NUCLEAR MEDICINE MANUFACTURING PROGRAM

NMMF Environment Protection Plan

For Siting Licence

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1. Purpose

The purpose of this Environment Protection Plan is to describe the organisational environment protection arrangements under the siting and development phase for a new Nuclear Medicine Manufacturing Facility (NMMF) at the ANSTO Lucas Heights campus.

The plan outlines the processes used in selection of the proposed site and to ensure compliance with the relevant legislation, including the Australian Radiation Protection and Nuclear Safety (ARPANS) Act [Ref: (1)] and Regulations [Ref: (2)]. This plan is an integral element of the ARPANSA Siting Licence Application.

ANSTO is committed to maintaining and enhancing the high standards of environment protection recommended by the International Atomic Energy Agency (IAEA) and required by ARPANSA and Safe Work Australia. The plan is consistent with international best practice, and in accordance with ARPANSA guidelines on radiation protection of the environment, specifically RPS G-1 [Ref: (3)] and various IAEA guidelines, specifically GSG-8 [Ref: (4)] and GSG-9 [Ref: (5)].

This plan should be read in conjunction with the NMMF Safety Analysis Report (SAR) [Ref: (6)] and Plans and Arrangements supporting the Siting Licence Application.

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Please note for clarity, NMMF refers to the Nuclear Medicine Manufacturing Facility, i.e., the physical structure. NMMP is the Nuclear Medicine Manufacturing Program which includes the NMMF, and the Program of works required to deliver the NMMF.

2. Scope

This document describes the considerations taken to ensure wildlife (plants and animals) in their natural habitats will not be adversely affected by the operations of the NMMF.

The scope of this plan covers the environmental issues in accordance with the Australian Radiation Protection and Nuclear Safety (ARPANS) Act 1998 [Ref: (1)] and Regulations 2018 [Ref: (7)] and ANSTO safety arrangements. It specifically covers the issues referred to in the ARPANSA Regulatory Guide – Plans and Arrangements for Managing Safety [Ref: (8)].

This plan should be read in conjunction with the other plans and supporting documents comprising the siting licence application, specifically the Safety Management Plan NMMP-0410-PM-0002 [Ref: (9)], NMMF Waste Management Plan NMMP-0410-PM-0004 [Ref: (10)], and NMMF Radiation Protection Plan NMMP-0410-PM-0003 [Ref: (11)].

3. Environmental Management System

3.1. Policy and Strategy

ANSTO has policies in place relating to all aspects of its operations. The Health, Safety, Community and Environment Policy [Ref: (12)] states ANSTO's commitment to the environment and sustainability. ANSTO is committed to minimising harm to the environment from its operations. ANSTO is certified to the ISO 14001:2015 Environmental Management System (EMS) Standard [Ref: (13)]. Prior to commissioning, ANSTO will seek to include the NMMF within its broader Lucas Heights AS/NZS ISO 14001 certification.

The ANSTO Corporate Plan [Ref: (14)] sets the strategic priorities and provides NMMF with direction in determining critical success factors and establishing appropriate objectives and targets. Key performance indicators, associated with operations, resources, health and radiation safety and protection of the environment are measured and monitored for the achievement of the set objectives. The Corporate Plan prioritises the implementation of the Environmental Sustainability Strategy [Ref: (15)], which states the objectives, targets and actions by which ANSTO will minimise its direct and indirect impacts on the environment.

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Staff members are encouraged to actively report environmental incidents through the ANSTO Incident Management System.

Environmental protection is everyone's responsibility at ANSTO, however specific roles have additional responsibilities, which are outlined in EMS Roles and Responsibilities [Ref: (16)]. Resources are appropriately planned and provided to ensure effective control of the licensable facilities, apparatus and materials together with continual improvement of the business and safety systems. The Building Managers and Area Supervisors safely manage the hazards and address any environmental issues in the controlled buildings described in the ARPANSA Facility Licence. The management team endeavours to promote and maintain a sound environmental management system to actively prevent environmental harm in the workplace.

3.2. Environmental Aspects

ANSTO's EMS requires divisions to identify, risk assess and appropriately control all environmental aspects of their activities within their sphere of control or influence, including their supply chain. Environmental aspects are recorded centrally in ANSTO's Environmental Aspects and Compliance Obligations Register [Ref: (17)] and reviewed periodically based on the risk of the aspect. Environmental aspects assessed to have a residual risk after controls of medium or above as per the ANSTO Risk Analysis Matrix [Ref: (18)] are deemed significant environmental aspects and therefore require more stringent controls to ensure environmental harm does not eventuate or is mitigated to ALARP.

The details of applicable environmental aspects and environmental compliance obligations for the NMMF are maintained in ANSTO's Environmental Aspects and Compliance Obligations Register. Once the NMMF becomes operational, these will be reviewed periodically to ensure the applicable controls remain suitable for the operational conditions.

3.3. Environmental Compliance Obligations

A wide range of statutory and non-statutory compliance obligations are applicable to the activities carried out by ANSTO.

Statutory compliance obligations include:

- ARPANSA licences
- Consent to Discharge Industrial Trade Wastewater with Sydney Water Corporation
- ANSTO's obligations under the *Environment Protection and Biodiversity Conservation Act 1999* [Ref: (19)].

Non-statutory compliance obligations include:

- International agreements
- Australian Government policies, such as the National Waste Policy
- Contractual arrangements, which may oblige ANSTO to conform with state environmental legislative requirements such as waste classification rules.
- Codes of practice or industry standards
- Public commitments
- Other voluntary commitments.

The identification and periodic evaluation of ANSTO's environmental compliance obligations is documented in Environmental Compliance Obligations [Ref: (20)].

Environmental compliance obligations are also recorded centrally in the Environmental Aspects and Compliance Obligations Register and reviewed periodically based on the risk of the associated environmental aspect.

ANSTO has submitted a referral to construct and operate a new Nuclear Medicine Manufacture Facility at Lucas Heights, NSW. The referral was for a proposed action under Section 68 of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

The delegate for the Minister for the Environment and Water has confirmed that the proposed action is not a controlled action, provided it is taken in the manner described in decision document (EPBC Notification of Referral Decision 2023/09748) [Ref: (21)].

Formal comments on the referral were received from:

- National Indigenous Australians Agency (NIAA)
- Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)
- Department of Industry, Science and Resources (DISR).

Geoscience Australia concurred with ANSTO that construction of the NMMF is not likely to have a significant impact to the environment and should not be considered a controlled action.

3.4. Management System Audits

The NMMP will schedule and conduct internal management system audits to determine the effective implementation of the EMS within the NMMF and to assess environmental performance against the planned arrangements. These audits may be integrated within the scope of other management system audits (e.g., work, health and safety), or Enterprise-wide environmental management system audits.

The planning and conduct of audits are based on risk and follows ANSTO Management System Audit Process [Ref: (22)]. Audits are carried out by trained auditors who are independent of the area being audited. Audit findings will be documented in the audit report and tracked through the ANSTO Incident Management System. Actions will be taken without delay to eliminate detected nonconformities and their causes.

A1 3.5. Management Reviews

The ANSTO Executive Management Team regularly review the organisation's environmental objectives and plans, monitor and review performance and communicate the review outcomes to relevant personnel as per Management Review Process [Ref: (23)]. Outputs from operational processes, audits and performance measurements are fed into the management review which in turn identifies opportunities for corrective, preventative and improvement actions.

The NMMP Team during siting and development activities will collect and analyse data to demonstrate the efficiency and effectiveness of processes to conform with the EMS; assess compliance with regulatory requirements; and the effective performance of this Environment Protection Plan. Results will be routinely collected and evaluated through the NMMP Radiation Protection and Safety Working Group.

Performance to this Environment Protection Plan will be reviewed regularly. Results from the management reviews, audits or assessments are continuously incorporated into the appropriate plans. Items from the NMMP Radiation Protection and Safety Working Group can be escalated for Program Executive Management level review if warranted.

Environmental performance reviews are also carried out at the Divisional level and facilitated through the NMMP Regulatory Working Group and Divisional Health & Safety Representatives meetings.

4. Responsibilities

The Chief Executive Officer (CEO) environmental management in line with the ANSTO Health, Safety, Community and Environment Policy. AB-0002 [Ref:(7)].

The NMMF Program Team have responsibility for protection of the environment associated with the facility and associated works. During the design and construction phases of the facility, the Program Director is responsible for making local arrangements for environmental management which includes protection of wildlife in their natural habitats in parallel to the protection of people [Ref: (16)] provides further detail on specific roles and responsibilities throughout ANSTO for environmental protection and management.

Local Environmental Coordinators (LECs) are nominated by Senior Management for each division, or major operational area. They provide ANSTO's divisions with an operational resource in relation to environmental management. An important responsibility of the LEC is to review proposed projects and activities as part of the Safety and Reliability Assurance (SRA) process and operational improvement of facilities.

The ANSTO Environmental Management Team, [redacted], have responsibility for:

- Reviewing new environmental aspects, as raised per AF-2092 Environmental Aspect Identification [Ref: (24)].
- Determination if a referral under the *Environment Protection and Biodiversity Conservation (EPBC) Act* 1999 [Ref: (25)] is required for a proposed action.
- Reviewing NMMF environmental documentation which is to be completed by the Program Director and Principal Contractor.
    - At the scoping stage of a project, AF-1376 Project Environmental Planning Checklist [Ref: (26)] should be completed and provided for review by ANSTO Environmental Management Team.
    - Reviewing the AF-5947 ANSTO Project Construction Environmental Management Plan (P/CEMP) [Ref: (27)] and other related environmental protection documentation, to be completed by the ANSTO Project Manager in the design phase and supported by the principal contractors P/CEMP prior to construction commencing.
- Reviewing and approve environmental protection measures for the removal of vegetation or changes to habitat, storage of materials, such as stockpiled soils.
- Auditing and reporting on the environmental and sustainability performance of the site preparation, construction and operation of the facility, in line with Government requirements, ANSTO's Environmental Sustainability Strategy AE-5362 [Ref: (15)] and ANSTO's ISO 14001 certification.

5. Area of Environmental Impact

The NMMF will be located within the nuclear precinct of the 70-hectare Lucas Heights Science and Technology Centre (LHSTC) which is surrounded by a 1.6 km radius buffer zone, centred around the Hi-flux Australian Reactor (HIFAR) which has now been permanently shut down. The residential suburbs of Barden Ridge and Engadine are in the north-east to south-east sectors, situated approximately 2.1 km and 1.7 km respectively from the NMMF, outside of the 1.6 km buffer zone boundary. The suburban area of Menai is located approximately 3.3 km to the north-east. There is no farming in the bush corridor and very little mixed farming within 5 km of the site.

Stormwater runoff to the surrounding watercourses does not contribute to any water catchments for public drinking water supply. The surrounding watercourses flow into the Woronora and Georges Rivers which are used for recreational purposes including fishing. Liquid trade waste effluent from ANSTO is discharged via a trade waste discharge pipeline, connecting with Sydney Water infrastructure at Barden Ridge. Liquid trade waste does not exceed an agreed minimum dilution factor of 25:1 at the point of entry to the Cronulla Waste Treatment Plant (CWTP). The combined sewage water undergoes tertiary treatment at the CWTP and is ultimately discharged to the ocean at Potter Point ocean outfall.

6. Discharge Criteria

Effluent discharges to sewer must comply with the current trade wastewater agreement between ANSTO and Sydney Water Corporation (Consent to Discharge Industrial Trade Wastewater #4423 [Ref: (28)]) for treated discharges from the Lucas Heights site. Sydney Water conducts independent testing of liquid effluent discharges to sewer and periodically reviews the Trade Waste Agreement to provide assurance that ANSTO's discharges remain within authorised radiological and non-radiological limits and pose no threat to the environment.

A condition from the licence issued by Environment Australia (now Department of Climate Change, Energy, the Environment and Water) for the construction and operation of the Open Pool Australian Light-water (OPAL) Reactor, placed a restriction on atmospheric radiological discharges to not exceed those from existing operations at ANSTO's Lucas Heights site. The NMMF will not prevent ANSTO from meeting this requirement.

7. Monitoring

Environmental monitoring will be carried out by ANSTO's Environmental Monitoring group following the AG-1304 Environmental Monitoring Program guide [Ref: (29)]. This program measures radioactivity levels in local environmental media including surface waters, ground waters, air, sediments, and in the marine biota located near the ocean outlet of the CWTP.

Cumulative annual effective dose from external radiation is monitored at the site perimeter fence, nearby residences using environmental thermo-luminescent detectors (TLDs), and at the CWTP. Environmental gamma radiation monitoring is available online and is measured at a remote meteorological station, located in the nearby suburb of Engadine, to the east of ANSTO. The ANSTO 49 m meteorological tower and two remote locations, Shackles Estate and Boystown collect relevant weather data. This data collected from the meteorology stations are primarily used for ANSTO's emergency response system and is an input for determining the quarterly and annual dose estimates from routine airborne emissions across ANSTO's licensed facilities.

In addition to radiological assessments of nearby river and groundwater, surface water, comprising of stormwater runoff and near surface groundwater, leaving the Lucas Heights site is routinely collected and analysed as per the G-3900 Environmental Monitoring Sampling Schedule [Ref: (30)]. The results from these monitoring activities are reported and published in ANSTO's Annual Reports and quarterly Buffer Zone Reports.

ANSTO has conducted further environmental evaluations to verify the effective control of authorised emissions to the appropriate standard of radiation protection and to detect any unplanned releases which could impact on the environment. Data from this program shows that ANSTO's activities have a negligible effect on local wildlife as described in Section 8.

7.1. Airborne Release

There will be no volatile radioactive wastes, gases, dusts, or other airborne emissions in significant quantities generated during the siting of the new facility.

During hot commissioning and once operational, the NMMF will produce volatile radioactive wastes, gases, particulates, or other airborne emissions which will be controlled through the Heating, Ventilating and Air Conditioning (HVAC) system active ventilation exhaust with a High-Efficiency Particulate Air (HEPA) filter and/or charcoal filter (Standard Iodine Adsorption Module – SIAM filter) where appropriate, supported by routine stack discharge monitoring. Further details on the active ventilation system role in controlling airborne activity is available in AG-2906 Active Ventilation System Manual [Ref: (31)].

A1 7.2. Release to Surface or Groundwater

There will be no radioactive or chemical discharge to the environment during the siting stage of the NMMF.

During hot commissioning and once operational, the NMMF will produce radioactive liquid waste streams which will be controlled by the Liquid Waste Management System by providing decay prior to transport to the ANSTO Waste Management facility for final treatment and disposition [Ref: (10)]. All B-line, C-line and D-line liquid waste will be connected to the site effluent treatment plants. Residual liquid waste will then be discharged offsite in alignment with the Industrial Trade Waste Consent agreement with Sydney Water Corporation [Ref: (28)].

8. Protection of Wildlife

The LHSTC was established in the mid-1950's for siting of HIFAR and associated infrastructure. Activities to establish the LHSTC included the clearing of most vegetation and removal of a substantial amount of topsoil. The LHSTC is therefore considered a brownfield site. The NMMF will be sited on land which is dominated by grasses and non-endemic ornamental shrubs. Consequently, the siting and construction of the NMMF is not likely to have any significant impacts to wildlife or their habitat.

The most recent assessment of potential radiological impacts to wildlife from ANSTO facilities at the LHSTC was conducted for the ANSTO Nuclear Medicine Mo-99 Facility and is detailed in ANSTO-E-785 Screening Assessment of Dose Rates to Wildlife related to the Nuclear Medicine Mo99 Facility [Ref: (32)]. This assessment considered both airborne emissions and liquid discharge pathways and conservatively evaluated ANSTO's cumulative potential discharges. This assessment used methods from international best practice as laid out by the ARPANSA Guide: Radiation Protection of the Environment [Ref: (3)], which is consistent with current approaches set forth by the International Commission on Radiological Protection (ICRP) and the International Atomic Energy Agency (IAEA).

During subsequent stages of the NMMF, an update to the existing screening assessment of dose rates to wildlife dose assessment will be conducted to include the operation of the NMMF.

9. Definitions

The following abbreviations / definitions have been used in this document:

Term	Definition
ANSTO	Australian Nuclear Science and Technology Organisation
ANM	ANSTO Nuclear Medicine
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
AVS	Active Ventilation System
CEO	Chief Executive Officer
CWTP	Cronulla Waste Treatment Plant
EIS	Environmental Impact Study
EPBC	Environment Protection and Biodiversity Conservation Act
HEPA	High-Efficiency Particulate Air
HIFAR	Hi-flux Australian Reactor
HVAC	Heating, Ventilation and Air Conditioning
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
LHSTC	Lucas Heights Science and Technology Centre
NMMF	Nuclear Medicine Manufacturing Facility
NMMP	Nuclear Medicine Manufacturing Program
OPAL	Open Pool Australian Light-water
P/CEMP	Project Construction Environmental Management Plan
SIAM	Standard Iodine Adsorption Module
SRA	Safety and Reliability Assurance
TLD	Thermo-Luminescent Detector

10. References

The following are referred to in this document or were used in its creation.

1. Australian Radiation Protection and Nuclear Safety (ARPANS) Act. s.l. : Cth, 1998.
2. Australian Radiation Protection and Nuclear Safety (ARPANS) Regulations. Cth, 2018. .
3. ARPANSA Radiation Protection Series RPS Guide G-1 Radiation Protection of the Environment . s.l. : ARPANSA, 2015. RPS G-1.
4. IAEA Radiation Protection of the Public and the Environment. GSG-8.
5. IAEA Regulatory Control of Radioactive Discharges to the Environment. GSG-9.
6. NMMF Safety Analysis Report. NMMP-0410-RT-0004.
7. Australian Radiation Protection and Nuclear Safety (ARPANS) Regulations. 1999.
8. ARPANSA-GDE-1735 ARPANSA Regulatory Guide - Plans and Arrangements for Managing Safety. 2023.
9. NMMP-0410-PM-0002 NMMF Safety Management Plan.
10. NMMP-0410-PM-0004 NMMF Waste Management Plan.
11. NMMP-0410-PM-0003 NMMF Radiation Protection Plan.
12. ANSTO Health, Safety, Community and Environment Policy. AB-0002.
13. ISO 14001 Environmental management systems - Requirements with guidance for use. Geneva : International Organisation for Standardisation, 2016.
14. ANSTO 2023-2027 Corporate Plan.
15. Environmental Sustainability Strategy. AE-5362.
16. EMS Roles and Responsibilities. AG-2565.
17. ANSTO Environmental Aspects and Compliance Obligations Register.
18. ANSTO Risk Analysis Matrix. AG-2395.
19. Environment Protection and Biodiversity Conservation Act.
20. Environmental Compliance Obligations. AP-2069.
21. EPBC Notification of Referral Decision. EPBC 2023/09748.
22. AR-1004 ANSTO Management System Audit Process.
23. AR-1006 ANSTO Management System Review .
24. AF-2092 Environmental Aspect Identification.
25. Environment Protection and Biodiversity Conservation Act, 1999.
26. AF-1376 Project Environmental Planning.
27. AF-5947 ANSTO Project Construction Environmental Management Plan (P-CEMP) .
28. Sydney Water Consent to Discharge Industrial Trade Wastewater. 2016. Consent No: 4423.
29. AG-1304 ANSTO Environmental Monitoring Program.
30. G-3900 Environmental Monitoring Sampling Schedule.
31. AG-2906 Active Ventilation System Manual .
32. E-785 ANSTO Screening assessment of dose rates to wildlife related to the Nuclear Medicine Mo99 Facility. s.l. : ANSTO, 2017.
33. ANSTO Nuclear Medicine Environment Protection Plan . 00003507.
34. IAEA Safety Standards, GSR Part 2, Leadership and Management for Safety. Vienna : International Atomic Energy Agency, 2016.

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