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Department of Defence

VISITS BY NUCLEAR POWERED WARSHIPS TO AUSTRALIAN PORTS

Report on Radiation Monitoring During 1997

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SUMMARY

Seven visits were made by five Nuclear Powered Warships (NPW) of the United States Navy and Royal Navy to Australian ports in 1997 as follows:

Port	Ship	Dates
Brisbane	USS SALT LAKE CITY	22–26 March
HMAS STIRLING	USS KEY WEST	30 April–5 May
	HMS TRENCHANT	7–17 July and 21 July
	USS CAVALLA	13–16 July and 24–28 July
	HMS TRAFALGAR	14–21 July

The Commonwealth Government requires that a radiation monitoring program be carried out in association with each visit to detect any release of radioactivity to the ports and their environs.

This report presents a summary of the objectives and requirements of the NPW radiation monitoring program, describes the implementation of the program for the visits during 1997 and records the results of radiation measurements taken in the ports visited.

No releases of radioactive material were detected, nor were any radiation levels recorded in excess of normal background levels of ionising radiation, either during or subsequent to these visits.

PART I—GENERAL

INTRODUCTION

1. Seven visits were made by five Nuclear Powered Warships (NPW) of the United States Navy and Royal Navy to Australian ports in 1997. The Commonwealth Government requires that a radiation monitoring program be carried out in association with such visits to detect any release of radioactivity to the ports or their environs or any increase in external radiation levels above those due to natural background radiation.

2. This report presents a summary of the objectives and requirements of the NPW radiation monitoring program, describes the implementation of the program for the visits during 1997 and records the results of radiation measurements taken.

THE RADIATION MONITORING PROGRAM

3. The requirements for the monitoring program are laid down in 'Environmental Radiation Monitoring During Visits of Nuclear Powered Warships to Australian Ports—Requirements, Arrangements and Procedures, Department of Defence, May 1988'. These requirements were previously published in the 'Report and Guidelines on Environmental Radiation Monitoring During Visits to Australian Ports by Nuclear Powered Warships, Department of Science and Environment, September 1979'.

4. The monitoring program has two main components:

a. environmental monitoring, designed to detect the release of any radioactive material (eg waste) to the environment; and

b. direct radiation monitoring, designed to provide warning of any malfunction of the reactor of an NPW while in port, which might lead to a release of radioactivity.

Environmental Monitoring

5. The environmental radiation monitoring program is intended to provide assurance that there has been no infringement of Australian public health standards because of the release of radioactive material from the waste control and retention systems of a visiting NPW.

6. The relevant Australian public health standards are those recommended by the National Health and Medical Research Council in 1995 ('Recommendations for limiting exposure to ionizing radiation (1995)', Radiation Health Series No. 39, AGPS, 1995). These standards relate to permissible ionising radiation doses received by individuals from both external radiation sources and from the intake of radionuclides in air, water and foodstuffs.

7. **Internal radiation.** Internal radiation exposure of individuals could follow consumption of seafoods should these become contaminated with radioactive waste material. Accordingly, a marine environmental monitoring program is implemented to take samples of the surface layer of the bottom sediment and selected seafoods or seaweed (where available) from the vicinity of approved berths and anchorages.

8. These samples are analysed for evidence of cobalt-60 and other artificial gamma ray emitting radionuclides known to characterise the radioactive waste likely to be held in an NPW.

9. **External radiation.** When an NPW is at an alongside berth, gamma radiation surveys are undertaken at the wharf in those areas in the vicinity of the vessel designated as free for access by the public or by port employees. Surveys are made initially on the vessel's arrival and periodically thereafter for the duration of the visit using portable dose rate meters capable of measuring ionising radiation dose rates down to 0.01 μSv/h.

10. Thermoluminescent dosemeters. In order to record the accumulated ionising radiation doses that might be received in the port environs following an accidental release of airborne radioactivity, a number of thermoluminescent dosemeters (TLD) are placed at selected locations. The TLD remain in position during the period that an NPW is in port or, in the event of an accident, would remain in position until the termination of the accident. Control TLD are exposed at the Australian Radiation Laboratory (ARL) in Melbourne and also in the port being visited, but remote from the NPW to provide a comparison with the TLD exposed in the field. Field and control TLD are returned to the ARL for measurement.

Direct Radiation Monitoring

11. In order to provide early warning of an NPW reactor malfunction at an alongside berth, fixed radiation detectors are located in the vicinity of the vessel to provide continuous monitoring of gamma radiation levels. The detectors cover the range 0.01 μSv/h to 100 μSv/h with an audible alarm set to trigger at a level of 1 μSv/h. A significant release of radioactivity into the interior of the vessel from the reactor would be detected and initiate an alarm.

PROGRAM IMPLEMENTATION

The Monitoring Program

12. Groups which consist of members from the Australian Nuclear Science and Technology Organisation (ANSTO), the Health and Environmental authorities of the host State or Territory and the Royal Australian Navy (RAN) undertake the external radiation monitoring program. The composition of the groups varies in different ports; however, the Leader of the Radiation Monitoring Group is always a radiation protection officer from ANSTO.

13. The marine environmental monitoring program is a joint undertaking by the Australian Radiation Laboratory (ARL) of the Commonwealth Department of Human Services and Health and either the State concerned or, where the berth is in a naval establishment, the RAN. The collection of samples of sediment and seafood or seaweed is carried out by State authorities or by the RAN, nominally at quarterly[1] intervals at approved berths and anchorages. Samples are also taken prior to and immediately after each visit. The analysis and measurement of samples is undertaken by ARL. Details of the measurement method and detection capability are presented in Part III.

14. The routine sampling program may be discontinued at NPW berths and anchorages which are visited infrequently or where an adequate database has been established. When an NPW subsequently visits such a berth, samples are taken prior to and immediately after the visit and a further set of samples taken three months later.

Contingency Arrangements

15. Port safety organisations have been established at all ports approved for NPW visits and arrangements made so that in the event of a reactor accident they would be activated immediately. Simultaneously, radiation surveys would be initiated by Commonwealth officers in order to identify any radiation hazards. Prior to each visit, the Port Safety Organisation is brought to a state of readiness and briefings are conducted to familiarise key participants with the operational procedures and the tasks required of them in the event of an accident. Normally, an exercise is conducted prior to an NPW visit involving key members of the Port Safety Organisation.

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1 In practice, quarterly generally means 14 days either side of the end of the quarter. Should pre- or post-visit samples fall within two weeks of the due date for routine sampling, then the same set of samples will suffice for the routine and either pre- or post-visit samples. Authorities occasionally have difficulty in obtaining samples within these time scales.

PART II—NUCLEAR POWERED WARSHIP VISITS IN 1997

BRISBANE, QUEENSLAND

VISIT BY USS SALT LAKE CITY

16. USS SALT LAKE CITY, a nuclear powered Los Angeles class attack submarine of the US Navy, visited Brisbane during the period 22–26 March 1997, berthing at the Coal Wharf, Fisherman Islands.

Radiation Monitoring

17. Throughout the visit gamma radiation levels were monitored in the vicinity of the vessel using fixed radiation detectors. Operation of the detectors commenced before the vessel's arrival and continued until its departure. Measurements were displayed and recorded on equipment located in a State Emergency Services caravan, located on the Coal Wharf, which was manned continuously. In addition, measurements of gamma radiation levels were taken using hand-held dose rate meters in those areas around the vessel which were accessible to personnel on the wharf.

Results

18. The average gamma radiation dose rate measured by both fixed and portable monitoring equipment during the visit was 0.15 μSv/h, indicating no significant variations above the natural background level.

19. TLD were exposed at eight designated locations during the visits. Control TLD were held in Brisbane and at ARL. The range of dose measurements from the TLD for the visits showed no obvious increase above the normal range of background levels.

HMAS STIRLING, GARDEN ISLAND, WESTERN AUSTRALIA

VISIT BY USS KEY WEST

20. USS KEY WEST, a nuclear powered Los Angeles class attack submarine of the US Navy, visited HMAS STIRLING during the period 30 April–5 May 1997, berthing at the Diamantina Pier.

Radiation Monitoring

21. Throughout the visit gamma radiation levels were monitored in the vicinity of the vessel using fixed radiation detectors. Operation of the detectors commenced before the vessel's arrival and continued until its departure. Measurements were displayed and recorded on equipment located in the Guardhouse which was manned continuously. In addition, measurements of gamma radiation levels were taken daily using hand-held dose rate meters in those areas around the vessel which were accessible to personnel on the base.

Results

22. The average gamma radiation dose rate measured by fixed and portable monitoring equipment during the visits was 0.2 and 0.14 μSv/h respectively indicating that there was no observable increase in the external gamma radiation level above background.

23. TLD were exposed at six designated locations during the visit. Control TLD were held in Perth and at ARL. The range of dose measurements from the TLD for the visit showed no obvious increase above the normal range of background levels.

VISIT BY HMS TRENCHANT

24. HMS TRENCHANT, a nuclear powered Trafalgar class attack submarine of the Royal Navy, visited HMAS STIRLING during the period 7–17 July and 21 July 1997, berthing at the Diamantina Pier.

Radiation Monitoring

25. Throughout the visit gamma radiation levels were monitored in the vicinity of the vessel using fixed radiation detectors. Operation of the detectors commenced before the vessel's arrival and continued until its departure. Measurements were displayed and recorded on equipment located in the Guardhouse which was manned continuously. In addition, measurements of gamma radiation levels were taken daily using hand-held dose rate meters in those areas around the vessel which were accesssible to personnel on the base.

Results

26. The average gamma radiation dose rate measured by fixed and portable monitoring equipment during the visits was 0.2 and 0.14 μSv/h respectively indicating that there was no observable increase in the external gamma radiation level above background.

27. TLD were exposed at six designated locations during the visit. Control TLD were held in Perth and at ARL. The range of dose measurements from the TLD for the visit showed no obvious increase above the normal range of background levels.

VISIT BY USS CAVALLA

28. USS CAVALLA, a nuclear powered Sturgeon class attack submarine of the US Navy, visited HMAS STIRLING during the periods 13–16 July and 24–28 July 1997, berthing at the Oxley and Diamantina Piers respectively.

Radiation Monitoring

29. Throughout the visits gamma radiation levels were monitored in the vicinity of the vessel using fixed radiation detectors. Operation of the detectors commenced before the vessel's arrivals and continued until its departures. Measurements were displayed and recorded on equipment located in the Guardhouse which was manned continuously. In addition, measurements of gamma radiation levels were taken daily using hand-held dose rate meters in those areas around the vessel which were accesssible to personnel on the base.

Results

30. The average gamma radiation dose rate measured by fixed and portable monitoring equipment during the visits was 0.2 and 0.14 μSv/h respectively indicating that there was no observable increase in the external gamma radiation level above background.

31. TLD were exposed at six designated locations during the visit. Control TLD were held in Perth and at ARL. The range of dose measurements from the TLD for the visit showed no obvious increase above the normal range of background levels.

VISIT BY HMS TRAFALGAR

32. HMS TRAFALGAR, a nuclear powered Trafalgar class attack submarine of the Royal Navy, visited HMAS STIRLING during the period 14–21 July 1997, berthing at the Diamantina Pier.

Radiation Monitoring

33. Throughout the visit gamma radiation levels were monitored in the vicinity of the vessel using fixed radiation detectors. Operation of the detectors commenced before the vessel's arrival and continued until its departure. Measurements were displayed and recorded on equipment located in the Guardhouse which was manned continuously. In addition, measurements of gamma radiation levels were taken daily using hand-held dose rate meters in those areas around the vessel which were accesssible to personnel on the base.

Results

34. The average gamma radiation dose rate measured by fixed and portable monitoring equipment during the visits was 0.2 and 0.14 μSv/h respectively indicating that there was no observable increase in the external gamma radiation level above background.

35. TLD were exposed at six designated locations during the visit. Control TLD were held in Perth and at ARL. The range of dose measurements from the TLD for the visit showed no obvious increase above the normal range of background levels.

PART III—MARINE ENVIRONMENTAL SAMPLING

Measurement Method

36. Each sample is measured for at least 10 000 seconds, in a standard geometry, in a low background gamma ray spectrometer with a hyperpure germanium detector. Each gamma ray spectrum is scrutinised over the energy range of 50 to 1500 KeV for evidence of cobalt-60 and other artificial gamma ray emitting radionuclides.

Detection Capability

37. The measurement method used has sufficient sensitivity to detect concentrations of gamma ray emitting radionuclides in shellfish which, based upon typical intakes of shellfish, would result in no more than one per cent of the annual limits for members of the public as given in the **'1990 Recommendations of the International Commission on Radiological Protection (ICRP Publication 60)'** which are currently in the process of being adopted for Australia by the National Health and Medical Research Council.

38. For surface layer of bottom sediment, the measurement method used has sufficient sensitivity to detect artificial gamma ray emitting radionuclides at concentrations at least as low as 40 millibecquerels per gram of sediment.

Marine Environmental Monitoring

39. Marine environmental samples appropriate to each berth visited in HMAS STIRLING and Brisbane were collected according to the agreed sampling program.

40. All samples were analysed at ARL. Certificates of analysis issued by ARL showed that no radionuclide was detected that would be characteristic of the radioactive waste associated with NPW operations.

PART IV—CONCLUSIONS

41. The program of radiation monitoring and marine environmental sampling implemented for visiting NPW during 1997 was consistent with the Commonwealth Government's requirements.

42. There was no indication of any infringement of Australian public health standards. Radiation monitoring did not detect any release of radioactive materials, nor did radiation measurements indicate any value in excess of background levels of ionising radiation either during or subsequent to these visits.