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HIFAR Facility Licence Application Part A

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APPLICATION FOR THE FACILITY LICENCE, "POSSESS OR CONTROL" FOR THE HIFAR FACILITY:

GENERAL INFORMATION

(Rev. 0)

Prepared By

Australian Nuclear Science and Technology Organisation

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1 PURPOSE AND SCOPE

This document constitutes Part A of an application for a Facility Licence, made by the Australian Nuclear Science and Technology Organisation (ANSTO[1]) for the shutdown HIFAR Facility, in accordance with the requirements of the ARPANS Act 1998 and Regulations 1999 as amended. [1, 2]

This Licence Application has been prepared for an authorisation to Possess or Control the facility. The period for which the Possess or Control licence will remain in force is called the "Possess and Control period" for the purposes of this application.

This document should be read in conjunction with other parts of this application.

ANSTO anticipates that this licence will be required for approximately ten years. Near the end of that period, ANSTO will seek a licence to commence decommissioning HIFAR. The ten year period is subject to the availability of the Commonwealth Radioactive Waste Management Facility and other factors.

1.1 Background Information

The 10 MW (thermal) High Flux Australian Reactor (HIFAR) operated by ANSTO was permanently shutdown on 30 January 2007 following completion of Operating Programme number 595 after a period of approximately 50 years of operation.

HIFAR first went critical on 26 January 1958 and routine full power operation began two years later.

HIFAR was operated in accordance with a Facility Licence (FO 0044-4A) issued by ARPANSA on 14 June 2001 [3] and its subsequent amendments. Prior to this, HIFAR was operated in accordance with "Authorisation - HIFAR Operation" since its introduction in 1983 and other previous authorisations.

HIFAR was taken out of service because it had reached the end of its useful life and is now considered technologically obsolete, and because the OPAL Reactor has now been licensed for operation.

ANSTO submitted a Preliminary Decommissioning Plan to ARPANSA on 1 May 2003. This Licence Application was prepared based on ARPANSA response on the Preliminary Plan and subsequent related communications between ANSTO and ARPANSA.

2 DESCRIPTION OF THE HIFAR FACILITY

2.1 HIFAR Historical Description

The HIFAR Descriptive Manual, Document Number NTP/TN 189 [4] provides the overall detailed description of the HIFAR facility in its operational state, including the reactor structure and systems, the Engineered Safety Provisions and shutdown mechanisms.

HIFAR (High Flux Australian Reactor) was a low power, high flux research reactor which was fuelled with enriched uranium (HEU for most of its lifetime), moderated and cooled by heavy water contained in a Reactor Aluminium Tank. HIFAR had a design nominal thermal power output of 10 MW, and included equipment and systems required for the safe operation of the reactor or for keeping the reactor in a safe shutdown state. In 2004, ANSTO obtained approval for the use of Low Enriched Uranium (LEU) fuel elements in the HIFAR core.

HIFAR was originally intended as a materials test reactor similar to the DIDO reactor built at Harwell in England in 1955-1956. The United Kingdom Atomic Energy Authority (UKAEA) provided the detailed plans and specifications of DIDO, which first operated at power towards the end of 1956. The foundations of HIFAR were begun in June 1956 and the then AAEC (now ANSTO), taking advantage of the early operating experience with DIDO, incorporated some modifications.

[1] Note that Definitions of the Terms and Acronyms used throughout this document are provided in the Glossary in Part 0 of this Licence Application.

The HIFAR Safety Document was the effective Safety Analysis Report for the operational phase of HIFAR. [5]

2.2 HIFAR Current Description

Since its permanent shutdown, the following items have been removed from the HIFAR reactor under the existing operating licence:

- all fuel elements,
- rigs and targets,
- heavy water (drained from the RAT and associated pipe-work), and
- safety rods and coarse control arms (CCAs).

Except for the CCAs, Safety Rods, rigs and targets, the above items have also been removed from the reactor building (building 15) to separately licensed facilities. These post-closure activities have been reported to ARPANSA separately. The targets will also be moved to separately licensed facilities - this may still be underway in the early stages of the Possess or Control period.

HIFAR is now a steel building containing the reactor block and shielding, the primary circuit, including the Reactor Aluminium Tank, the core internals, the graphite reflector and the Reactor Steel Tank. The existing Engineered Safety Provisions are also part of the facility, but other than the Active Extract Ventilation, are no longer required. Approval will be sought to disable those obsolete ESPs that may be contrary to good safety practices. OL&C surveillance requirements on these systems have also ceased.

Following the completion of the initial post-closure activities, HIFAR is now a "de-fuelled facility" with a significant reduction in hazards.

For further description of the de-fuelled HIFAR facility, see the Safety Analysis Report (SAR) (Rev.0) which forms Part C of this licence application.

3 HIFAR SITE AND SURROUNDING AREAS

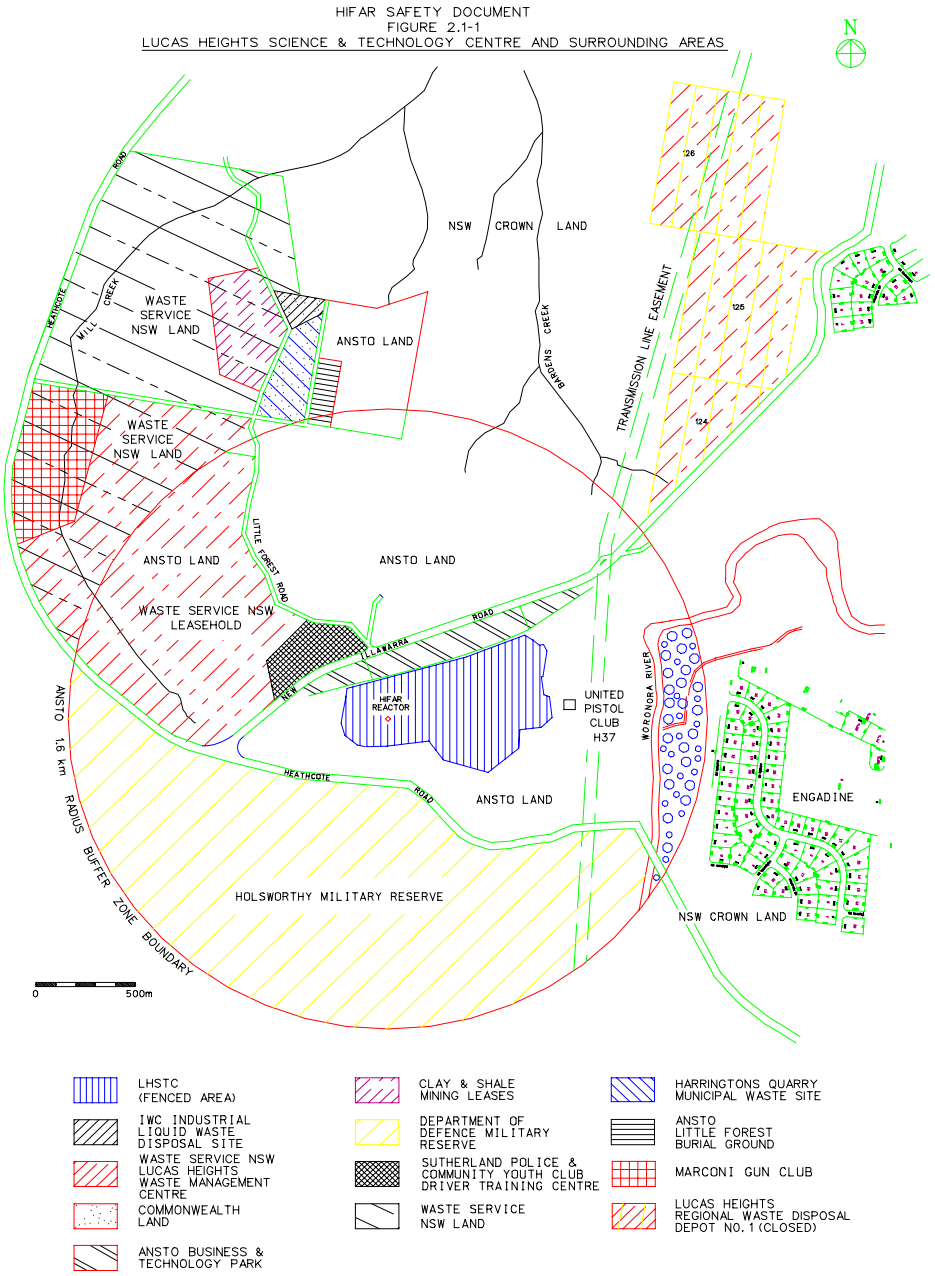
The HIFAR facility is located at Building 15 and associated buildings at the Lucas Heights Science and Technology Centre, New Illawarra Road, Lucas Heights, New South Wales at the co-ordinates 298.091.043 East and 1230.638.600 North on ANSTO Drawing No AE 100.000 "Lucas Heights - Plan of Permanent Marks" dated 31/1/1979. The reactor is owned and controlled by ANSTO, previously, the Australian Atomic Energy Commission (AAEC).

The Lucas Heights Science and Technology Centre, where HIFAR is located, is situated some 35 km south-west of the Sydney CBD on the dissected Woronora Plateau at an elevation of about 150 m AHD. The site is approximately 2 km west of the Woronora River and 8 km south of the Georges River and is surrounded by bushland extending for several kilometres with no significant habitation in the north-west, west and south-west quadrants.

HIFAR is located within a 70 ha fenced area which is surrounded by a 1.6 km radius buffer zone centred on HIFAR. No permanent residential development is permitted within the ANSTO buffer zone. The residential suburbs of Barden Ridge and Engadine are located in the north-east to south-east sectors adjacent to the ANSTO buffer zone boundary while the growing suburban area of Menai is located some 3 km further to the north-east. The ANSTO buffer zone area south of Heathcote Road is administered by the Department of Defence as part of the Holsworthy Military Reserve.

A map of the LHSTC and surrounding areas (see Figure 1) shows the current ownership and leases of land in the area, roads, creeks, etc. For further details of the LHSTC and surrounding areas and related information, see the SAR of the HIFAR facility (Part C of this licence application).

Figure 1



4 DECOMMISSIONING STRATEGY

Deferred dismantling is one of three internationally accepted decommissioning strategies, and is the strategy in which parts of a facility containing radioactive contaminants are either processed or placed in such a condition that they can be safely stored and maintained until they can subsequently be decontaminated and/or dismantled to levels that permit the site to be released for unrestricted use or with restrictions imposed by the regulatory body [6 s1.5]. This option allows processing and removal of some radioactive materials from the facility after the end of operations and before final dismantling. [6 s1.6, s8.3]

Deferred dismantling is sometimes called "safe enclosure".

Contemporary IAEA safety standards recommend immediate dismantling as the preferred decommissioning strategy [6 s4.2], but recognises that there may be situations where this is not practicable [6 s4.2].

Depending on the applicable national regulations, specific licences may cover one or more separate stages of deferred dismantling leading to eventual decommissioning [6, 7].

4.1 HIFAR Strategy

In the planning for final shutdown of HIFAR, options for ultimate decommissioning were considered. Following that study, and taking into account international guidance [eg refs 7, 8, 9], and the experience of the overseas research reactors in final closure and commencement of decommissioning [eg 10, 11] the ANSTO strategy was developed. This adopted strategy involves:

- Closure and final shutdown of the reactor (now completed under the operating licence[2]);
- Refurbishment and Preliminary dismantling of inactive systems and equipment that are no longer required;
- A period of Safe Enclosure (which is expected to last approximately ten years); and
- Commencement of final dismantling (to be undertaken under a decommissioning licence to be sought at a later date).

This strategy was selected based on various factors including:

- The proposed Commonwealth Radioactive Waste Management Facility for radioactive waste storage/disposal will not be available until near the end of the proposed Safe Enclosure period;
- Staff experienced in the operation of HIFAR were available for the initial post-closure activities enabling these key activities to be undertaken promptly;
- On the available evidence, a Safe Enclosure period of approximately 10 years is near-optimal in terms of achieving a point of "diminishing returns" of decay of radioactive inventory. Therefore, optimisation of radiation protection of workers, the public and the environment will be achieved when the eventual dismantling operation to be carried out;
- The initial post closure activities and the activities to be undertaken early in the Possess and Control period present a clear message to all stakeholders that ANSTO is committed to the eventual decommissioning of the facility;
- There will be reduced maintenance and site service costs over the period of Safe Enclosure because non-active equipment that is not needed will have been removed; and
- The relatively short period of Safe Enclosure permits a high confidence of retention of documentation and corporate knowledge as well as some staff expertise, thus providing a balance between substantial decay of radioactive material whilst retaining plant knowledge.

The selection of a Safe Enclosure period of approximately ten years is based upon data available for reactors similar to HIFAR, showing that there is only a relatively small decrease in radionuclide inventories and associated doses after a period of 10 years following de-fuelling [see figure in ref 10]. The slowed rate of decay after ten years means that similar remote handling technology would be required for dismantling the reactor even after 60 years after de-fuelling and the quantity of ILW generated in final dismantling would not be significantly less than that generated after 10 years. Consequently, the 10 year period appears on the information available to be close to optimal in terms of the factors discussed.

Furthermore, the ten year period of Safe Enclosure would appear to be advantageous over longer periods because it:

[2] Subject to ARPANSA approval, some closure projects commenced under the operating licence may continue into the Posses or Control period, or into some period of overlap of licences as appropriate.

- Limits the impact of the loss of site expertise prior to final decommissioning,
- Limits the costs associated with licensing, surveillance and maintenance, and
- Reassures stakeholders that the process for final decommissioning is on a foreseeable schedule, will have continued funding and that the facility will not be a burden on future generations.

4.2 International Best Practice

This section outlines how the adopted strategy for ultimate decommissioning is consistent with international best practice.

The proposed strategy for Possess and Control period of HIFAR is consistent with the IAEA guidance. The arguments presented in section 4.1 above for the selection of the strategy are consistent with the "relevant factors" that may taken into account for choosing deferred over immediate dismantling. [6 s4.2] and the strategy and approach is consistent with the requirements of section 4 of reference 6.

Furthermore, the proposed strategy for HIFAR is similar to that of three of its sister reactors (DIDO, PLUTO – both in the UK – and DR-3 in Denmark). The proposed period of safe enclosure is consistent with current views of the optimal balance between the retention of staff knowledge and allowing significant decay of short-lived radionuclides and minimising the generation of intermediate-level radioactive wastes. Research reactors that have been completely dismantled within ten years of de-fuelling include the Omega West reactor at Los Alamos (USA), the Japanese Power Demonstration reactor and the Georgia Tech reactor (USA). Decommissioning within ten years of de-fuelling is also planned for the DR3 at Risø (Denmark), and the University of Michigan reactor (USA). This strategy relieves future generations of the responsibility for handling the facility, reassures stakeholders that the facility will be dismantled and maximises use of experienced staff in the decommissioning process.

Australia has ratified the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management, and is required to observe IAEA safety standards when planning activities such as the decommissioning of HIFAR. Amongst the important requirements of the Joint Convention are that the processes identified should aim to avoid imposing undue burdens on future generations and that the generation of radioactive wastes should be kept to the minimum amount practicable. The adopted strategy of the deferred decommissioning achieves this requirement in the Australian context.

4.3 Licensing

It has been agreed with ARPANSA [see ref 12 and subsequent correspondence] that it was most appropriate to undertake final shutdown and immediate post closure activities of the reactor under the existing operating licence, and these activities are now complete. It was also agreed that the most appropriate licence for the refurbishment projects, preliminary dismantling activities and Safe Enclosure was a Possess or Control licence.

Therefore, this Licence Application has been prepared for an authorisation to Possess or Control the facility. During the period this licence remains in force, ANSTO proposes to undertake some preliminary dismantling of inactive systems that are not required; refurbishment of systems that are required; ongoing maintenance and surveillance; and, if necessary, some sample gathering to support radionuclide inventory characterisation. These tasks (which are described in detail in Part E of this application) will prepare the facility for Safe Enclosure for the period until deferred decommissioning commences (for which a new licence will be required).

5 REFERENCES

1 Australian Radiation Protection and Nuclear Safety (ARPANS) Act 1998

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

3 Facility Licence – Nuclear Installation, Authorisation to Operate a Controlled Facility, ANSTO High Flux Australian Reactor (HIFAR), Licence No. FO0044-4A, 14 June 2001, issued by ARPANSA.

4 HIFAR Descriptive Manual, Document No. NTP/TN 189

5 HIFAR Safety Document, Document No. NTP/TN 193, Revision 2, 2002

6 IAEA Safety Standards, Decommissioning of Facilities Using Radioactive Material, Safety Requirements, WS-R-5, 2006.

7 IAEA Safety Guide, “Decommissioning of Nuclear Power Plants and Research Reactors”, No. WS-G-2.1

8 Safety Reports Series No. 26, Safe Enclosure of Nuclear Facilities during Deferred Dismantling, IAEA, 2002

9 Safety Reports Series No. 45, Standard Format and Content for Safety Related Decommissioning Documents, IAEA, 2005.

10 Manorcroft Consultancy Ltd, DIDO and PLUTO Reactors Post Decommissioning Report, August, 1995, MCL/D&P/DECOM/1/95

11 Klaus Iversen, 2001, Revised cost estimate for the decommissioning of the reactor DR3, Risø-R-1291(EN)

12 ARPANSA letter to ANSTO (J Loy to I Smith) dated 2 February 2007 on HIFAR Final Shutdown 2007 and Subsequent Closure Activities – Facility Licence FO 0044-4A