Australian Government

Nuclear-based science benefiting all Australians

HIFAR Facility Licence Application Part B(3)

Document ANSTO/06/749/2/FP-3

# RADIATION PROTECTION PLAN FOR THE HIFAR FACILITY

(REV. 0)

**Prepared By**

**Australian Nuclear Science and Technology Organisation**

**May 2007**

| **REVISION SHEET** | | **Document** ANSTO/06/749/2/FP-3 | | | |
|---|---|---|---|---|---|
| | | Print name, date and sign or initial | | | |
| Revision Number | Description of Revision | Prepared | Checked/ Reviewed | Approved | Agreed |
| 0 | Original issue | Simon Bastin | Alison Parkes<br>Pertti Sirkka | John Rowling | Con Lyras |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

# CONTENTS

# 1 PURPOSE AND SCOPE

The purpose of this Radiation Protection Plan is to describe the organisational arrangements and procedures for the control of exposures to ionising radiation during all activities at the HIFAR facility during the period that this Possess or Control licence remains in force.

The plan outlines the systems and processes that ensure compliance with standards and regulatory requirements on radiation protection and the application of optimisation of protection, which contribute to the development of a safety culture at HIFAR.

This Plan has been prepared for the safe management of the facility and as part of the "Possess or Control" Licence Application (refer to Part A of the Application for further details).

This plan should be read in conjunction with other plans, specifically those relating to effective control, emergency arrangements and waste management.

# 2 RESPONSIBILITIES

ANSTO, as the licence holder, has responsibility for the management of the HIFAR facility. The Executive Director of ANSTO has delegated responsibility for the safe management of HIFAR to the General Manager, Technical Services and Facility Management (TS&FM) during the period that this licence remains in force. The Operating Organisation for this phase, with roles, responsibilities and lines of communication of key personnel, is described in detail in the Effective Control Plan.

The General Manager, Technical Services and Facilities Management has overall responsibility for the maintenance of and the safety of activities undertaken in HIFAR during the period that this licence remains in force, consistent with ANSTO policies and general arrangements. The Nominee is delegated to make, amend or vary the application in the name of ANSTO, pursuant to paragraph 34(a) of the ARPANS Act 1998 and regulation 39 of the ARPANS Regulations 1999.

The General Manager, Technical Services and Facilities Management has delegated responsibility for implementing these Plans to the Facility Manager. The Facility Manager is responsible for planning and managing resources to ensure the safety of activities undertaken in HIFAR and the effective maintenance and control of HIFAR (TSFM Procedure DHF 001 – "Quality Management Planning – De-fuelled HIFAR Facility" [1] and Procedure NHP 1.2 – "Organisation, Responsibilities and Authority". [2]

# 3 RADIATION PROTECTION ARRANGEMENTS

ANSTO OHSE arrangements implement its Safety Policy APOL 2.1 and help ensure the radiation protection of its employees and others, whether on the HIFAR site or elsewhere. These arrangements in relation to radiation protection centre on OHSE AS2310 *ANSTO OHSE Standard - Radiation Safety* and are implemented through the application of the following guides and practices:

AG 2505 *ALARA Assessment (Guide)*

AG 2506 *Risk Assessment and ALARA Cost-benefit Analysis*

AG 2471 *Safe Management of Licensable Sources (Guide)*

AG 2508 *Derived Air Concentrations and Annual Limits on Intake of Common Radionuclides (Guide)*

AG 2509 *Classification of Radiation and Contamination Areas (Guide)*

AG 2510 *Entry to and Exit From Classified Radiation Areas (Guide)*

AG 2511 *Clothing to be Worn in Classified Radiation Areas (Guide)*

AG 2512 *Clothing Change Procedures When Entering or Leaving Classified Areas (Guide)*

AG 2513 *Contamination Clearance Levels (Guide)*

AG 2514 *Clearance of Radiation Classified or Radioactive Contamination (Guide)*

AG 2521 *Personal Dosimetry (Guide)*

HIFAR Procedure, NHP 9.2.21 – "Radiological Safety" implements these arrangements at the facility level. This procedure was used during the operational phase of the reactor in compliance with the relevant provisions of the existing HIFAR Operating Licence.

## 3.1 Radiation Protection Staff

HIFAR has a Service Level Agreement (SLA) with ANSTO's Safety and Radiation Services (SRS) Division, which provides services (through Health Physics staff assigned to HIFAR and others in the SRS) in the areas of radiation protection and related services.

The Nominee, the Facility Officer, the assigned Radiation Protection Adviser (RPA) (from SRS), and other staff related to radiation protection services implement the radiation protection strategies at the HIFAR facility during the period that this licence remains in force, as described in this plan and associated documents.

The RPA is a tertiary qualified person trained in radiation protection who advises the facility management/leaders, supervisors and others on radiation protection issues, safe working practices, standards and the optimisation of operational radiation protection measures. The RPA has professional experience in applied health physics and radiation protection. The RPA assists in supporting staff with improvements in radiation safety on a day-to-day basis. Advice on licensed source handling and storage, radioactive waste and transport of radioactive material are also available from the RPA and HPS.

The RPA advises on the development, application and modification of HIFAR procedures, instructions and written work systems for all activities where radiological safety assessment is required.

The duties and the responsibilities of the Health Physics staff are detailed in the existing local HIFAR Procedure, NHP 9.2.21 – Radiological Safety [3].

The RPA is supported by Health Physics Surveyors (HPSs), who are technically trained staff who have been accredited in providing radiation protection and monitoring services and advices to staff. The HPSs perform radiation monitoring surveys for tasks performed within the facility. The HPSs report to the RPA.

## 3.2 Radiation Protection Standards

ANSTO's radiation protection arrangements have been designed to comply with the "National Standard for Limiting Occupation Exposure to Ionising Radiation" [4]. The arrangements are also in accordance with those outlined in the "International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources" [5].

The transport of radioactive materials complies with the ARPANSA "Code of Practice for the Safe Transport of Radioactive Materials" [6], and the IAEA "Regulations for the Safe Transport of Radioactive Material" [7].

ANSTO is committed to applying international best practice, where available, and any necessary changes will be made to the ANSTO system through the updating of the Radiation Safety Standards in the ANSTO OHSE System.

## 3.3 Dose Limits

ANSTO applies the basic radiation protection principle of limitation as recommended by the national standard, IAEA Basic Safety Standard [5], ARPANS Regulations [8] and the ICRP [9].

In accordance with the above, for occupational exposure, the effective dose shall not exceed 20 millisieverts annually, averaged over five consecutive years, and shall not exceed 50 millisieverts in any single year.

For occupational exposure, the annual equivalent dose shall not exceed:

- 150 millisieverts to the lens of the eye;
- 500 millisieverts to the hands and feet;
- 500 millisieverts to the skin (average dose received by any one square centimetre of skin).

For public exposure, the annual effective dose must not exceed 1 millisievert (mSv).

For public exposure, the annual equivalent dose must not exceed:

- 15 millisieverts to the lens of the eye
- 50 millisieverts to the skin (average dose received by any one square centimetre of skin).

Persons under the age of 16 are not allowed to work in a controlled area under any circumstances. They may visit radiologically classified areas for educational purposes, provided the Area Supervisor or other responsible person familiar with the area accompanies them.

Persons over the age of 16 but under 18 may work in controlled areas under supervision for training purposes, but the following annual dose constraints apply:

- 1 millisievert effective dose,
- 15 millisieverts to the lens of the eye,
- 50 millisieverts to the hands and feet,
- 50 millisieverts to the skin (average dose received by any one square centimetre of skin).

## 3.4 Dose Constraints

ANSTO is committed to ensure that, for all activities at the HIFAR facility during the period that this licence remains in force, effective radiation doses (including committed effective radiation doses) to persons do not exceed any dose constraints for the facility agreed by the CEO, ARPANSA.

## 3.5 As Low As Reasonably Achievable (ALARA)

ANSTO is committed to the fundamental radiation protection principle of optimisation as outlined in the ANSTO OHSE standards – Radiation Safety, and the OHSE Optimisation practice. All activities undertaken in HIFAR during the period that this licence remains in force shall be performed in close consultation with Health Physics Staff, where applicable. The planning process shall consider ALARA, where relevant, to ensure that all exposures to ionising radiation are ALARA.

## 3.6 Radiation Monitoring

### 3.6.1 General

Radiation monitoring is the collection of information about radiological conditions in the workplace and the assessment, interpretation and evaluation of this information (workplace/area monitoring). This, together with information on exposures to individuals (individual monitoring), assists in confirming safe working practices and engineering standards, and that radiological hazards are under effective control in a way which complies with international best practice and regulatory requirements.

The monitoring programs that demonstrate adequate protection and optimisation of those protection measures are described in two parts. The first is based on measurements (known as ‘surveys’) taken in the workplace or area where personnel work (workplace/area monitoring). The second is based on measuring exposure to radioactivity, or radioactivity in or on an individual (individual monitoring, also known as personal dosimetry). These monitoring programs are described in AG 2521 - Personal Dosimetry (Guide).

- Routine monitoring is the foundation of the operational monitoring program, and consists of planned monitoring that confirms the radiological conditions and levels of individual dose to meet radiation protection requirements and objectives.
- Task-related monitoring applies to a specific task, and can be used to provide data on the safe management of the task and decisions on protection techniques and their optimisation.

### 3.6.2 Routine Area Monitoring

The purpose of routine area monitoring in HIFAR is as summarised above, and more specifically is:

- to confirm effective control of sources of radiological hazards in all areas by the use of safe working procedures and engineering features,

- to confirm the area classifications and any changes in radiological conditions,
- to review area classifications, and
- to evaluate actual and potential dose rates, surface and air contamination levels.

#### 3.6.3 Task Related Area Monitoring

Task-related area monitoring is any dose rate, air or surface contamination measurements using similar (or same) equipment to that described for routine area monitoring. ALARA and dose reduction assessment monitoring for a specific activity or group of activities is an example of this type of monitoring. It is anticipated that this may occur at times when specific tasks are being undertaken during the possession and control period of HIFAR or as assessments in preparation for final decommissioning.

#### 3.6.4 Individual Monitoring

Individual (routine, task and special) monitoring is the measurement, assessment and evaluation of radiological exposure information to an individual. Monitoring of occupationally exposed workers is performed as part of the routine dosimetry program described in AG 2521. Monitoring may also be performed for reassurance purposes or to show compliance with non-occupationally exposed worker (public) dose limits.

Routine external monitoring using Thermoluminescent Dosimeters (TLDs) for effective (beta, gamma and neutron) and extremity (beta and gamma) dosimetry is carried out. Where required, individual monitoring using electronic dosimeters for effective (gamma) dose assessment is also carried out (AG 2521). TLD issue/assessment periods are usually monthly or three-monthly.

Task and special external individual monitoring may be warranted for ALARA or incident/event or process assessment of exposures to different parts of the body and whole body (effective).

Individual monitoring for internal dosimetry is performed by whole body and thyroid counting for gamma emitting contaminants and bioassay samples of urine tested for tritium, as described in AG 2521. Regular routine individual monitoring for potential internal exposure is performed if indicated by an assessment of the risk of intake of radioactivity from surface and airborne radionuclides. Special monitoring may be performed if an intake is indicated or suspected and for reassurance purposes following an incident.

Reference levels for individual (occupationally exposed worker) values exist in the form of Investigation Levels. The investigation levels are set at 1 mSv per month for effective dose, and 40 mSv per month for skin or extremity doses. Investigations are performed by an RPA, and results are discussed with line management in order to assess contributing factors and protective actions if required. A reference level for individual effective value, known as an ALARA assessment value, is set at 2 mSv per year (AG 2505).

## 3.7 Radiation Monitoring Instrumentation

The radiation monitoring equipment used in HIFAR consists of a combination of fixed and portable instrumentation designed to monitor the radiological conditions and the personnel throughout the facility.

The fixed radiation monitoring in the reactor building is used to detect tritium (as tritiated water vapour) and gamma emitters. These are described in the Safety Analysis Report, but a summary is presented here.

The current instruments in the facility are:

- Area radiation monitoring system;
- Beam radiation monitors;
- Portable radiation monitors; and
- Tritium monitor.

Radiation monitors are installed to measure and display gamma radiation levels in the Reactor Building. They incorporate visual warnings and visual and audible alarms. Each channel consists of a detector/transmitter, local display unit and a main amplifier. They are connected to the HIFAR instrumentation power supply.

The detectors are distributed strategically within the building. Each detector displays the local radiation level and incorporates a radiation warning light and visual and audible high radiation alarms. Connected to the monitors are visual high radiation warnings and alarms. The monitors also initiate alarms of high radiation, with set points for warning at 100µSv/h and alarm at 1000 µSv/hr.

Gamma radiation monitors were used to monitor radiation from the reactor beams. They provide a local visual and audible alarm when the radiation at the detector exceeds the set point of 1 mSv/hr.

Gamma alarms are provided in areas with high intermittent radiation to give a local display of radiation fields. They also provide visual and audible alarms of high radiation. The radiation level is displayed and visual and optional audible alarm is given.

There are two gas monitors installed in the HIFAR Facility. They are calibrated for tritium or gamma radiation, but they are used here to measure tritium. One can be valved to sample the heavy water plant room and the reactor top void if appropriate. The units incorporate a local audible alarm.

The functions of the fixed radiation monitoring instrumentation are complemented by the use of portable radiation monitoring equipment that has the ability to monitor beta and gamma dose rates and surface and airborne contamination levels throughout the reactor, items and individuals.

Portable monitors will be used to supplement the fixed monitors whenever any refurbishment or dismantling work is being undertaken. Portable instruments are also used to measure items leaving classified areas and to clear items for use or disposal outside the building. Potentially contaminated surfaces are surveyed using portable instruments or applying smear sampling techniques and remote assessment. Portable air samplers are also provided to assess tritium, particulate and iodine concentrations in air.

Personnel doses are monitored using Thermoluminescent Dosimeter (TLD) badges and, in special cases, direct reading dosimeters. Techniques for detecting and measuring potential internal contamination are available.

# 4 INTERNATIONAL BEST PRACTICE

The Radiation Protection Plan for HIFAR during the Possess and Control period is consistent with international best practice and according to the IAEA's standards and guidelines on protection against the effects of ionising radiation (IAEA Safety Series No. 115, 1996 and Safety Guide No. RS-G-1.1, and ICRP 60). The plan covers the radiation protection principles and policies, radiological classification of areas and more importantly, the monitoring programs for the Possess and Control Period. The plan is similar to the one submitted previously to ARPANSA with licence application for other controlled facilities in ANSTO and has demonstrated its effectiveness.

# 5 REFERENCES

1 TSFM Procedure DHF 001 (Rev. 0) – "Quality Management Planning – De-fuelled HIFAR Facility"

2 HIFAR Procedure NHP 1.2 (Rev. 11) – "Organisation, Responsibilities and Authority"

3 HIFAR Procedure NHP 9.2.21 (Rev. 2) – "Radiological Safety"

4 National Standard for Limiting Occupational Exposure to Ionising Radiation [NOHSC:1013 (1995)]

5 "International Basic Safety Standards for Protection against Ionising Radiation and for the Safety of Radiation Sources", IAEA Safety Series No. 115, 1996

6 Code of Practice for the Safe Transport of Radioactive Materials, ARPANSA Radiation Protection Series No. 2

7 Regulations for the Safe Transport of Radioactive Material, IAEA Safety Standards Series No. TS-R-1 (ST-1, Revised), 1996 Edition (Revised 2000)

8 Australian Radiation Protection and Nuclear Safety (ARPANS) Regulations 1999

9 Recommendations of the International Commission on Radiological Protection (ICRP), Publication 60, 1990