



Department of Defence

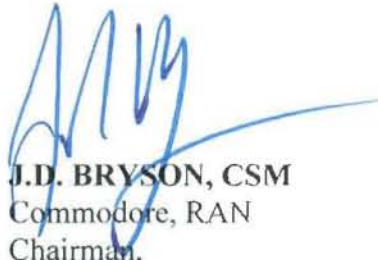
VISITS BY NUCLEAR POWERED WARSHIPS
TO AUSTRALIAN PORTS

Report on Radiation Monitoring During 2009

Canberra, Australia
2010

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).



J.D. BRYSON, CSM
Commodore, RAN
Chairman,
Visiting Ships' Panel (Nuclear)

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SUMMARY

Five Nuclear Powered Warships (NPW) visits were made to Australian ports in 2009. The visits were made by ships of the United States Navy. The details of the visits are as follows:

Port	Ship	Visit Dates
FREMANTLE	USS GEORGE WASHINGTON	2 – 7 July 2009
HMAS STIRLING	USS TOPEKA	31 July – 5 August 2009
	USS TOPEKA	9 August 2009
	USS TOPEKA	12-19 August 2009
	USS TOPEKA	23 August 2009

Total Visit Days: 19

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 2009 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 2009 and records the results of radiation measurements taken.

VISITING SHIPS PANEL (NUCLEAR) ACTIVITIES

3. During 2009 the Visiting Ships Panel (Nuclear) (VSP(N)) met on four occasions and the biennial Nuclear Powered Warships Seminar was held. OPSMAN 1 was also reviewed during 2009 to ensure the document remains current and the activities of the VSP(N) are delivered in accordance with OPSMAN 1 and meet the findings of the 1989 Senate Inquiry.
4. The VSP(N) Working Group continues to conduct Port re-validations of authorised Nuclear Powered Warship (NPW) ports. Melbourne and Hobart were validated in 2009.

THE RADIATION MONITORING PROGRAM

5. 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.
6. 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

7. 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.
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8. The relevant Australian public health standards are those recommended by the Australian Radiation Protection and Nuclear Safety Agency 2002, *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*, Radiation Protection Series No. 7, republished 2004, ARPANSA, Yallambie. 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.

9. **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.

10. 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.

11. **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 $\mu\text{Sv/h}$.

12. **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

13. 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 $\mu\text{Sv/h}$ to 100 mSv/h with an audible alarm set to trigger at a level of 1 $\mu\text{Sv/h}$. 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

14. 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.

15. The marine environmental monitoring program is a joint undertaking by the ARPANSA, Environmental and Radiation Health Branch 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, 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.

16. 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

17. 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 2009

FREMANTLE, WESTERN AUSTRALIA

Visit by USS GEORGE WASHINGTON

18. USS GEORGE WASHINGTON (CVN 73) a nuclear powered Nimitz Class Aircraft Carrier of the US Navy visited Gage Roads, Fremantle on one occasion during the period 2-7 July 2009 whilst conducting exercises with the RAN. She anchored off Fremantle in Gage Roads anchorage.

Radiation Monitoring

19. Throughout the visit gamma radiation levels were monitored in the vicinity of the vessel using mobile radiation detectors located in a vessel that continuously operated within 600 metres of the vessel during the period of the visit.

Results

20. The gamma radiation dose rates measured by the 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 the natural background levels.

HMAS STIRLING, WESTERN AUSTRALIA

Visit by USS TOPEKA

24. USS TOPEKA (SSN 754), a nuclear powered Los Angeles class attack submarine of the US Navy, visited HMAS STIRLING on four occasions during the period 31 July 2007 to 23 August 2007 whilst participating in exercises with the RAN. She conducted personnel transfers in Cockburn Sound and berthed at Diamantina Pier during the periods 31 July – 05 August 2009, 09 August 2009, 12 – 19 August 2009 and 23 August 2009.

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 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

26. 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.

PART III - MARINE ENVIRONMENTAL SAMPLING

Measurement Method

30. Each sample is measured for at least 10,000 seconds, in a standard geometry, in a 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

31. For the 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.

32. 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

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

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

PART IV - CONCLUSIONS

35. The program of radiation monitoring and marine environmental sampling implemented for visiting NPW during 2009 was consistent with the Commonwealth Government's requirements.

36. 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.