequences than Australian plans.[84]

8.97 Few members of the general public are expected to be present in Zone 1. There may, at some ports, be considerable numbers of port workers. At HMAS STIRLING, a considerable number of naval personnel may be on the base. But more direct methods than distributing leaflets to the public are available to ensure that these groups are informed of emergency response procedures for Zone 1. The Committee would regard consultation and liaison with port unions, for example, as more effective.

8.98 The Committee would not wish to discourage any State or Territory that regarded distribution of an information leaflet as appropriate for a particular port. But the Committee does not consider that leaflet distribution should be made a precondition for visits to ports, even where there are residents within Zone 2. The Committee noted that the British port safety plans available to it do not require leaflet distribution. Nor is it a requirement or practice followed generally in the context of Australian plans for non-nuclear hazards.[85]

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84. e.g. see NZ, Wellington Regional Civil Defence Plan for a Nuclear Powered Vessel Visit to the Port of Wellington, (1983), para. 8 (Evidence, pp. 1147-48).

85. Evidence, p. 1300.46 (Department of Defence): 'apart from areas such as Darwin which are prone to cyclone emergencies, it is very rare for the general public to receive documentation on disaster reaction procedures'.

Reporting on Radiation Monitoring during Visits

8.99 As noted in Chapter 2, between 1976 and 1986 the Commonwealth department having responsibility for the environment reported annually on the results of radiation monitoring during visits.[86] In 1986, the responsibility for reporting was transferred to the Department of Defence.

8.100 It was evident that the Department of Defence was regarded by the authors of a number of submissions as being a partisan advocate of continued visits by nuclear powered warships. On this view, the transfer to Defence from a department concerned with the environment might be seen as lessening the independence of the reporting.

8.101 The Committee put this view to the Australian Ionising Radiation Advisory Council (AIRAC) and the Department of Defence. The Committee was told that there was minimal risk of loss in the independent reporting of monitoring due to the change. This was because of the large number of organisations, with different policy and program objectives, involved in the monitoring program.[87]

8.102 The Committee accepts this explanation.

MONITORING TO PROVIDE ACCIDENT NOTIFICATION

Introduction

8.103 The Commonwealth provides guidelines for the carrying out of routine environmental monitoring, of monitoring to detect

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86. See para. 2.31: in no case has any release of radioactive material or infringement of Australian public health standards been reported.
87. Letter from Cdre N. J. Stoker, Chairman of the VSP(N), 26 April 1988, p. 3 (Evidence, p. 706.718); Evidence, p. 748 (AIRAC).

a reactor accident, and of post-accident monitoring.[88] The detailed instructions for carrying out monitoring are also contained in a Commonwealth document.[89] Because monitoring is governed by a single set of guidelines and instructions, it is conducted in a uniform way for all Australian ports that receive visits from nuclear powered warships.

Basic Methods

8.104 Accident response can only commence once the relevant authorities are aware that an accident has happened. A communications link is established routinely with a visiting warship in order to permit direct communication, including notification of an accident by its commander.[90]

8.105 Some submissions expressed a concern that the warship commander would fail to provide the earliest possible notification of a reactor accident.[91] The United States Government has provided an assurance that notification will occur 'immediately in the event of an accident involving the reactor of the warship during a port visit'.[92] The Committee has no cogent reason to

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88. See para. 2.29.
89. ibid.
90. Information supplied at briefings to Coommittee members by WA Officials, 1 February 1988; Tasmanian officials, 21 March 1988. See also the submission from the Tasmanian Government, p. 3; Evidence, p. 436 (ANSTO).
91. e.g. submissions from Scientists Against Nuclear Arms (WA) and Medical Association for the Prevention of War (WA), p. 6 (Evidence, p. 792); Senator J. Vallentine, p. 16 (Evidence, p. 1059).
92. US 'Standard Statement', para. 2(c) (Evidence, p. 1078). See also the UK 'Standard Statement', para. 2(c) (Evidence, p. 1300.16) for a similar assurance. The Committee was also referred to the notification provisions of the 1986 multilateral Convention on Early Notification of a Nuclear Accident: second supplementary submission from the Department of Defence, p. 10 (Evidence, p. 238.265). This Convention applies to 'any nuclear reactor wherever located': article 1(2)(a). For reference to the text of the Convention and the question of its applicability to an accident in an Australian port, see below, para. 13.48.

doubt this.[93]

8.106 Continuous early warning monitoring is used for the duration of each visit. It is designed to provide independent notice of the occurrence of any accident of sufficient severity to threaten a major release of fission products to the environment. Concern was expressed that this monitoring would not provide sufficiently quick notification.[94]

8.107 The basis of the concern was not explained, but it appeared to rest on the assumption that early warning monitoring operated by detecting the release of radionuclides to the atmosphere. In fact, the early warning monitoring is for gamma radiation penetrating through the vessel's hull.[95] This radiation would follow any major release of fission products from the reactor core to the containment.[96] Signals from the monitors are relayed automatically to a recorder and alarm located at a continuously staffed monitoring post. Detection is not dependent on airborne release to the environment,[97] and hence not dependent on wind speed and direction bringing the release towards monitors.

8.108 Detection is, however, dependent on sufficiently strong gamma radiation reaching the monitor. The Committee considered three factors which might inhibit effective monitoring: the

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93. See the second supplementary submission from the Department of Defence, p. 16 (Evidence, p. 238.271) for reasons (apart from legal obligation) which, in the Department's view, make it unrealistic to assume a vessel commander will fail to notify an accident. See also the submission from the Tasmanian Government, p. 3 on the cooperative attitude shown by visiting US warship commanders and their willingness to comply with requests by Tasmanian officials.
94. Submission from Scientists Against Nuclear Arms (WA) and Medical Association for the Prevention of War (WA), p. 6 (Evidence, p. 792).
95. Evidence, pp. 238.290, 238.293 (ANSTO). On the early warning monitoring arrangements see Department of Defence, Environmental Radiation Monitoring during Visits by Nuclear Powered Warships to Australian Ports: Requirements, Arrangements and Procedures, (May 1988), Part 2, para. 4.1.
96. Evidence, p. 238.294 (ANSTO).
97. Evidence, p. 238.293 (ANSTO).

possibility that line-of-sight between the monitor and the vessel would be obstructed; the possibility of fully effective biological shielding around the reactor; and the distance at which the early warning monitors are located from the vessel.

Obstructions between the Vessel and the Monitor

8.109 One of the factors that may cause erroneous readings on early warning monitors is the interposition of large objects between the vessel and the monitor. AIRAC suggested that cargo containers stacked on the wharf used for nuclear powered vessel visits to Brisbane might have this effect.[98]

8.110 The Committee is satisfied that monitoring personnel understand the importance of ensuring that monitors are always in line-of-sight of the vessel, both at Brisbane[99] and generally.[100] Monitoring procedures for berths are satisfactory in this regard. The additional problems encountered in ensuring line-of-sight monitoring with respect to anchorages are noted in paragraph 8.124.

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98. AIRAC, 'Review of Safety and Monitoring Arrangements for Visits by Nuclear Powered Warships', p. 8 (Evidence, p. 759). Another example relates to the alleged radiation incident during the visit by USS Swordfish to Sasebo, Japan in May 1968. The basis for the allegation was a monitor reading taken from a small boat about 100 metres from the vessel. US authorities investigated the allegation and rejected it. One reason for doing so was that, according to the investigators, at the time of the reading a US Navy repair ship was between the vessel and the monitor, masking completely the one from the other. Moreover, on the repair ship welding equipment was being operated in direct view of the monitor. See US Congress, Joint Committee on Atomic Energy, Naval Nuclear Propulsion Program - 1971 - Hearing, 10 March 1971, p. 83 (Vice Admiral H. G. Rickover).
99. AIRAC, 'Follow-up Actions on Report of Visits to Hobart/Darwin/ Brisbane', p. 9 (Evidence, p. 769).
100. e.g. see the instructions in Department of Defence, Environmental Radiation Monitoring during Visits of Nuclear Powered Warships to Australian Ports: Requirements, Arrangements and Procedures, (May 1988), Part 2, para. 4.1.

Effect of Biological Shielding

8.111 In paragraph 4.20, it was explained that in addition to having containment, naval reactors are enclosed to some extent in biological shielding. The primary function of the latter is to ensure operator safety during normal reactor operation. For single reactor vessels (ie. submarines) the shielding is not such as would prevent detection of gamma radiation through the hull following a reactor accident that could release fission products to the containment.[101]

8.112 As indicated in the next chapter, the Department of Defence is confident that a multi-reactor vessel will be able to proceed to a remote anchorage under its own power following an accident to one of its reactors. This suggests that the shielding on multi-reactor vessels is sufficient to at least sharply reduce penetration by gamma radiation of the surroundings of the stricken reactor. The early warning monitoring, on the other hand, relies on gamma radiation penetrating through the containment, the shielding, and the hull so as to be detected by the monitors located outside the vessel.

8.113 In other words, the more effective the shielding the more credible vessel removal under its own power is, and the less likely it is that early warning monitoring will be effective. Conversely, if early warning monitoring is regarded as likely to be effective, doubt must exist as to the vessel removal under its own power. The Committee lacked the information necessary to resolve this issue conclusively. However, for the reasons given in paragraph 9.54 in the context of vessel removal, the Committee considered it likely that a multi-reactor vessel would remain operable following an accident to one of its reactors.

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101. e.g. see UK, Ministry of Defence, Liverpool Special Safety Scheme for Visits to Liverpool by Nuclear Powered Submarines, (April 1986), paras. 8 and 18; Evidence, p. 238.292 (ANSTO).

8.114 It followed that the Committee had some doubt on the extent to which early warning monitoring of multi-reactor vessels would be effective. The question is one of degree: the weaker the radiation penetrating the hull, the less likely the monitoring will be effective, especially if the monitoring device is at some distance from the hull. Moreover, there is not necessarily a conflict between external monitoring and continued vessel operability. Shielding could be arranged so as to protect those on board, without at the same time protecting those alongside the vessel. The Committee, however, lacked firm information that this was the case.

8.115 In summary, the Committee cannot confirm that early warning monitoring of a surface vessel would be effective in providing immediate notification of the escape of fission products into the containment.

Distance between Vessel and Monitor

8.116 There is no difficulty in locating monitoring equipment sufficiently close to a vessel at a berth. However, the range of the monitors is limited. According to ANSTO, it 'has been estimated to be about 600 metres for the reference accident source term'.[102] For this reason, land-based monitoring equipment would not provide effective early warning of an accident on a

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102. ANSTO, Radiation Monitoring Handbook for Visits by Nuclear Powered Warships to Australian Ports, (ANSTO, Lucas Heights, NSW, 1985), p. 10 (Evidence, p. 304). See also Evidence, p. 433 (ANSTO). Contrast the statement in the WA Port Safety Scheme, p. 10A-3: 'the gamma-radiation [through the hull] should be readily detectable out to several kilometres'. This statement is also made in OPSMAN 1 (original edition, 1981), p. 3E1-2, but not in later editions: see OPSMAN 1 (Revision 1, 1986), Chapter 4, Annex A, paras. 17-21 (Evidence, pp. 88-89).

vessel anchored a kilometre or more from shore.[103]

8.117 Monitoring equipment has nonetheless sometimes been sited more than this distance from the vessel.[104] In these cases, immediate initiation of protective measures could only have occurred if the vessel's commander had provided notification of the accident.[105] Moreover, this absence of constant early warning monitoring does not appear to conform to the Department of Defence's radiation monitoring requirement, which does not differentiate between berths and off-shore anchorages.[106]

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103. The statement in the text may not be precisely accurate for the reactors on Nimitz-class aircraft carriers, as these are several times larger than the reactor size used to calculate the reference accident source term. Equally, if the reactor is smaller than that used to calculate the source term, the effective monitoring distance will presumably be less than the 600 metre distance based on the reference accident source term. Additionally, the calculation of the reference accident source term has been safety-oriented, using 'worst-case' assumptions for the amount of the release from the reactor into the containment. Any calculation of the range of a detector based on the conservatively-calculated source term would over-state the range unless a 'realistic' source term was substituted for this purpose. In effect, in order to maintain an overall safety-orientation in planning, the size of the release to the containment should be under estimated for the purpose of assessing the efficacy of accident-detection monitoring equipment.

104. For example, during visits to Gage Roads the fixed gamma radiation monitoring equipment has been located in the Port Authority Tower, Fremantle: e.g., Department of Arts, Heritage and Environment, Visits by Nuclear Powered Warships to Australian Ports: Report on Radiation Monitoring during 1985, (DAHE, Canberra, 1986), p. 5 (Evidence, p. 353). This is about 4 km from the anchorage used for Nimitz-class vessels. As further examples, for the 1985 visit of USS Pogy to an anchorage off Darwin the equipment was sited on shore 1.2 km away: ibid, pp. 6-7 (Evidence, pp. 354-55); during the 1982 visit by USS Truxtun to an anchorage in the Derwent near Hobart the equipment was located 1.5 km away at Kangaroo Bluff: Department of Home Affairs and Environment, Visits by Nuclear Powered Warships to Australian Ports: Report on Radiation Monitoring during 1982, (DHAE, Canberra, 1983), para. 6.1. Neither of these annual monitoring reports indicates any awareness that the equipment was ineffective for the purpose of early warning in the position used.

105. AIRAC, 'Review of Safety and Monitoring Arrangements for Visits by Nuclear Powered Warships', p. 5 (Evidence, p. 756).

106. OPSMAN 1 (2nd edn.), Chapter 4, Annex A, para. 17 (Evidence, p. 88); Department of Defence, Environmental Radiation Monitoring during Visits of Nuclear Powered Warships to Australian Ports: Requirements, Arrangements and Procedures, (May 1988), Part 2, para. 4.1: 'a facility to provide early warning of a reactor accident is required'.

8.118 The Committee noted, however, that during the 36-hour visit of USS Sea Dragon to an anchorage at Jervis Bay in 1983 no early warning monitoring was undertaken.[107] This suggested that the Department of Defence took the view (on this occasion at least) that early warning monitoring was not necessary for visits to anchorages where few members of the public are likely to be within Zones 1 and 2.

8.119 The main aim of the monitoring is to provide an immediate signal for the evacuation of Zone 1.[108] In the situation where land-based early warning is ineffective, there would be no residents, port workers, etc. to evacuate. The only immediate concern would be for any fishermen, pleasure craft users, etc. who might be afloat in the vicinity of the vessel.

8.120 After evacuation of Zone 1, accident notification would be required in order to commence protective measures for Zone 2. The major concern in this context is the anchorage at Gage Roads off Fremantle approved for use by vessels having a reactor power

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107. Department of Home Affairs and Environment, Visits by Nuclear Powered Warships to Australian Ports: Report on Radiation Monitoring during 1983, (DHAE, Canberra, 1984), p. 11, describes other monitoring for the visit. The implied rationale for no early warning monitoring was the isolated nature of the anchorage: ibid.

108. Evidence, p. 433 (ANSTO). See also Department of Defence, Radiation Monitoring at Australian Ports Visited by Nuclear Powered Warships, (Revision 1, DoD, Canberra, 1986), Part 1, para. 8: an early warning system is provided to enable timely remedial action to be taken at berths, where significant numbers of workers could be within Zone 1; Department of Defence, Environmental Radiation Monitoring during Visits of Nuclear Powered Warships to Australian Ports: Requirements, Arrangements and Procedures, (May 1988), Part 1, para. 2.2.1: early warning monitoring is linked to the need 'to protect the health of members of the public in the vicinity of the berth'. Both of these documents discuss the rationale in relation to berths, making no mention of anchorages in this context.

output greater than 100 Mw(t).[109] The anchorage has a 2-hour vessel removal time when used by this class of vessel.[110]

8.121 The Visiting Ships Panel (Nuclear) undertook to AIRAC to provide it with a paper on the issue of early warning monitoring for off-shore anchorages.[111] It appears that this has not been done. As a result, the Committee was not able to say how necessary or practical the VSP(N) considered the use of monitors mounted on a separate monitoring vessel for early warning at those anchorages where land-based monitors would be ineffective in this role.[112]

8.122 The Committee considered that the use of ship-borne monitors in this role is only necessary in either of two cases. The first is where people are likely to be on the water close to

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109. The concern arises on the assumption that the warship commander would not only fail to notify Australian authorities of an accident but would also fail to remove the warship until directed by those authorities. The possibility was raised in a few submissions that the warship commander might try to conceal the reactor accident: e.g. see the submission from Senator J. Vallentine, p. 16 (Evidence, p. 1059). However, on this hypothesis it would be in the interest of the commander to remove the vessel as quickly as possible. Vessel-removal would generally offer the best prospect of concealing the fact that a reactor accident had occurred which might create a radiation hazard beyond the immediate vicinity of the vessel. Due to the potential weather and sea conditions at Gage Roads, multi-reactor vessels are the only nuclear powered vessels that anchor there in practice. The ability of a multi-reactor vessel, following an accident to one reactor, to use its remaining reactor(s) is discussed in the next chapter. Subject to the points made there, and assuming the commander was intent on concealing the accident, the warship could be immediately taken to sea on its remaining reactor(s).
110. Where a 24-hour removal time exists, decisions about vessel-removal are less time-critical.
111. AIRAC, 'Follow-up Actions on Report of Visits to Hobart/Darwin/Brisbane', p. 6 (Evidence, pp. 766).
112. When USS Enterprise visited the Quarantine Anchorage, Hobart in 1976 HMAS BASS was stationed near it throughout the visit to provide a monitoring base: Department of Environment, Housing and Community Development, Report on Environmental Radiation Monitoring During Visits to Australian Ports by Nuclear Powered Warships in 1976, (DEHCD, Canberra, 1977), para. 3.4. The RAN vessel, TV NEPEAN, was anchored near the USS Long Beach to facilitate monitoring during the latter's visit to an anchorage near Melbourne in 1976: ibid., para. 3.5. Rough weather limited the effectiveness of this monitoring at Melbourne: ibid.

the visiting vessel (e.g. for a regatta). Use in this situation could be rendered unnecessary by excluding people from entering the area in which immediate protective measures would be required in the event of an accident.[113] The second is where a short time is specified for vessel removal.[114]

8.123 The Committee RECOMMENDS that where land-based monitoring is too remote from an anchorage to provide early warning of an accident, ship-borne early warning monitoring be required in two cases: first, when the specified vessel removal time is less than 24 hours, and, secondly, when adequate measures cannot be made to ensure that people are not in the vicinity of the vessel.

8.124 Where ship-borne monitoring is used, problems may arise in ensuring that it remains in line-of-sight to the vessel being monitored. The interposition of a transiting vessel would not cause difficulties, due to the brief time it might screen the monitor. A different problem may arise if the vessel is anchored or moored in such a way that it can swing with the effect of wind and tide.

8.125 The reactors are located near the midships region of the vessel. Viewed along the length of the vessel from the bow or stern, the structure of the vessel provides a measure of

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113. cf. the prohibition on traditional ship's open days for nuclear powered warships, so as to prevent the possibility of a large number of visitors being aboard the visiting vessel in the event of an accident: OPSMAN 1 (2nd edn.), para. 311 (Evidence, p. 63).

114. 'Specified' in this context includes the situation for the Hobart primary anchorage, where the short removal time is not specified in the anchorage assessment/conditions of entry but is voluntarily adopted by the Tasmanian authorities in order to reduce the size of Zone 2: see para. 8.50.

shielding. It appears from the data supplied by ANSTO,[115] that early warning monitoring might not be effective if the monitor was end-on to the bow or stern. To be effective, it seems to the Committee that the ship-borne monitor would need to be able to reposition itself relative to its target. This would add to the complexity of the monitoring task, although the problems would not be insuperable.

False Alarms

8.126 The Committee examined whether timely notification would be delayed by a need to check an alarm to ensure that it was not due to faulty equipment or some other extraneous cause.[116] The Committee was told that redundancy in the monitoring system would reduce the impact of any equipment fault. Moreover, it would be possible within 15 minutes to determine if an alarm was false or real, independently of any information provided by the vessel

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115. ANSTO, Radiation Monitoring Handbook for Visits by Nuclear Powered Warships to Australian Ports, (ANSTO, Lucas Heights, NSW, 1985), p. 20, (Evidence, p. 314) gives an isodose contour chart for gamma radiation through the hull. A dose of 5000 mSv alongside the reactor compartment reduces to less than 1 mSv end-on to the bow or stern. See also the 'Supplement to the Safety Scheme for Visits of Nuclear Powered Warships to Tasmania: Royal Hobart Hospital Arrangements', p. 2: using caesium-137 as a benchmark gamma emitter, a 5.3 cm thickness of steel between the source and the subject would have the effect of reducing the radiation received to a tenth of the unattenuated dose rate.

116. cf. Department of Home Affairs and Environment, Visits by Nuclear Powered Warships to Australian Ports: Report on Environmental Radiation Monitoring during 1980 and Amendments to (Environmental Radiation) Monitoring Guidelines, (DHAE, Canberra, 1981), para. 5.2.1, describes some of the false alarms at HMAS STIRLING, WA experienced

> due to minor equipment malfunction, electrical interference and in some cases it is believed due to stray radio frequency interference. Installation of permanent monitoring equipment will shortly be completed at HMAS Stirling which should alleviate this problem.

Permanent monitoring detectors have now been installed: HMAS STIRLING Sub-Plan, para. 1306(3).

commander.[117]

OTHER MONITORING

Monitoring for Airborne Contamination

8.127 In addition to early warning monitoring, monitoring has a critical role in guiding the accident response by plotting the size, direction and extent of dispersal of any release of airborne contamination. Data from monitoring assists in choosing the appropriate protective measures to be implemented. Monitoring also has a longer term role in guiding decisions relating to possible decontamination requirements, re-occupation of any evacuated areas, and resumption of any suspended activities such as the use of farm products and foodstuffs from the area around the site of the accident.[118]

8.128 It was questioned whether all this monitoring would be effective due to lack of standardisation of units of measurement, equipment and procedures, and due to insufficient equipment and trained personnel.[119] The basis of the doubt was comment made at a 1982 seminar which considered measures for protecting the Australian public from ionising radiation.[120]

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117. Evidence, p. 434 (ANSTO). See ANSTO, Radiation Monitoring Handbook for Visits by Nuclear Powered Warships to Australian Ports, (ANSTO, Lucas Heights, NSW, 1985), pp. 12-13 (Evidence, pp. 306-07), which describes the steps necessary before an 'alarm' becomes a 'confirmed alarm'. For the steps in the context of a specific plan, see WA Port Safety Scheme, para. SP B15.
118. See Department of Defence, Environmental Radiation Monitoring During Visits of Nuclear Powered Warships to Australian Ports: Requirements, Arrangements and Procedures, (May 1988), Part 2, paras. 4.2.1 and 4.3 for details of these uses of monitoring.
119. Submission from Scientists Against Nuclear Arms (WA) and Medical Association for the Prevention of War (WA), p. 5 (Evidence, p. 791).
120. Report of Proceedings of a Study on the Protection of the Australian Public from Ionising Radiation: 8-12 November, 1982, (Australian Counter Disaster College, Mt Macedon, Vic, 1983). See particularly pp. 7-10, 82, 117, 223-24 and 225.

8.129 Much of the seminar comment was not relevant to a naval reactor accident. The seminar focused heavily, though not exclusively, on the aftermath of a nuclear war. The range of equipment and trained personnel required to meet this situation would clearly be far greater that for a single naval reactor accident. Available personnel and equipment, civil and military, would be used in a far more ad hoc way than in the planned response to a naval reactor accident.[121]

8.130 The equipment for warship early warning monitoring and for immediate post-accident monitoring is all provided by the Commonwealth.[122] Most items are held by ANSTO, and are made available at a port receiving a visit.[123] The concern put to the Committee that there was insufficient monitoring equipment in Perth and none at Albany incorrectly assumed that local sources were to be relied on.[124]

8.131 No current comprehensive list is available to the Committee of the monitoring equipment that the authorities regard as the minimum needed. However, earlier and partial lists indicate that the number of items required for routine and

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121. e.g. see the seminar comment (p. 9) that the planning for nuclear powered ship visits had led to some improvements applicable to responses to other radiation emergencies. ANSTO provides training to RAN and State personnel on the operation of the specific monitoring equipment: Department of Defence, Visits by Nuclear Powered Warships to Australian Ports: Report on Radiation Monitoring during 1986, (DoD, Canberra, 1988), Part II, paras. 14-15. This assists in ensuring that all concerned operate to a common standard.
122. OPSMAN 1 (2nd edn.), Chapter 4, Annex A, para. 33 (Evidence, p. 92).
123. ibid. The remaining equipment is held by the RAN.
124. Submission from Scientists Against Nuclear Arms (WA) and Medical Association for the Prevention of War (WA), p. 6 (Evidence, p. 792).

immediate post-accident monitoring is small.[125] No information was put to members of the Committee during their inspection visits to Tasmania and Western Australia that suggested deficiencies, either in the kind or amounts of equipment specified, or in the actual provision of that equipment by the Commonwealth during visits. No submission based on knowledge of the relevant documentation suggested deficiencies.

8.132 The Commonwealth documentation suggests that the number of personnel required to carry out monitoring is small.[126] As with equipment, however, there is no comprehensive list available to the Committee setting out precise numbers of persons and the precise skills they require. Again as with equipment, no deficiencies with regard to personnel and their training came to light during inspection visits by members of the Committee, or in a documented form in submissions.

8.133 Not all portable items of monitoring equipment

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125. OPSMAN 1 (original edition, 1981), Chapter 3, Annex E, Appendix 1, para. 2.2.3. This paragraph has been carried across into the WA Port Safety Scheme, p. 10A-5, but no equivalent appears in the more recent editions of OPSMAN 1. Department of Science and the Environment, Report and Guidelines on Environmental Radiation Monitoring during Visits to Australian Ports by Nuclear Powered Warships, (DSE, Canberra, 1979), Annex A, para. 2.2.3, lists 11 items as comprising the equipment for the immediate program of radiation monitoring. The 1988 version of these guidelines contains no equivalent list. It provides instead that equipment lists are to be set out in the Radiation Monitoring Handbook when the revised edition is prepared: Department of Defence, Environmental Radiation Monitoring during Visits of Nuclear Powered Warships to Australian Ports: Requirements, Arrangements and Procedures, (May 1988), p. 10. Australia, Environmental Considerations of Visits of Nuclear Powered Warships to Australia, (May 1976), Annex C, paras. 37 and 39 (Evidence, pp. 169-70) lists the minimum equipment required for routine and emergency monitoring. ANSTO, Radiation Monitoring Handbook for Visits by Nuclear Powered Warships to Australian Ports, (ANSTO, Lucas Heights, NSW, 1985), p. 47 (Evidence, p. 341) lists a 'typical NPW mobile monitoring kit inventory'.

126. ANSTO, Radiation Monitoring Handbook for Visits by Nuclear Powered Warships to Australian Ports, (ANSTO, Lucas Heights, NSW, 1985), pp. 9-10 (Evidence, pp. 303-04).

operate on the international system (SI) units of measurement,[127] which is the system of units used in the Australian planning documentation. The monitoring instructions, however, make provision for the conversion of readings from non-SI equipment to SI units before reporting results.[128] The United States Navy does not use SI units for radiation monitoring.[129] The Committee did not envisage major problems arising from this, as the planned radiation monitoring response that would immediately follow an accident does not rely on non-Australian resources.

8.134 After the initial phases, response to a major accident is also planned initially to involve ANSTO resources in the main.[130] It is recognised, however, that it might also involve Australian resources not specifically identified in the plans.[131] Overseas assistance presumably might also be accepted. But this stage of the response would not be time-critical. There would be time to resolve problems (if any) relating to unfamiliar equipment or units of measurement.

8.135 The Committee considers that there is sufficient monitoring equipment available, that there are sufficient trained personnel to use the equipment, and that no confusion is likely to arise due to the differing systems of units used by the equipment.

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127. SI is an abbreviation of the French name for the international system of units, Le Système International d'Unités, which is gradually replacing units previously used. See the table at the end of the Glossary for a list of SI and corresponding older units for measuring radiation.
128. ANSTO, Radiation Monitoring Handbook for Visits by Nuclear Powered Warships to Australian Ports, (ANSTO, Lucas Heights, NSW, 1985), p. 16 (Evidence, p. 310).
129. ibid., p. 38 (Evidence, p. 332).
130. OPSMAN 1 (2nd edn.), Chapter 4, Annex I, para. 4 (Evidence, p. 113) sets out the extra equipment and personnel to be supplied.
131. ibid., Annex A, para. 29 (Evidence, p. 91). See also Evidence, p. 238.319 (Department of Defence).

Calibration of Instruments

8.136 The Committee noted that, following the 1979 reactor accident at Three Mile Island, various kinds of portable survey equipment were used, none of which was calibrated for the low energies of xenon-133 which in fact predominated in the radiation plume.[132] This is an illustration of how planning for the more serious accident may prove deficient if a more limited radiation release actually occurs.

8.137 The Committee found that this potential problem is avoided under Australian arrangements. One of the monitoring devices used during each visit, a gamma spectrometer,[133] is capable of identifying all the radionuclides in an air sample. Based on the results of using this device, appropriate equipment is available which can, if necessary, be brought into use. In practice, it appears to the Committee that any re-calibration would only be necessary where, as at Three Mile Island, only minimal amounts of the radioiodines were released.

Thermoluminescent Dosemeters

8.138 Thermoluminescent dosemeters (TLD's) are devices containing a type of film which is sensitive to ionising radiation.[134] The devices are exposed and, when subsequently analysed in a laboratory, indicate the amount of radiation

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132. A. P. Hull, 'Critical Evaluation of Radiological Measurements and of the Need for Evacuation of the Nearby Public during the Three Mile Island Incident', International Atomic Energy Agency, Current Nuclear Power Plant Safety Issues: Proceedings of an International Conference Organized by the International Atomic Energy Agency, Stockholm, 20-24 October 1980, (IAEA, Vienna, 1981), p. 86.
133. ANSTO, Radiation Monitoring Handbook for Visits by Nuclear Powered Warships to Australian Ports, (ANSTO, Lucas Heights, NSW, 1985), pp. 15 and 23-27 (Evidence, pp. 309 and 317-21) refers to the use of the gamma spectrometer. The references made to 'laboratory measurement' (e.g. ibid., p. 14) refer to use of a test facility set up for the duration of each visit using moveable equipment assembled for the occasion.
134. See Evidence, pp. 238.317-18 (Department of Defence) for a more detailed description.

received during the period of exposure. During each nuclear powered warship visit to an Australian port, TLD's are exposed at a number of locations in the vicinity of the vessel. The locations are determined jointly by authorities of the Commonwealth and of the State/Territory receiving the visit.[135] The particular TLD's used are identical to those used as personal monitors by radiation workers.[136]

8.139 Following a ship visit, the TLD's are returned to the Australian Radiation Laboratory for assessment of the doses received. The TLD's provide an additional means of confirming whether or not there has been a radiation accident with consequences for the environment during the visit.

8.140 In some plans overseas, TLD's are used to assist in immediate post-accident decision-making.[137] The Australian Radiation Laboratory told the Committee that 'in the event of an accident the TLD's would be replaced at the termination of the accident'.[138] The Committee understood from this, and from the time taken to process the TLD's,[139] that the TLD's were not intended to be used to guide decision-making on the implementation of protective measures during the period immediately following a reactor accident. Instead, the TLD's would be used

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135. Department of Defence, Environmental Radiation Monitoring during Visits of Nuclear Powered Warships to Australian Ports: Requirements, Arrangements and Procedures, (May 1988), Part 2, para. 3.1.2. For maps showing the TLD locations used for particular visits to Gage Roads/Cockburn Sound, Darwin, Hobart and Brisbane, see Evidence, pp. 361-64.

136. Submission from the Australian Radiation Laboratory, p. 4 (Evidence, p. 1008).

137. e.g. see R. Raufer and R. Flessner, 'Off-site emergency planning exercises in Illinois', Nuclear Engineering International, February 1984, p. 41: after an accident

> radiation measurements are made with portable radiation detection equipment and thermoluminescent dosimeters (TLDs). The TLDs give a good measurement of the time-integrated dose, in support of population dose projections.

138. Submission from the Australian Radiation Laboratory, p. 4 (Evidence, p. 1008).

139. The fact that the TLD's would have to be returned to the Australian Radiation Laboratory at Melbourne for assessment would prevent their being used as speedy guides to post-accident decision-making.

after an accident was over to provide evidence of the total dose accumulated at each TLD location.

8.141 The Committee accepts this as satisfactory, as it considers the other radiation monitoring methods adequate to guide decision-making immediately following an accident.

METEOROLOGICAL INFORMATION

8.142 In addition to the results of radiation monitoring, weather information would be needed to guide decision-makers in the immediate post-accident phase. Information about wind speed, direction, etc., will help assess the extent and effects of airborne contamination.[140]

8.143 In 1984, an AIRAC working group noted during an on-site inspection of arrangements for Hobart that there 'was an apparent lack of appreciation of the role which the Meteorological Bureau could play under emergency conditions'.[141] Provision has, however, been made for the use of smoke generators to assist in monitoring wind conditions.[142] AIRAC was unable to confirm that planning now has due regard for the assistance available from the Meteorological Bureau.[143] However, it was clear to members of the Committee during the inspection they made at Hobart in March 1988 that those involved in the implementation of the plan had a good appreciation of the importance of data relating to wind and weather.[144]

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140. OPSMAN 1 (2nd edn.), Chapter 4, Annex A, para. 27 (Evidence, p. 90).
141. AIRAC, 'Review of Safety and Monitoring Arrangements for Visits by Nuclear Powered Warships', p. 3 (Evidence, p. 754).
142. ibid., p. 2 (Evidence, p. 753); Hobart Safety Scheme, paras. 1311(c) and 1423(4)(d).
143. AIRAC, 'Follow-up Actions on Report of Visits to Hobart/Darwin/Brisbane', p. 3 (Evidence, p. 763).
144. See also Hobart Safety Scheme, Chapter 4, Annex A, para. 27, and para. 514.

8.144 The only other issue relating to weather information to come to the Committee's attention was also raised by AIRAC. This related to inadequate wind force measuring equipment at the approved berths at the Fisherman Island Container Terminal, Brisbane.[145] Again AIRAC was unable to confirm that remedial action had been taken.[146]

8.145 The Committee RECOMMENDS that the Visiting Ships Panel (Nuclear) confirm that the wind force measuring equipment at the approved berths at Fisherman Island, Brisbane is now adequate.

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145. AIRAC, 'Review of Safety and Monitoring Arrangements for Visits by Nuclear Powered Warships', p. 7 (Evidence, p. 758).
146. AIRAC, 'Follow-up Actions on Report of Visits to Hobart/Darwin/ Brisbane', p. 8 (Evidence, p. 768).