Australian Government
Department of Defence

VISITS BY NUCLEAR POWERED WARSHIPS TO AUSTRALIAN PORTS

Report on Radiation Monitoring During 2022

Canberra, Australia
2023

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

Two Nuclear Powered Warship (NPW) visits were made to Australian ports in 2022. The visits were made by warships of the United States Navy. Details of the visits are as follows:

Port	Ship	Visit Dates
HMAS STIRLING	USS SPRINGFIELD	23 - 29 Apr 22
HMAS STIRLING	USS MISSISSIPPI	28 Nov – 06 Dec 22
Total Visit Days	**15**	

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 2022 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 2022 and records the results of radiation measurements taken.

THE RADIATION MONITORING PROGRAM

3. The requirements for the monitoring program are laid down in OPSMAN1 *Visits to Australia by Nuclear Powered Warships* and Environmental Radiation Monitoring during *Visits of Nuclear Powered Warships to Australian Ports - Requirements, Arrangements and Procedures*, Department of Defence, September 2003.

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 published in the Radiation Protection Series (RPS) by the Australian Radiation Protection and Nuclear Safety Agency. Of particular relevance to NPW visits are:

a. Code for Radiation Protection in Planned Exposure Situations (RPS C-1);

b. Guide for Radiation Protection in Existing Exposure Situations (RPS G-2); and

c. Guide for radiation Protection in Emergency Exposure Situations (RPS G-3).

7. These guides 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 during and post-accident.

8. A marine environmental monitoring program is implemented to determine the potential for exposure to people and the environment due to the release of radionuclides into the marine environment. The monitoring technique is used to extract and quantify radiocaesium (caesium-137 and caesium-134) from the seawater in the vicinity of approved berths and anchorages. The radiocaesium is concentrated, onto chemically coated filter cartridges, using an in-situ caesium extraction unit (see Part III).

9. These samples are analysed for evidence of radiocaesium (Cs-134 and Cs-137) that are known to be present in a nuclear reactor accident release. Low levels of Cs-137 are present in the marine environment as a result of global fallout. Background levels of caesium-137 in Australian waters range from 0.7 to 1.4 mBq/L.

10. **External radiation**. When a NPW is at an alongside berth, gamma radiation surveys are undertaken at the wharf in areas near the vessel designated as free for access by the public or by port employees. Surveys are conducted 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.

11. **Passive dosimeters**. 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 Optically Stimulated Luminescence dosimeters (OSL) are placed at selected locations. The OSL remain in position during the period that an NPW is in port or, in the event of an accident, would remain until the accident's termination. Control OSL 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 OSL exposed in the field. Field and control OSL are returned to ARPANSA for measurement.

Direct Radiation Monitoring

12. 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 10 nSv/h to 10 Sv/h, are solar powered with a battery backup and provide remote telemetry transmitted via the cellular network and a backup satellite communication pathway. The alarm is 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

13. Radiation Monitoring 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.

14. The marine environmental monitoring program is a joint undertaking by ARPANSA, Radiation Health Services and either the State concerned or, where the berth is in a naval establishment, the RAN. The collection of samples is carried out by ARPANSA, State authorities or 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.

15. 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 immediately after the visit.

Contingency Arrangements

16. 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 2022

HMAS STIRLING, WESTERN AUSTRALIA

Visit by USS SPRINGFIELD

17. USS SPRINGFIELD (SSN761) a nuclear powered Los Angeles class submarine of the United States Navy visited HMAS STIRLING 23-29 April 2022.

Radiation Monitoring

18. Throughout the visit gamma radiation levels were monitored in the vicinity of the vessel using fixed radiation detectors. The 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

19. The gamma radiation dose rates measured by both the fixed and portable monitoring equipment during the visit were between 0.06 and 0.23 μSv/h indicating that there was no observable increase in the external gamma radiation level above background.

20. The activity concentration in the post-visit seawater samples was 1.26 ± 0.20 mBq/L and 1.13 ± 0.15 mBq/L for Cs-137 and below the minimum detectable activity concentration for Cs-134. The results indicate there was no release of radionuclides to the marine environment.

21. The dose received by passive dosimeters at all locations were below the minimum reportable dose.

Visit by USS MISSISSIPPI

22. USS MISSISSIPPI (SSN782) a nuclear powered Virginia class submarine of the United States Navy visited HMAS STIRLING 28 November – 06 December 2022.

Radiation Monitoring

23. Throughout the visit gamma radiation levels were monitored in the vicinity of the vessel using fixed radiation detectors. The 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

24. The gamma radiation dose rates measured by both the fixed and portable monitoring equipment during the visit were between 0.09 to 0.16 μSv/h indicating that there was no observable increase in the external gamma radiation level above background.

25. The activity concentration in the post-visit seawater sample was 1.09 ± 0.11 mBq/L for Cs-137 and below the minimum detectable activity concentration for Cs-134. The results indicate there was no release of radionuclides to the marine environment.

26 The dose received by passive dosimeters at all locations were below the minimum reportable dose.

PART III—MARINE ENVIRONMENTAL SAMPLING

Measurement Method

27. Seawater is sampled from the site of the visiting ship and pumped through a series of filter cartridges. The coated cartridges, containing the extracted radiocaesium, undergo laboratory pre-treatment which includes drying, ashing and homogenisation, prior to measurement using high resolution gamma spectrometry.

Detection Capability

28. The detection limit for the radiocaesium (based on a 24 hour count time) is better than 0.2 mBq/L. This monitoring approach will provide the means to determine if there have been any releases from the NPW to the marine environment.