Australian Government
Australian Radiation Protection and Nuclear Safety Agency

arpansa

Inspection report

Licence holder: Australian National University (ANU)	**Licence number:** F0073, F0074 and F0075
Location inspected: Canberra, ACT	**Date/s of inspection:** 18-19 March 2020
	Report no: R20/02898

An inspection was conducted as part of ARPANSA's baseline inspection program to assess compliance with the *Australian Radiation Protection and Nuclear Safety Act 1998* (the Act), the Australian Radiation Protection and Nuclear Safety Regulations 2018 (the Regulations), and conditions of facility licences F0073, F0074 and F0075.

The scope of the inspection included an assessment of ANU's performance against the Performance Objectives and Criteria (POCs). The inspection consisted of a review of records, interviews, and physical inspection of the facilities.

Background

The Australian National University houses three prescribed radiation facilities (PRFs) within the Research School of Physics (RSPhys). These facilities are split between two departments. The Heavy Ion Accelerator (HIAF) (F0074) is operated by the Department of Nuclear Physics, and both the Rutherford Backscattering accelerator (RBS) (F0073) and High Energy Implanter (HEI) (F0075) are operated by the Department of Electronic Materials Engineering.

The HIAF has a wide range of applications including materials science, resource/energy exploration, waste management, research in environmental, biological and life sciences, investigating climate change, archaeological and heritage studies, and critical investigations into nuclear science.

The HEI provides for ion implantation and the RBS allows for ion beam analysis. Both these accelerators are used in the fields of materials science, quantum computing, photovoltaics and electrical engineering.

The main codes and standards applicable to these licences are those that appear in section 59 of the Regulations plus:

- Health Physics Society (HPS), Installations using non-medical x-ray and sealed gamma-ray sources energies up to 10MeV (ANSI/HPS N43.3-2008)
- Australian/New Zealand Standard, Safety in Laboratories – Ionizing Radiations (2018)(AS/NZS 2243.4-2018)

619 Lower Plenty Road, Yallambie VIC 3085
+61 3 9433 2211
PO Box 655 Miranda NSW 1490
+61 2 9541 8333
info@arpansa.gov.au
arpansa.gov.au

Observations

Performance reporting and verification

Incident reporting for the RSPhys, as stated in their Plans and Arrangements, adopts the university policy for reporting. Incidents involving radiation are to be immediately reported to the local area supervisor and Radiation Safety Officer (RSO). An incident report is then entered into the university's workplace safety incident and hazard reporting tool. Incidents are forwarded to the WHS team and are triaged to the appropriate staff in order to determine the severity of the incident and whether further notifications are required (i.e. to ARPANSA, etc.).

ANU has a defined list of events that need to be reported to APRANSA within 24 hours. This includes those rated at an International Nuclear and Radiological Event Scale (INES) 'above an incident'.
The INES scale categorises incidents over three levels: anomaly (1), incident (2) or serious incident (3). Incidents that require reporting to ARPANSA within 24 hours are outlined in ARPANSA Regulatory Guide: Reporting an accident, and include any occurrence that is rated at, or has the potential to be rated at level 2 or above on the INES scale, as well as some other incidents such as those involving transport packaging. Thus the wording of the procedure is not fully aligned with ARPANSA's definition which could cause future incidents to not be reported correctly. This is an area for improvement (AFI).

No radiation safety related incidents have been reported or were observed to have occurred.

Configuration management

Risk assessments supplied by ANU highlight the standards that are applied to the conduct authorised by their licences. While these specifically highlight the Australian Standard, AS 2243.4 Safety in Laboratories – Ionising Radiation, they do not include the version of the standard. From this, it is unclear whether an assessment has been done against the most recent version being the Australian/New Zealand Standard, Safety in Laboratories – Ionizing Radiations (2018)(AS/NZS 2243.4-2018). In recent years, a new applicable code/standard (Health Physics Society (HPS) Installations using non-medical x-ray and sealed gamma-ray sources energies up to 10 MeV (ANSI/HPS N43.3-2008)) has been applied to similar facilities licensed for conduct with a particle accelerator with a beam greater than 1 MV (now known as PRF-1). At the time of the inspection, it was apparent that the licence holder was unaware of this code and its applicability. As such, ANU should ensure their procedures and Plans and Arrangements reflect current codes and standards. This is an area for improvement.

ANU's PRF licences will be re-issued in the near future and will then require ANU to conduct a self-assessment against all applicable codes and standards at least every three years.

In 2018, ANU replaced a safety interlock system on the HIAF control console which saw the removal of an override interlock switch and replacement by a 3-key system. The interlock system is applied to a low energy faraday cup which, when placed into the 'in' position, prevents the beam from entering the accelerator. They 3-key system will not allow the cup to be removed or placed in the 'out' position unless all keys have been returned. This is an improvement and ARPANSA was notified of this change in the July–September 2018 quarterly report. This is appropriate for changes having minor implications for safety (in accordance with section 64 of the regulations, previously regulation 52). However, a determination of the safety significance of the change to determine if the change was significant to safety and which would therefore require prior approval from the CEO of ARPANSA was not performed. There was also no evidence of change control/change management which would demonstrate how such a change was initiated, executed, and followed through to a post implementation review. The IAEA's GSR Part 2: Leadership and Management for Safety requires provision in the management system to identify any changes that could have significant implications for safety and to ensure that they are appropriately

analysed. This includes the cumulative effect of minor changes. This expectation is outlined in BM2.2 and BM 2.3 of ARPANSA's POCs. This is considered an area for improvement.

The Plans and Arrangements also contain some outdated information including outdated regulations, reference to previous passive dosimeters, outdated radiation protection training information allowing staff to work without being trained until the next course is available, etc. An area for improvement from the previous inspection also refers to Plans and Arrangements not adequately describing the hazards involved with the accelerators. During the inspection the RSO for the HIAF indicated that a 'Safety Analysis Report' is currently being developed. This report will help to categorise the safety systems and clearly establish the possible harm, if any, that can occur if controls are not effective.

Inspection, testing and maintenance

Preventative maintenance is performed on the HIAF in the form of a 'tank opening'. This occurs approximately every 12 months and can have a duration of as little as a week or multiple months. This period is the best opportunity for ANU's technical staff to complete as much preventative maintenance as possible. All other maintenance is based around the accelerators performance or usage requirements. For example, the HIAF is able to continue to run even if multiple megavoltage units perform poorly as the others are able to share the load. However, if a situation arose where performance could not be maintained, breakdown maintenance would ensue. Also, if an experiment was being performed which required slightly increased time periods with the beamlines, preventative maintenance would be delayed as long as there were no operational or performance issues.

Maintenance on the accelerators is only performed by ANU's technical staff. All accelerator maintenance for the HIAF is authorised by the accelerator manager.

The HEI and RBS also have tank openings but these are 'as needed' and are based on the performance of the accelerator. As such, these facilities have no routine maintenance.

For each of the accelerators, all faults and operating parameters are recorded in logbooks which are kept in the control console areas. The HIAF also has an online database which is used to record all faults. All faults are actioned as soon as possible and can be trended or reviewed as required.

There was some ambiguity in the documentation as to whether there were any 'Operating Limits and Conditions (OLCs)' which applied to this facility. The concept of OLCs are primarily applied to nuclear reactors, though some licence holders employ them at other facilities. While the HEI and RBS appear to not have OLCs, the HIAF has documented 'Limiting Conditions for Safe Operation'. The IAEA's Safety Guide NS-G-4.4 Operating Limits and Conditions and Operating Procedures for Research Reactors (2008) defines OLCs as '…a set of rules setting forth parameter limits, and the functional capability and performance levels of equipment and personnel approved by the regulatory body for safe operation of an authorized facility'. As previously noted, a SAR is being prepared which may provide additional clarity on whether an OLC applies to these facilities or if the documented constraints have only non-significant safety implications.

Training

Both ANU policy and facility Plans and Arrangements stipulate the requirements for radiation protection training. Workplace radiation inductions, provided by the facility Radiation Safety Officers, are mandatory along with a full local area induction. Any radiation worker who works less than 20 days does not have to undertake the "ionising radiation safety – machines" course but will have their work supervised and will not be able to enter a radiation zone. Anyone whose work is expected to last for 20 days or more is expected to successfully complete the aforementioned course before work can commence. There are provisions which allow for recognition of prior learning or training in radiation protection, however, the individual must pass the course exam and demonstrate their competence. All

records of completion are held by the university's training and development team which resides within the human resources department.

Event protection

Given the nature of the facilities, there are no situations which would give rise to an event with radiological consequences. A recent thunderstorm has left hail damage to the infrastructure of the buildings which house the accelerators. This damage has only had an operational affect and has had no impact on radiological safety.

Security

Security arrangements for the accelerators are integrated with university wide policies and systems. As such, the access controls, physical security, information security, administrative security, security patrols, etc. are not unique to the facilities. For example, a site wide card access system is used by the facilities to allow access only to appropriately trained and authorised personnel. This same system is in place across the entirety of the campus.

The arrangements in place are considered to be appropriate. However, the information found in the Plans and Arrangements for the facilities does not completely reflect the security arrangements in place nor is it aligned with ARPANSA's regulatory guidance (Plans and Arrangements for Managing Safety). Providing addition detail in these documents is considered to be an area for improvement.

Radiation protection

University policy dictates dose constraints of greater than 80 µSv in a month, greater than 250 µSv per quarter or greater than 1 mSv annually. Dose constraints at the PRF level are slightly misaligned with university policy, set at a higher value of 300 µSv per quarter and 250 µSv in two consecutive quarters. The university policy also refers to ARPANSA's dose limits as a recommendation. These are not recommendations but a statutory limit.

Calibration of radiation detection instruments ensures that they are operating correctly and that readings are reliable; these should be traceable to a primary standard. University policy prescribes the calibration frequency for radiation detectors at ANU. The terminology used at the higher policy level differentiates a radiation detector from a radiation monitor, which is intended is to align with the Safety in Laboratories standard (AS/NZS 2243.4), i.e. instruments for quantitative measurements shall be calibrated at annual intervals and those providing a qualitative measurement only should be calibrated at least every five years.

Portable radiation monitors held at the HIAF, used only to demonstrate the presence of radiation, have not been calibrated within this five-year period. Area radiation monitors attached to the RBS (last calibrated in 2014) and the HEI (calibrated in 2016) which have low alarm set points of 10 µSv have also not been calibrated in accordance with the annual requirement.

The differing dose constraints and frequency of calibrations in place at the facility compared with those imposed by university policy is considered an area for improvement.

Calibration requirements will be part of the self-assessment against applicable codes and standards. When the licences are re-issued, such requirements will become a matter of compliance.

Neutron monitoring is also in place at HIAF. These detectors have been specifically designed for the HIAF with all data flowing back to a single point that displays information across multiple monitoring stations set up across the facility. The graphical interface is used to display both the current radiation levels and the status of any interlocked systems such as doors or motion sensors or keys removed. This interface is

provided at access points as well as in the RSO's office which provides for enhanced oversight of the status of the facility. Procedures were supplied along with records showing that these are tested bimonthly (every two months) along with tests of all associated lights, audible alarms, reset buttons, and warning signs. However, nothing has been documented for how such a unique setup should undergo calibration. This should be included as part of the assessment of the applicable codes and standards.

Emergency preparedness and response

It is university policy that evacuation exercises must be carried out at least once per year in all buildings. The RSPhys conducts its own fire evacuation annually. The response to the evacuation is timed, any issues during the response are noted and are then used to inform participants to improve their performance for the next evacuation. A higher level ionising radiation management plan, which covers all facilities, adopts the university procedure when it comes to spillage, fire/explosion, first aid, flood or anything of a chemical or biological nature. While no formalised plan for what do in an exposure situation exists, the risk has been identified as being low and response to such a situation is presented during facility inductions.

Findings

The inspection revealed the following **areas for improvement**:

1. Alignment of reporting requirements with ARPANSA's terminology for incidents/accidents
2. Enhance change management process
3. Applicable codes and standards should be reflected within procedures, Plans and Arrangements, etc.
4. Adherence to university policy
5. Alignment of the security plan with ARPANSA's guidance material

It is expected that improvement actions will be taken in a timely manner.

In response to any potential non-compliance, the licence holder must carry out its responsibilities under section 57 of the Regulations

THIS REPORT WILL BE PUBLISHED ON THE ARPANSA WEBSITE