Australian Government
Department of Defence

VISITS BY NUCLEAR POWERED WARSHIPS TO AUSTRALIAN PORTS

Report on Radiation Monitoring During 2016

Canberra, Australia
2017

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).

CONTENTS

SUMMARY

No Nuclear Powered Warship (NPW) visits were made to Australian ports in 2016.

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 as no visits occurred in 2016 no radiation monitoring was conducted.

This report presents a summary of the objectives and requirements of the NPW radiation-monitoring program.

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 2016 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 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 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 to100 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 2016

16. There were no NPW visits to Australian ports during 2016.

Radiation Monitoring

17. During an NPW visit gamma radiation levels are 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 are displayed and recorded on equipment located in the vicinity of the berth and manned continuously during the visit. 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 radiation monitoring personnel.

PART III - MARINE ENVIRONMENTAL SAMPLING

Measurement Method

18. 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

19. 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 more than one per cent of the annual limits for members of the public as given in the Australian Radiation Protection and Nuclear Safety Agency 2002, Recommendations *for limiting exposure to ionizing radiation (*1995) and National Occupational Health and Safety Commission 2002, *National standard for limiting occupational exposure to ionizing radiation*, Radiation Protection Series No. 7, republished in 2004 by ARPANSA, Yallambie.

20. 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.