The Parliament of the Commonwealth of Australia

The Senate Standing Committee on Foreign Affairs, Defence and Trade

VISITS TO AUSTRALIA BY NUCLEAR POWERED OR ARMED VESSELS:

Contingency Planning

for the

Accidental Release of Ionizing Radiation

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CONTENTS

CHAPTER 8 - **CURRENT PLANNING - GENERAL ISSUES**

CHAPTER 9 - **CRITICISMS OF CURRENT PLANS - PART I**

MEMBERSHIP OF THE COMMITTEE

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This inquiry was commenced in the 34th Parliament by the Senate Standing Committee on Foreign Affairs and Defence, whose membership was:

Senator G. D. McIntosh (Western Australia) Chairman
Senator T. Aulich (Tasmania)
Senator J. R. Black (Queensland)
Senator R. L. D. Boswell (Queensland)
Senator Hon Sir J. Carrick, KCMG (New South Wales)
Senator D. J. Hamer, DSC (Victoria)

TERMS OF REFERENCE FOR THE INQUIRY

The Senate referred the following matter to the Committee:

> The adequacy of current contingency planning by Federal and State authorities to deal with the accidental release of ionizing radiation from visiting nuclear powered or armed vessels in Australian waters and ports.

LIST OF RECOMMENDATIONS

The Committee **RECOMMENDS** that:

1. 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. (para. 8.21)

2. 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. (para. 8.64)

3. the zone of complete isolation around a remote anchorage be specified as 1.6 kilometres. (para. 8.68)

4. 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. (para. 8.78)

5. 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. (para. 8.79)

6. 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. (para. 8.85)

7. 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. (para. 8.91)

8. 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. (para. 8.123)

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

10. the Commonwealth Government produce a document containing all the necessary scientific background on naval nuclear reactors; the nature of the potential hazards resulting from accidents involving the reactors which the plans have to address; and other background information which is common to all the plans. The document should be suitable for incorporation in, or attachment to, individual port safety plans. (para. 9.21).

11. the wording of the WA Port Safety Scheme be clarified on the question of whether vessel removal procedure differs according to whether the accident is notified by the vessel commander or detected by early warning monitoring. (para. 9.42)

12. the Visiting Ships Panel (Nuclear) develop guidelines to assist decision-makers in determining under what circumstances vessel removal is appropriate. In particular, the guidelines should indicate under what circumstances and at what ports automatic removal following an accident would be appropriate. (para. 9.46)

13. the Department of Defence seek information and assurances from the United States Navy that, with respect to its multi-reactor vessels:
    (a) the likelihood of a reactor accident leaving one without propulsion power is not sufficiently credible to require planning; and
    (b) the biological shielding and ventilation arrangements are adequate to permit the continued operation of the vessels following the reference accident occurring to one reactor.

    If adequate information and assurances are not obtained, the Committee RECOMMENDS that condition (e) of the conditions of entry be amended to require the provision of a towing capability during visits by multi-reactor warships. (para. 9.55)

14. the Department of Defence confirm that condition of entry (e) is interpreted by the commanders of visiting warships having more than one reactor as requiring that a second reactor be kept in a sufficient state of readiness to be used for post-accident vessel removal. If the Department is unable to confirm this, the Committee RECOMMENDS that condition (e) be reworded to make this state of readiness a condition of entry for multi-reactor warships. (para. 9.59)

15. the Department of Defence determine if assistance from one or more tugs would be essential to effect the speedy removal from any approved berth of a multi-reactor vessel with a damaged reactor, and, if so, require as a condition of entry for the visit that the necessary assistance be available during visits to that berth. (para. 9.63)

16. condition (e) of the conditions of entry be reworded to put beyond doubt that towing facilities are required to be made available as soon as possible after an accident, rather than merely within the maximum time of 24 hours specified for vessel removal for berth assessment purposes. (para. 9.75)

17. it be a requirement that a person sufficiently trained to conduct radiation monitoring be on board a vessel designated for emergency towing following a reactor accident. (para. 9.87)

18. no visits to berths at Fisherman Islands, Brisbane be approved until adequate, documented, provisions are made: either for the evacuation of port workers, persons on ships in the vicinity, and tourists and other recreational land users likely to be within the inhalation hazard zone (Zone 2); or for avoiding the presence of such persons during a visit by a nuclear powered warship. (para 9.109)

19. the approved berths up-stream (ie. closer to Brisbane) of the ones currently used at the Container Terminal not be used until adequate, documented, provisions are made for the evacuation of residents from within the Zone 2's for the berths. (para. 9.109)

20. no visits be permitted to the northern approved anchorage or to either of the approved berths at Darwin until detailed provision is made in the Darwin Port Safety Plan for evacuation of the relevant Zones 1 and 2. (para. 9. 113)

21. the berth approval for Macquarie Wharves, Hobart be rescinded. (para. 9.120)

22. no approval be given to any berth or anchorage where a major hospital lies within the zone in which evacuation may be required (ie. Zone 2) following an accident. (para. 9.120)

23. no visits be made to the primary approved anchorage in the Derwent near Hobart until adequate, documented, provisions are made for evacuation of residents and others from within 1.2 km (ie. Zone 2) of the anchorage. (para. 9.122)

24. before further visits are permitted to Jervis Bay there should be an examination of whether contingency planning for evacuation and other countermeasures in respect of areas outside HMAS CRESWELL is required. This examination should include consideration of the need for liaison with New South Wales authorities. (para. 9.124)

25. the Western Australian planners delete their provision for distribution of potassium iodate tablets to the general public beyond Zone 2. (para. 9.152)

26. the Government seek advice to determine if there is a practical need to administer stable iodine for several days, rather than as a single dose, in order to provide continued blocking of thyroid uptake of radioiodine following a brief exposure. The Committee RECOMMENDS that, if the advice received by the Government states that administration over several days is required, plans relating to stable iodine distribution be amended accordingly. (para. 9.160)

27. visits not be approved to berths unless detailed provisions are in place to ensure that those evacuating the surrounding Zone 1 and emergency personnel entering the Zone 1 are able to be supplied with stable iodine. (para. 9.163)

28. the Department of Defence advise the authorities responsible for the individual port safety plans of the need for the plans to contain specific criteria to assist post-accident decision-makers in deciding if sheltering should be adopted as a countermeasure in the particular circumstances prevailing. (para. 10.6)

29. the Department of Defence and ANSTO investigate whether water-spray drenching of an accident-stricken vessel would provide a useful supplementary protective measure. (para. 10.17)

30. no visit to a port be allowed unless the Visiting Ships Panel (Nuclear) is satisfied, after consultation with the relevant State/Territory planners, that the safety plan for that port has been exercised in sufficient depth to demonstrate its adequacy and efficacy. (para. 10.26)

31. no visit to a port be allowed unless, immediately before the visit, there has been an exercise of the port safety organisation. No exercise should be required, however, if an exercise has been held at the port during the previous 12 months, and there has been no change in key personnel since that exercise. (para. 10.31)

32. port safety plans for alongside berths include arrangements, such as those existing for HMAS STIRLING, for the monitoring of evacuees from Zone 1, and for the decontamination of those found to be contaminated. For anchorages, where the Zone 1 comprises no land area, the Committee RECOMMENDS that the plans require that advice be given to those who might be within Zone 1 and downwind of the vessel of the need to take decontamination measures. (para. 10.53)

33. the Department of Defence, based on consultation with the navies of the countries to which the visiting warships belong, provide guidance to State/Territory planners on the planned role of civilian firefighters in the highly unlikely event of a combined fire and radiation hazard on a visiting nuclear powered warship. The Department should attempt to ensure that plans make clear either the role that civilian firefighters have, or the fact that they have no role, as the case may be. If the role requires specialist training and equipment, these should be provided as part of the plans. (para. 10.70)

34. the Department of Defence confirm that, with regard to the public information response to a reactor accident on a visiting warship, measures are in place to ensure:
    (a) that the response of Commonwealth bodies, the State/Territory concerned, and the country to which the warship belongs be coordinated through a single information centre;
    (b) that technical expertise about naval reactors, nuclear weapons, radiation effects and safety measures be available to that information centre; and
    (c) that before visits are approved these public information measures be in place. (para. 10.87)

35. the Department of Defence ensure that the report on the inadequacies of the public information provisions of APTCARE are drawn to the attention of State/Territory planners, together with the results of the review of these provisions in APTCARE. Further, the Department should ensure that the planners incorporate in their plans all relevant lessons of the public information response at Lucas Heights following the 18 March 1987 fire there. (para. 10.91)

36. steps be taken to make better provision in the port safety plans for the making and long-term keeping of records of individuals' presence in the vicinity of the vessel at the time of an accident, of the levels of radiation to which they might have been exposed, and of any evacuation or decontamination which they may have undergone. In particular, the Committee RECOMMENDS that the Natural Disasters Organisation's 'National Inquiry and Registration System' be examined with a view to using it to provide a means of recording and preserving this information. (para. 10.112)

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

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

39. the Commonwealth Government confirm that the State and Northern Territory Governments have adequate plans to deal with shipping accidents involving hazardous cargoes in their ports. The Commonwealth should encourage the States and Northern Territory to make these plans public where this is not already the case. (para. 12.68)

GLOSSARY

Absorbed Dose The energy that is deposited by radiation in any material. (see table following this Glossary)

Activity In terms of radiation measurement, the activity of a radioactive material refers to its rate of radioactive transformation or decay. (see table following this Glossary)

AIRAC Australian Ionising Radiation Advisory Council.

ANSTO Australian Nuclear Science and Technology Organisation (prior to 27 April 1987, the Australian Atomic Energy Commission).

ARL Australian Radiation Laboratory.

Arming As applied to explosives and weapons, the changing from a safe condition to a state of readiness for initiation.

ASROC Anti-submarine rocket launched from surface ships, and capable of carrying either a nuclear or conventional warhead.

Attack Class Submarines Submarines whose primary mission is that of attacking other ships. US submarines in this category are generally capable of deploying theatre nuclear weapons.

Ballistic Missile Submarines Submarines armed with inter-continental ballistic missiles. Submarines of this type do not visit Australia.

Becquerel The unit in the international system of measurements for measuring the activity of a radioactive source. (see table following this Glossary)

Biological Shielding Material placed around a nuclear reactor to protect operating personnel and others from exposure to radiation in excess of permitted levels.

Cladding A thin layer of metal totally enclosing nuclear fuel which protects the fuel from chemical attack (corrosion) by the coolant, prevents the escape of fission products, and provides structural support.

Containment A structure which completely surrounds the reactor system and is designed to contain the releases from accidents with little or no significant release to the environment.

Control Rod A solid element that absorbs neutrons and hence, when inserted into the reactor core, decreases reactivity, producing a decrease or shut-down in power production. Control rods are used for reactor control.

Coolant In a pressurised water reactor, the water passed through the core of a reactor to remove the heat liberated in the fission process. The coolant may also be referred to as the primary coolant.

Core See 'Reactor Core'.

Core Melt The term applied to the overheating of a reactor core as a result of the failure of reactor cooling systems, leading to melting of the fuel and the structures which hold it in place. Also called 'meltdown'.

Critical Just capable of sustaining (at a constant level) a chain reaction. A nuclear reactor is critical when the rate of neutron production is equal to the rate of neutron loss. A reactor is said to be subcritical when it can no longer sustain a chain reaction and supercritical when it is more than capable of sustaining such a reaction.

Critical Mass The least mass of fissionable material that will permit a self-sustaining chain reaction.

Curie The traditional unit for measuring the activity of a radioactive source, now being replaced by the Becquerel. (see table following this Glossary)

Decay Heat The heat produced by radioactive decay of fission products in the reactor's fuel.

Dose (of Radiation) Amount of energy delivered to a unit mass of a material by radiation travelling through it.

Dose Equivalent The absorbed dose multiplied by a modifying factor that reflects the fact that different kinds of radiation having the same amount of energy per unit mass have different biological effects. For example, one gray of alpha radiation can cause about twenty times the biological damage caused by one gray of gamma radiation. By use of dose equivalents, the effects of absorbed doses of different types of radiation can be added together. (see table following this Glossary)

Emergency Core Cooling System (ECCS) A separate cooling system designed to maintain core cooling in a shutdown reactor, following an accident that has disabled the normal coolant system.

Emergency Reference Level (ERL) A level of exposure to radiation which regulatory authorities recommend should not be exceeded in an emergency, and which serves as a guide to when emergency protective measures should be taken

Enriched Uranium Uranium in which the proportion of the fissile isotope uranium-235 has been increased above its natural level of 0.7%.

Fission The breaking of a nucleus into two lighter fragments (known as fission products) plus free neutrons - either spontaneously or as a result of absorbing a neutron.

Fission Products Nuclides produced directly by nuclear fission or by the subsequent radioactive decay of such nuclides.

Fuel Element The smallest individual unit of a reactor core containing nuclear fuel as its principal constituent.

Gamma Radiation High energy radiation of considerable penetrating power emitted by some radioactive substances.

General Accounting Office An agency created by the United States Congress to monitor government expenditure and to review government programs. It is an approximate equivalent to the Australian Auditor-General's Office.

Gray The unit in the international system of measurements for measuring the energy that is deposited by radiation in any material (ie. the absorbed dose). (see table following this Glossary)

Half Life (Radioactive) The time taken for the activity of a radioactive material to lose half its value by radioactive decay.

Insensitive High Explosive (IHE) As defined by the US Department of Energy, explosive substances which, although mass detonating, are so insensitive that there is negligible probability of accidental initiation or transition from burning to detonation. IHE is used for the explosive trigger in most US nuclear weapons developed since the late 1970's.

Iodine A non-metallic element. In radioactive forms it is one of the radionuclides that may be released from the reactor core in a reactor accident.

Ionising Radiation Any radiation that directly or indirectly displaces electrons from the outer domains of atoms.

Isotopes Nuclides having the same number of protons in their nuclei, and hence belonging to the same chemical element, but differing in the number of neutrons. Such atoms have identical chemical properties but their nuclear characteristics, e.g. neutron absorption or fissile properties, may be vastly different (as, for example, the isotopes of uranium U-235 and U-238).

Light Water Reactor A nuclear reactor which uses ordinary water as both coolant and moderator.

Loss of Coolant Accident (LOCA) An accident resulting from a failure in the normal reactor cooling water system (primary coolant system) leading to a loss of the cooling water from the system.

Megawatts Thermal - Mw(t) The amount of power in the form of heat produced by a reactor, measured in millions of watts.

Meltdown See 'Core Melt'.

Noble Gases The elements helium, neon, argon, krypton, xenon, radon. They are all chemically inactive.

Non-volatiles See 'Volatiles'.

NPW Nuclear Powered Warship.

Nuclear Weapons Capable Warship A vessel equipped with the means to carry nuclear weapons. In a narrower sense, the term is also used to refer to vessels equipped to use nuclear weapons, thereby excluding replenishment and transport vessels.

Nuclear Weapons Certified Warship A US nuclear weapons capable warship that has been fitted with extra safety devices required in relation to nuclear weapons and has undergone the necessary inspection, and whose crew have met the selection, training and inspection standards required in order to be permitted to handle nuclear weapons.

Nuclide A particular kind of atomic nucleus characterised by the number of protons and neutrons and, in some cases, by the energy state of the nucleus; e.g. U-235 and U-238 are nuclides contained in natural uranium.

One-Point Detonation The detonation at one point of the high explosive which surrounds the nuclear material in a nuclear weapon and acts as a trigger.

One-Point Safe A US design standard under which there must be less than 1 : 1,000,000 chance of a nuclear weapon producing a nuclear fission yield of more than 4 lbs (1.81 kg) TNT equivalent energy release following a one-point detonation.

OPSMAN 1 The short title of the Australian Department of Defence's manual of procedures governing visits by nuclear powered warships to Australian ports.

Plume The trail of airborne contamination from a radiation accident, fire, etc.

Power Excursion Very rapid increase of reactor power above the normal operating level.

Pressure Vessel In water-cooled reactors, the reactor vessel is designed for a substantial operating pressure; the vessel is therefore often called a pressure vessel.

Primary Circuit The main circuit of the reactor through which coolant passes so as to remove heat from the core.

Pressurised Water Reactor (PWR) A reactor using water under pressure as a coolant and moderator.

Rad The traditional unit for measuring the energy that is deposited by radiation in any material (ie. the absorbed dose), now being replaced by the Gray. (see table following this Glossary)

Radiation Neutrons, alpha or beta particles or gamma rays which radiate out from radioactive substances.

Radioactive Decay The decrease in activity of a radioactive material as it transforms spontaneously from one nuclide into another or into a different energy state of the same nuclide.

Radioactivity The property, possessed by some atoms, of disintegrating spontaneously with the emission of radiation in the form of alpha or beta particles, gamma rays, or neutrons. See the table following this Glossary for the units used in measuring radiation.

Radionuclide A synonym for radioactive nuclide.

Reactor Core The part of a nuclear reactor in which a chain reaction takes place; the reactor core contains the fuel elements, moderator and support structures, and the coolant passes through it.

Rem The traditional unit for measuring the biological effectiveness of a dose of radiation (ie. the dose equivalent), now being replaced by the sievert. (see table following this Glossary)

Risk The combination (usually expressed as the product) of the probability of occurrence of an accident and the magnitude of the consequences of the occurrence.

Runaway An increase in power or reactivity that cannot be controlled by the normal reactor control system.

Safing As applied to weapons, the changing from a state of readiness for initiation to a safe condition.

Scram Of a reactor, its rapid shutdown (to prevent or minimise a dangerous condition) which is initiated when some operational parameter reaches a level determined by operational or safety requirements.

Secondary Circuit The system to which heat is transferred from the primary system.

Sievert The unit in the international system of measurements for measuring the biological effectiveness of a dose of radiation (ie. the dose equivalent). (see table following this Glossary)

Source Term A quantitative description of the release of radioactive material in a nuclear accident. The description includes the physical and chemical form of the nuclides released.

Stable Iodine Iodine that is not radioactive. Iodine taken in this form will block for a time the uptake by the human thyroid gland of any radioactive iodine that may be inhaled or ingested.

Standard Statement A statement issued by the United States Government containing assurances regarding the safety and operation of its nuclear powered warships during visits to other countries. The United Kingdom Government has given assurances in virtually identical terms in relation to its nuclear powered warships.

Steam Explosion A phenomenon in which molten nuclear fuel rapidly fragments and transfers its energy to the reactor coolant resulting in steam generation, shock waves and possible mechanical damage.

SUBROC Rocket with 40-55 km range launched from a submarine which, after flight, re-enters the water to strike against other submarines. There is no version of SUBROC with a conventional warhead.

Theatre Nuclear Weapons A category of weapons of relatively short range that excludes ballistic missiles, which are classed as strategic or intercontinental weapons. Ballistic missiles are not carried on the types of warships that visit Australia.

Thyroid In humans, a small gland weighing about 20 grams situated in the lower front part of the neck. The gland concentrates and stores iodine taken into the body.

Transient A condition of the nuclear plant in which parameters are varying, usually sharply, either because of planned operations, such as load changes, or because an unplanned departure from the specified function of a system or component has occurred.

Volatiles Substances that evaporate easily or rapidly and hence, in the reactor accident context, are more readily dispersed than less volatile substances.

VSP(N) Visiting Ships Panel (Nuclear) - an interdepartmental committee, chaired by a representative of the Australian Department of Defence, which since its formation in 1972 has dealt with safety and other issues relating to visits by nuclear powered warships to Australia. Since February 1988, the VSP(N) has also had responsibilities relating to visits by nuclear weapons capable warships.

UNITS USED IN RADIATION MEASUREMENT

Units are needed to measure a number of different characteristics of radiation. In addition, two separate systems of measurement are used, the International System of units (in French, Le Système International d'Unités from which comes the standard abbreviation, SI units), and the non-SI units. The former are gradually replacing the latter.

Physical Quantity	SI Unit	Non-SI Unit	Relationship
Activity	becquerel (Bq)	curie (Ci)	$1Ci = 3.7 \times 10^{10} Bq$
Exposure (x rays and gamma rays only)	coulomb/kilogram (C/kg)	roentgen (R)	$1 R = 2.58 \times 10^{-4}$ C/kg
Absorbed dose	gray (Gy)	rad	1 rad = 0.01 Gy
Dose equivalent	sievert (Sv)	rem	1 rem = 0.01 Sv