



Australian Government
Department of Defence

**VISITS BY NUCLEAR POWERED WARSHIPS
TO AUSTRALIAN PORTS**

Report on Radiation Monitoring During 2015

Canberra, Australia
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FOREWORD

1. This publication has been prepared for the Australian Department of Defence in consultation with the appropriate Commonwealth departments through the standing inter-departmental committee, the Visiting Ships' Panel (Nuclear).

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SUMMARY

Six Nuclear Powered Warship (NPW) visits were made to Australian ports in 2015. The visits were made by ships of the United States Navy. Details of the visits are as follows:

Port	Ship	Visit Dates
HMAS STIRLING	USS ALBERQUE	24 - 28 February 2015 07 – 12 March 2015 15 – 18 March 2015
HMAS STIRLING	USS JACKSONVILLE	25 June - 01 July 2015
FREMANTLE	USS CARL VINSON	25 April – 02 May 2015
BRISBANE	USS GEORGE WASHINGTON	19 – 24 June 2015
Total Visit Days	33	

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 visit during 2015 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. 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 Nuclear Powered Warships (NPW) radiation monitoring program, describes the implementation of the program for the visits during 2015 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, September 2003. These requirements were previously published in the ‘Environmental Radiation Monitoring during Visits of Nuclear Powered Warships to Australian Ports’, Department of Defence, August 1994.
4. The monitoring program has two main components:
 - (a) environmental monitoring, is designed to detect the release of any radioactive material (e.g. waste) to the environment; and
 - (b) direct radiation monitoring is 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 attributable to 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 Australian Radiation Protection and Nuclear Safety Agency, *Recommendations for limiting exposure to ionizing radiation* (1995), and the National Occupational Health and Safety Commission 2002, *National standard for limiting occupational exposure to ionizing radiation*, republished 2002, ARPANSA, Yallambie, and Nuclear Safety Agency, Radiation Protection Series No.7, *Intervention Levels in Emergency Situations Involving Radiation Exposure*, published in 2004 by ARPANSA. 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 seafood 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 seafood 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 a NPW.

9. **External radiation.** When a 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 mSv/h.

10. **Thermoluminescent dosimeters.** 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 dosimeters (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 Protection and Nuclear Safety Agency's (ARPANSA) laboratory 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 ARPANSA 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 of 0.01 mSv/h to 100 mSv/h with an audible alarm set to trigger at a level of 1 mSv/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 ARPANSA, Radiation Health Branch and either the State concerned or, where the berth is in a naval establishment, the RAN. The collection of samples is carried out by State authorities or by the RAN, at approved berths and anchorages. The analysis and measurement of samples is undertaken by ARPANSA. 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, Commonwealth officers would initiate radiation surveys 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.

PART II - NUCLEAR POWERED WARSHIP VISITS IN 2015

HMAS STIRLING, WESTERN AUSTRALIA

Visits by USS ALBERQUE and USS JACKSONSVILLE

19. USS ALBERQUE (SSN776) and USS JACKSONSVILLE (SSN699) nuclear powered Los Angeles class submarines of the US Navy visited HMAS STIRLING as follows:

- a. USS ALBERQUE 24 – 28 February, 07 – 12 March 2015, 15 – 18 March 2015, and
- b. USS JACKSONSVILLE 25 June – 01 July 2015.

Radiation Monitoring

20. 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 Emergency Operations Centre 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

21. The gamma radiation dose rates measured by both the fixed and portable monitoring equipment during the visit were between 0.1 and 0.3 $\mu\text{Sv/h}$ indicating that there was no observable increase in the external gamma radiation level above background.

FREMANTLE, WESTERN AUSTRALIA

Visit by USS CARL VINSON

22. USS CARL VINSON (CVN70), a nuclear powered Nimitz class aircraft carrier of the US Navy visited Fremantle 25 April – 02 May 2015.

Radiation Monitoring

23. Throughout the visit gamma radiation levels were monitored in the vicinity of the vessel by fixed radiation detectors onboard the Radiation Monitoring Vessel. Operation of the detectors commenced before the vessel's arrival and continued until its departure. Measurements were displayed and recorded on equipment located on the Radiation Monitoring Vessel which was manned continuously.

Results

24. The gamma radiation dose rates measured by the monitoring equipment during the visit were between 0.1 and 0.3 $\mu\text{Sv/h}$ indicating that there was no observable increase in the external gamma radiation level above background.

BRISBANE, QUEENSLAND**Visit by USS GEORGE WASHINGTON**

25. USS GEORGE WASHINGTON (CVN73), a nuclear powered Nimitz class aircraft carrier of the US Navy visited Brisbane 19 – 24 June 2015.

Radiation Monitoring

26. 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 caravan located on the wharf which was manned continuously.

Results

27. The gamma radiation dose rates measured by the monitoring equipment during the visit were between 0.1 and 0.3 $\mu\text{Sv/h}$ indicating that there was no observable increase in the external gamma radiation level above background.

PART III - MARINE ENVIRONMENTAL SAMPLING

Measurement Method

28. Each sample is measured for at least 10,000 seconds, in a standard geometry low background gamma ray spectrometer with a hyper-pure germanium detector. Each gamma ray spectrum is scrutinised over the energy range of 50 to 2000 keV for evidence of iodine-131, cesium-137, cobalt-60 and other artificial gamma ray emitting radionuclides.

Detection Capability

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

30. The measurement method used has sufficient sensitivity to detect concentrations of gamma ray emitting radionuclides in shellfish at levels below the marker radionuclide Reference Levels for contaminated foodstuff in Australian Radiation Protection and Nuclear Safety Agency, Radiation Protection Series No. 7, *Intervention Levels in Emergency Situations Involving Radiation Exposure*, republished in 2004 by ARPANSA

Marine Environmental Monitoring

31. Marine environmental samples appropriate to the anchorages and berths visited in Fremantle and HMAS STIRLING were collected according to the agreed sampling program.

32. All samples were analysed at ARPANSA. Analysis Reports issued by ARPANSA show that no radionuclide was detected that would be characteristic of the radioactive waste associated with NPW operations.

PART IV - CONCLUSIONS

33. The program of radiation monitoring and marine environmental sampling implemented for visiting NPW during 2015 was consistent with the Commonwealth Government's requirements.

34. 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.