Australian National Report for the Joint Eighth and Ninth Meeting of the Convention on Nuclear Safety

In conformance with article 5 of the Convention on Nuclear Safety

August 2022

Acknowledgement of Country

The Australian Government respectfully acknowledges Australia's Aboriginal and Torres Strait Islander communities and their rich culture and pays respect to their Elders past and present. We acknowledge Aboriginal and Torres Strait Islander peoples as Australia's first peoples and as the Traditional Owners and custodians of the land and water on which we rely.

We recognise and value the ongoing contribution of Aboriginal and Torres Strait Islander peoples and communities to Australian life and how this enriches us. We embrace the spirit of reconciliation, working towards the equality of outcomes and ensuring an equal voice.

Contents

Introduction

General

i. This report is issued according to Article 5 of the Convention on Nuclear Safety (CNS, also referred to as the Convention). Australia ratified the CNS in December 1996. Since then, Australia has submitted National Reports to, and actively participated in, every review meeting of the CNS. The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) coordinates, on behalf of the Australian Government, the reporting on how Australia meets its obligations under the Convention.

ii. Australia does not have, or plan to establish, any 'nuclear installations' as defined in the Convention but has one operating research reactor, the Open-Pool Australian Light Water (OPAL) reactor. Another research reactor, the High Flux Australian Reactor (HIFAR), has been permanently shut down and all fuel elements have been removed. An application for decommissioning for HIFAR is expected in the 2022 calendar year. Both reactors are managed by the Australian Nuclear Science and Technology Organisation (ANSTO), an Australian Government entity, and are regulated by ARPANSA. Both reactors are located at the Lucas Heights Science and Technology Centre south of Sydney in the State of New South Wales[1].

iii. For this report, Australia finds it useful to refer to its research reactors in describing how its obligations under the Convention are met. Other licensed nuclear activities at ANSTO include: the collection, treatment and storage of radioactive wastes; the handling and storage of new and irradiated nuclear fuel and nuclear materials; and the production of commercial quantities of radiopharmaceuticals and radioisotopes for use in medicine and research within Australia and overseas.

National nuclear activities/policy

iv. Under Australian legislation, specifically the *Australian Radiation Protection and Nuclear Safety Act 1998* (the Act), the CEO of ARPANSA is prohibited from authorising the construction or operation of nuclear power plants. The *Environment Protection and Biodiversity Conservation Act 1999* and legislation in many Australian states and territories have similar prohibitions.

v. As reported in the 7th CNS Review Report, the Nuclear Fuel Cycle Royal Commission (NFCRC) was established by the South Australian (SA) Government in March 2015 to undertake an independent and comprehensive investigation into the potential for increasing South Australia's participation in the nuclear fuel cycle. It reported to the SA Government on 6 May 2016 with recommendations[2], including that SA Government pursue removal of existing legislative prohibitions on nuclear power generation to allow nuclear power to contribute to a low-carbon electricity system in the future, if required.

vi. On 15 November 2016, the SA Government released its Response to the NFCRC Report recommendations[3]. The recommendation to pursue the removal of existing legislative prohibitions on nuclear power generation was not supported. There has been no change to this stance.

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1 Australia is a federation of six states and two self-governing territories

2 See https://yoursay.sa.gov.au/pages/nuclear-fuel-cycle-royal-commission-report-release/

3 See http://assets.yoursay.sa.gov.au/production

Waste management development update

vii. The reprocessing of spent nuclear fuel is not permitted under Australian law. As such, all spent nuclear fuel is sent abroad for reprocessing under inter-governmental agreements and Australia receives an amount of intermediate level solid waste (ILSW) back that is in equivalence in radiological terms to the spent fuel elements sent. All returned ILSW produced from the reprocessing of spent fuel elements is held at Interim Waste Storage (IWS) facility at ANSTO.

viii. In March 2022, the last of the HIFAR reprocessed fuel was received back into Australia in a type B(U) TN-81 dual purpose storage/transport container from the Sellafield facility in the United Kingdom. This contained 4 canisters of vitrified CSD-V material. This represented the radiological equivalence of 114 spent HIFAR fuel elements which were previously sent to the Dounreay facility for reprocessing into 51 cement drums[4]. This container is stored at the ANSTO IWS facility with the previously reported B(U) TN-81 container and Type A ISO freight container which was received from the AREVA (now ORANO) La Hague facility in France in December 2015. The B(U) TN-81 container holds 20 canisters of vitrified reprocessed HIFAR spent fuel waste (CSD-U) and the Type A ISO freight container contains six drums of CBF-C2 waste generated during reprocessing operations

ix. OPAL's spent fuel continues to be stored onsite until it is periodically transported to La Hague, France, for reprocessing. The first shipment of spent fuel to France occurred in mid-2018 and the equivalent ILW is not expected to be received back into Australia until the early 2030s. Assuming up to 30 spent fuel elements arising per year, it is envisaged that, on average, there will be one overseas shipment of spent fuel every six or seven years.

x. The Australian Government continues to progress the establishment of a National Radioactive Waste Management Facility (NRWMF) which is intended to allow disposal of low level waste (LLW) and temporary storage of ILSW. Two major developments have occurred in the last reporting period as follows:

- The Commonwealth Department of Industry, Science, and Resources (DISR) which administers the *National Radioactive Waste Management Act 2012*, established the Australian Radioactive Waste Agency (ARWA) in July 2020. ARWA is tasked with, amongst other areas, establishing the NRWMF, coordinating Australia's radioactive waste inventory and progressing long-term work to site a separate, permanent location for disposal of ILW, as well as other waste management functions outlined in the Australian Radioactive Waste Management Framework[5].
- The second major development is the announcement of a proposed site for the NRWMF in November 2021, which is the Napandee site close to Kimba in South Australia[6]. The site selection process was conducted as follows: in 2015 the Australian Government called on landholders across Australia to voluntarily nominate their land to be considered as a site for a NRWMF as provided by the NRWM Act. More than 40 applications were received from interested landowners. These were evaluated using a framework to assess technical

[4] ANSTO and the United Kingdom (UK) Nuclear Decommissioning Authority enacted a substitution agreement in 2013, under which ANSTO gave up title to the reprocessed residues from the reprocessing of 114 HIFAR spent fuel elements at Dounreay. In exchange, ANSTO agreed to take a radiological equivalent to the Dounreay waste in the form of four canisters of CSD-V vitrified material currently held at Sellafield for ease of transport.

[5] See https://www.industry.gov.au/data-and-publications/australian-radioactive-waste-management-framework

[6] See https://www.industry.gov.au/data-and-publications/ministers-statement-of-reasons-for-the-national-radioactive-waste-management-facility-site-declaration

potential against a range of economic, environmental and other criteria including public and community consultation. A licence to prepare a site for a NRWMF is expected in 2024.

xi. ARPANSA continues to undertake independent stakeholder engagement for the NRWMF to explain the regulatory process under the ARPANS Act. This includes outreach activities with the Kimba community to inform the public and local organisations on the regulatory process, ARPANSA's role, and what the public can expect in terms of interaction with the regulator during review and assessment of an application to prepare a site for a waste facility. This work is not required under the ARPANS Act or Regulations but is being undertaken as it is seen to be best regulatory practice.

xii. For more information on Australia's waste management, refer to the Australian Joint Convention on the safety of spent fuel management and on the safety of radioactive waste National Report 2020[7].

Statement of commitment to the CNS

xiii. Australia remains committed to the articles and spirit of the Convention on Nuclear Safety, despite not having nuclear installations, as defined under Article 2 of the CNS Convention, and views participation as an effective review and improvement process for nuclear safety.

Report structure and scope

xiv. This report content and structure is as per the INFCIRC/572/Rev.6 and as such is designed to be a stand-alone document. Therefore, information from previous CNS Review meeting Australian reports has been reproduced as appropriate.

[7] See https://www.arpansa.gov.au/about-us/what-we-do/international-collaboration/joint-convention/previous-reports

Summary

Summary

a) Vienna Declaration principles

Australia continues to meet the three Principles in the Vienna Declaration on Nuclear Safety (VDNS) in respect to the OPAL research reactor. Principle 1 on design, siting and construction is addressed in Articles 17 and 18 (but summarised in Article 18). Principle 2 on ongoing safety assessments is covered in Article 14. Principle 3 on the application of IAEA Safety Standards is covered in Articles 7, 10 and 14 (but summarised in Article 14).

Australia does not expect to face difficulties in continuing to apply the VDNS principles and safety objectives to the existing research reactors or potential new builds in the future.

b) Common areas identified in the 7th CNS President Report

As per the recommendation in the 7th CNS President Report, progress against the major common themes identified across the country groups has been reported as follows:

- Safety culture – **Article 10**
- International peer review – **This section**
- Legal framework and independence of regulatory body – **Article 7**
- Financial and human resources – **Article 11**
- Knowledge management – **Article 11**
- Supply chain – **No issues reported for Australia at the 7th CNS meeting or at the time of this report**
- Managing the safety of ageing nuclear facilities and plant life extension – **No issues reported for Australia at the 7th CNS meeting or at the time of this report**
- Emergency preparedness – **Article 16**
- Stakeholder consultation and communication – **Article 8**

c) Action taken from lessons learnt from the Fukushima Daiichi accident

The safety reassessment of OPAL performed in accordance with the guidance contained in IAEA Safety Report Series No. 80 *Safety Reassessment for Research Reactors in the Light of Accident at the Fukushima Daiichi NPP* is completed. **This is reported on in Article 16**.

d) Response to challenge to Australia from the 7th CNS Review Meeting

At the 7th CNS review meeting, held in Vienna in March 2017, Australia was part of country group 7 which also included Croatia, Denmark, India, Ireland, Mali, Netherlands, Peru, Sri Lanka, Switzerland and Ukraine. One challenge was issued to Australia:

Challenge 1: Acquire and maintain adequate resourcing and competence within the regulator to cope with additional/new work and activities. **This is reported on in Article 8.**

e) Open status challenges from the 6th CNS Review Meeting

Two challenges to Australia from the 6th CNS review meeting remain open due to their ongoing and long-term nature:

Challenge: *Maintenance of competence within both the operator and regulator, including readiness to cope with expected applications for new (non-reactor) facilities*. **This is reported on in Article 11.**

Challenge: *Engagement with the wider Australian community over planned waste facilities.* **This is reported on in the Introduction section – paragraph xiii.**

f) International peer review missions

- An Integrated Regulatory Review Service (IRRS) team undertook a full scope mission in Australia in 2007. This IAEA effort was an in-depth review of ARPANSA's Regulatory Services Branch. A follow-up mission was then conducted in 2011, when a module on medical exposure and patient protection was introduced. All actions from this mission have been implemented. The reports and closure of recommendations are published on the ARPANSA website[8].
- A further full scope IRRS mission to Australia occurred 4–16 November 2018, which reviewed Australia's national, legal and governmental framework for nuclear and radiation safety against the IAEA's Safety Standards. This mission included participation from all Australian self-governing states and territories[9], as well as the Commonwealth of Australia (the federal Australian Government). The IRRS team consisted of 15 senior regulatory experts from 13 IAEA Member States, three IAEA staff members and two observers.
- The scope of the IRRS mission to Australia included all modules offered by the IRRS. It included all facilities and activities regulated in Australia, with the exception of the uranium mining industry and the management of waste containing naturally occurring radioactive material (NORM). The mission scope included ARPANSA's role and responsibilities as the Commonwealth regulator for radiation protection and nuclear safety in all modules. In addition, for specific areas (radiation sources control, transport, occupational radiation protection, control of public exposure, environmental monitoring and medical exposure control), the mission scope included all state and territory regulatory bodies.
- The IRRS mission included a policy issue discussion on national uniformity of radiation protection and nuclear safety policy and practices across the Commonwealth, states and territories.
- This was the first IRRS mission to undertake a comprehensive multi-jurisdictional review of a federated constitution in which all of the jurisdictions are self-governing. This was identified as a good practice by the team and a model that other federal countries may want to consider when planning for future IRRS missions.
- The mission found 4 good practices, and made 23 recommendations and 12 suggestions for improvement. These are addressed to the various Australian governments and regulatory bodies. The report is published on the ARPANSA website[10]. A follow-up mission will be conducted in October 2023. The follow-up mission had been delayed due to the COVID-19 pandemic.

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8 See https://www.arpansa.gov.au

9 Queensland, New South Wales, Victoria, Tasmania, South Australia, Western Australia, the Northern Territory, the Australian Capital Territory.

10 See https://www.arpansa.gov.au

- The findings of the IRRS mission were addressed to the various stakeholders in the following way:
    - The Australian Government received 2 recommendations
    - All Australian governments (Commonwealth and states and territories) received 7 recommendations and 2 suggestions
    - All regulatory bodies received 4 recommendations and 2 suggestions
    - State and territory regulators received 2 recommendations
    - ARPANSA received 8 recommendations and 6 suggestions
- Since August 2019, a national action plan for the IRRS mission 2018 has been developed and published on the ARPANSA website[11]. The plan provides a governance structure for monitoring progress against the findings and has been endorsed by the Australian Health Protection Principal Committee (AHPPC). ARPANSA has developed its own governance framework to progress findings that were addressed solely to the agency. Where findings are related to CNS areas, these have been addressed under the relevant Articles namely **6, 8, 15 and 16.**
- Work is progressing within the Environmental Health Standing Committee (enHealth), a subcommittee of the Australian Health Protection Principal Committee (AHPPC), to address the findings addressed to all the jurisdictions. While COVID-19 has impacted the work program, a number of the findings have been partially addressed and work is ongoing to address as many in full before the return mission.
- As of August 2022, ARPANSA has completed 12 of the 14 ARPANSA specific findings from the action plan and continues to support the implementation of the multi-jurisdictional findings. ARPANSA aims to complete all 14 ahead of the follow-up mission. The remaining findings owned exclusively by ARPANSA are:
    - R08 - ARPANSA should enhance its human resource management to include an assessment of the number and capabilities of staff required to effectively perform their regulatory and emergency response duties and enhance their training programme based on an analysis of the necessary skills and competencies.
    - R18 - ARPANSA should strengthen its Incident Management Plan by assigning roles and responsibilities, ensuring all elements of the Plan are tested and addressing lessons learned following exercises or real events.
- All international review reports and Australia's national reports under the *Convention on Nuclear Safety* and the *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management* are published in the ARPANSA website. See **Article 8** for further information on transparency.

g) Response to the COVID pandemic

- As requested in the CNS Presidency Letter dated 23 June 2021, the following information is provided on response to the COVID-19 Pandemic.
- ANSTO responded to the pandemic by acting with the aim of ensuring that critical operations, particularly for nuclear medicine, were conducted in a safe and compliant manner. In light of this, the following response measures were implemented across the entire organisation:
- The scope of stack monitoring to confirm the magnitude of discharges to the environment was restricted to major facilities and stacks only. Major facilities continued to collect, measure and assess samples showing any Iodine-131 and particulates released. Real-time online stack

[11] See https://www.arpansa.gov.au/sites/default/files/irrs_action_plan.pdf

monitoring continued for many of the facilities. The results of the discharge reports continued to be issued.

- The wearing period for personal dosimetry (thermoluminescent dosimeters - TLD) worn by staff that continued to work on-site in the critical facilities was extended from 3 to 6 months.

ANSTO implemented the following key arrangements for the OPAL research reactor:

- *Access Restrictions* - The reactor building was restricted to essential staff only with the Main Control Room (MCR) further restricted to a need to be present basis only (i.e. no access for any non-operations staff members) and strict social distancing was enforced.
- *Increased Hygiene and health measures* - Entry to the MCR was not permitted without a body temperature check and hand wash and twice per shift including shift handover, the operator staff conducted a deep clean of all surfaces in the MCR.
- *Way of working* - Paper based issue of permits/sign off for Operational Limits and Condition forms were minimised where practical with approvals completed by email or other online methods where possible.
- *Maintenance* - All planned maintenance was graded based on the frequency of the maintenance, the likelihood of failure within that frequency and the consequences on the safety and reliability of OPAL with only essential work conducted. In practice, most in-house maintenance was completed as scheduled by each group working slightly longer hours than normal when they were on site.
- *Working from Home* - Staff that did not require a direct operational need or have planned training worked from home. Attendance of operations, key management, maintenance and other personnel on site was staggered. The OPAL Maintenance Group was split into two teams to reduce potential spreading of the virus across the whole team. However, if needed (such as during a shutdown) most of the team came to work as the workload was too much for half the team to manage. At such times, appropriate COVID safe work arrangements were implemented (mask, distancing etc).
- *Training* - Training of reactor operation staff, including retraining of ex operators who currently work on other areas of site, was accelerated to ensure future resources are available if required.
- *Supply Chain* - The ANSTO executive team focussed on the supply chain for reactor operation to ensure there is no interruption in receipt of essential supplies, including PPE.

The changes that were implemented at OPAL specifically, and across ANSTO more broadly, were evaluated for safety significance by ANSTO, reported to ARPANSA, and assessed by ARPANSA.

ARPANSA's key response to the pandemic was as follows:

- Regulatory inspections continued as planned although time on site was reduced where possible (use of video link etc.). Where attendance at site could not be avoided, social distancing and hygiene controls were applied.
- Regular meetings were implemented via videoconference/telephone with ANSTO management (and other licence holders) to monitor ongoing safety and security during the COVID-19 pandemic.
- All licence holders were requested to provide their response to the COVID-19 pandemic in writing that were then assessed by ARPANSA to ensure ongoing safety/security of facilities and sources.
- ARPANSA staff worked from home in line with government advice. The presence of staff in the work premises was restricted to only those carrying out essential functions.

- After the roll out of the national vaccination program, only fully vaccinated ARPANSA staff were permitted to attend licence holders' premises.

As of August 2022, the majority of COVID-19 restrictions have been removed in Australia and the operations of the OPAL reactor is back to pre-pandemic status, and ARPANSA is operating at a level and tempo that is commensurate for effective regulation.

h) Snapshot of new information in National Report under each Article

A snapshot of new information/changes since the 7th CNS Review Meeting is presented below:

Article 6 – Existing nuclear installations

- An event, rated on the International Nuclear Event Scale as a level 3, occurred at the ANSTO Health Products (formerly ANSTO Health) Radiopharmaceutical Facility in August 2017 which involved significant contamination of a worker. As a result, ARPANSA issued a direction to ANSTO to initiate an independent safety review of the facility conducted by a team of international and national experts in the fields of nuclear safety, safety and organisational culture, radiation protection and human factors. The report from this review is published on the ARPANSA website[12].
- In total, the review team raised 85 recommendations to be addressed by ANSTO. The ARPANSA CEO approved the implementation action plan in December 2019. With the application of a licence condition, ARPANSA required that ANSTO report on progress of the implementation plan every six months, which has been occurring since the end of 2019. As of August 2022, the majority of the recommendations have now been addressed and associated actions completed and validated. The remaining recommendations and associated actions are being progressed in line with agreed timeframes.
- In November 2021, the Australian Government announced the availability of funds to support the design of a new world-leading nuclear medicine facility, to replace the facility mentioned above which is where nuclear medicine products are assembled, loaded, tested and distributed.

Article 7 – Legislation and regulatory framework

- In the last reporting period, a number of amendments have been made to the ARPANS Regulations 2018, including the requirement for new licence applicants to submit a Safety Analysis Report (SAR) and a Decommissioning Plan for each stage of licensing; introduction of cost-recovered licence application fees for complex facilities, including an hourly rate, to reflect the true cost of assessment; and the introduction of a requirement for licence holder to review and update plans and arrangements for managing safety following safety events.
- ARPANSA also published a new regulatory guide – *Preparation of the Safety Analysis Report for Non Reactor Facilities*[13] in March 2021 to provide further explanation and clarification of ARPANSA's expectations for the preparation and maintenance of a safety analysis report for non-reactor facilities.
- ARPANSA recently sought stakeholder feedback, including public comment, on a draft advisory note on public health considerations for disposal of radioactive waste. The note informs how health

[12] See https://www.arpansa.gov.au/news/arpansa-approves-ansto-implementation-plan-following-safety-review

[13] See https://www.arpansa.gov.au/regulation-and-licensing/licensing/information-for-licence-holders/regulatory-guides/regulatory-guide-preparation-safety-analysis#:~:text=The%20SAR%20is%20a%20document,place%20to%20mitigate%20the%20risks.

and well-being will be considered as part of licence applications such as those relating to the government's proposed NRWMF.

Article 8 – Regulatory body

- The 2018 IRRS mission made the following recommendation which ARPANSA is continuing to address as part of its ongoing action plan for the 2018 IRRS mission and through revision of its work force plan.

  > *ARPANSA should enhance its human resource management to include an assessment of the number and capabilities of staff required to effectively perform their regulatory and emergency response duties and enhance their training programme based on an analysis of the necessary skills and competencies*

- The ARPANSA work force plan sets out management strategies to build on current knowledge, prepare for future challenges to resources, implement succession planning, attract and recruit new staff as well as considering areas such as diversity and inclusion.
- ARPANSA implemented a revised qualification system in 2017 with associated defined competencies that all regulatory officers must meet before formal appointment as an inspector. This has been successfully rolled out and continues to be used for new inspectors.

Article 10 – Priority to safety

- In 2019, in response to another recommendation from the 2018 IRRS mission, ARPANSA developed and piloted a custom-built safety culture maturity model within the Regulatory Services Branch (RSB). The model was consistent with the guidance for safety culture assessment of the International Atomic Energy Agency (IAEA) Safety Standard GS-G-3.5 *The Management System for Nuclear Installations* although modified to be more targeted at the role of the regulator rather than the operator. The results of the initial safety culture assessment has been published on the ARPANSA website[14] although the actions are ongoing, having been delayed by the COVID-19 pandemic.

Article 12 – Human factors

- ARPANSA Regulatory Services Branch created a full-time equivalent position in 2020 for an organisational psychologist, whose role, amongst other areas, is to assist in developing and implementing a Human and Organisational Factors Integration Program. This plan will enhance the capabilities of ARPANSA in identifying, assessing, analysing, and providing feedback to licence holders regarding their performance in human and organisational factors. Other activities described in the plan include updates to legislation, guidance and education on human factors for licence holders as well as training for ARPANSA inspectors.

Article 14 – Assessment and verification of safety

- In line with the Licence Condition issued by ARPANSA, OPAL submitted a Periodic Safety and Security Review in November 2021. This PSSR covered 15 Safety Factors and 18 Security Factors and included an assessment of the integration between safety and security. This is currently under assessment by ARPANSA.

[14] See https://www.arpansa.gov.au/regulation-and-licensing/regulation/regulatory-integrity/safety-culture-assessment

- In line with a suggestion from the IRRS 2018 mission to Australia and a subsequent licence condition issued by ARPANSA, ANSTO submitted a revision to the OPAL Safety Analysis Report identifying and assessing Design Extension Conditions (DECs) for the OPAL reactor in June 2021. The results indicate that no additional mitigations are required for OPAL and the revision of the SAR has been approved by ARPANSA.

Article 15 – Radiation protection

- The 2018 IRRS Mission made the following recommendation:

  > *ARPANSA should make provision for an independent monitoring programme to confirm the monitoring results submitted by licensees and should consider basing the programme on an assessment of the nuclides that make a major contribution to public dose.*

- In response to this recommendation, ARPANSA has implemented an environmental monitoring of airborne and liquid discharges, groundwater and surface water, soil, sediment and vegetation, and ambient radiation dose rates near major nuclear installations. An initial set of baseline measurements was collected in November 2019 and further measurements were conducted in 2020. ARPANSA plans to obtain further data on an annual basis. The initial results are consistent with ANSTO's reported values and have shown that radiation doses to the public and the environment from gaseous and liquid discharges around the ANSTO Lucas Heights site are negligible. There are no expected health impacts from radiation at these levels.

Article 16 – Emergency preparedness

- In the last reporting period, two emergency exercises were conducted at the OPAL reactor and a number of emergency drills. One exercise was security based and one involved the combination of a simulated bushfire, loss of power, local fire alarm requiring building evacuation and an injured person. The exercises targeted effectiveness of the interfaces between ANSTO and external responders, adequacy of the processes at the OPAL reactor and site-wide protocols, and capabilities of personnel and equipment. The lessons learnt identified improvements in a number of areas, such as communications and evacuation procedures.
- The DECs have now been identified and assessed for the OPAL reactor. No significant safety related actions or additional mitigations were required for emergency response as a result of this analyses.

Article 17 – Siting

- During the country group review of the 8th CNS country report of Australia, a number of questions were asked regarding the safety of the OPAL reactor in relation to bushfires. Therefore, information has been included in this section regarding safety assessment for bushfire hazards. In summary, an extreme bushfire is considered to result in loss of off-site power which does not present a safety challenge to onsite facilities and is within design basis. The ANSTO site characteristics (flat site with sparse vegetation) and existing bushfire management plans are such that the intensity of an approaching bushfire is reduced and radiant heat impact on the OPAL reactor has been shown to be minimal.

- In March 2022, a licence was granted to ANSTO to authorise preparation of a site for a waste store known as the Intermediate Level Waste Capacity Increase (ILWCI) Facility. The existing ILSW store[15] at ANSTO that stores ILSW produced at the Lucas Heights facility is predicted to reach capacity by 2027. The new facility will enable 10 more years of storage and hence enable continued radiopharmaceutical production and research.

Article 19 – Operation

- In November 2020, ANSTO reported that defects/cracks were found in the OPAL Upper chimney/riser[16] during the in-pool in-service inspection program (ISI). Justification for continued operation of OPAL was granted by the CEO of ARPANSA following submission of an investigation report which determined the root cause to be the hard automatic closure of primary coolant system (PCS) flap valves that create a pressure pulse/surge causing additional stress on the riser and an action plan with short, medium and long-term actions to address the issue.
- These actions include engineering evaluation, safety evaluation and rectification planning and implementation. Actions include; plans to repair/remediate and replace the riser, redesign the PCS flap valves to reduce/eliminate the pressure pulse/surge and ongoing ISI with additional focus on other plant that may have been damaged by the pressure pulse. ARPANSA imposed a licence condition that requires periodic visual inspections of the riser internal and external surfaces to be provided to the CEO, as part of ongoing monitoring of the situation.
- In October 2021 the CEO of ARPANSA approved a modification to the wide range nucleonics channels (namely a change to the capacitor in the pre-amplifiers) to correct a design fault. It was noted through operational experience that an electronic module in the channels could measure neutron flux incorrectly under certain high flux conditions and hence, the first reactor protection system under these circumstances would not perform as intended. Whilst failure of the FRPS is within design basis, once the fault was discovered (March 2021), ARPANSA issued a licence condition to require the correction as soon as practicably possible.
- Recent changes to the OPAL operational limits and conditions include a change to the requirement to have the Primary Coolant System Flap Valves operational at all reactor states. This was implemented to enable a short-term rectification to the Riser defect issue (mentioned above). By holding the flap valves shut manually, it avoids the hard automatic closure which creates the pressure pulse that was identified as the root cause of the damage. Note that this is an interim arrangement implemented in advance of a longer-term action to redesign the flap valves.

[15] The 'existing ILSW store' mentioned here is a separate facility to the 'Interim Waste Store' (IWS) mentioned above which is used to hold ILSW that has been received following reprocessing of spent nuclear fuel overseas.

[16] The chimney collects and bound primary cooling system water flowing through the reactor core. The chimney comprises of the Lower chimney that is part of the reflector vessel and the Upper chimney also called the riser. The Lower chimney is made of Zircaloy-4 alloy and the Riser is made of stainless steel.

Open Pool Australian Lightwater (OPAL) reactor

Articles

Article 6 – Existing nuclear installations

Each Contracting Party shall take the appropriate steps to ensure that the safety of nuclear installations existing at the time the Convention enters into force for that Contracting Party is reviewed as soon as possible. When necessary in the context of this Convention, the Contracting Party shall ensure that all reasonably practicable improvements are made as a matter of urgency to upgrade the safety of the nuclear installation. If such upgrading cannot be achieved, plans should be implemented to shut down the nuclear installation as soon as practically possible. The timing of the shutdown may take into account the whole energy context and possible alternatives as well as the social, environmental and economic impact.

Nuclear research reactor that existed at the time the Convention entered into force for Australia

6.1. The only research reactor at the time the Convention came into force was the High Flux Australian Reactor (HIFAR) - a 10 MW(t) heavy water, tank type, materials testing reactor. This reactor operated between 1958 and 2007. HIFAR has been shut down and all fuel has been removed. ANSTO is currently managing HIFAR under a 'possess or control' licence while preparing to decommission it in the future.

New information for 9th Review Meeting

6.2. ANSTO is expected to submit an application for a licence to decommission the HIFAR reactor in 2022.

List of current research reactors

6.3. Australia has one operating research reactor, the Open Pool Australian Light-water (OPAL) reactor[17]. OPAL is a high flux, thermal, multi-purpose pool type reactor. OPAL achieved full power of 20 Megawatts in 2006. The reactor is fuelled with low enriched uranium (LEU). The fuel elements are aluminium-clad uranium silicide plates. It is cooled by light water and has a heavy water reflector surrounding the core.

6.4. OPAL is housed in a containment building which also houses the primary cooling circuit and most of the auxiliary plant. The stainless steel reactor pool has a water depth of 12.6 metres and is surrounded by a thick-walled, reinforced high density concrete construction (the Reactor Block). The reactor core sits at the bottom of the pool and is surrounded by a Zircaloy reflector vessel which also houses all the irradiation rigs and beam tube assemblies. A service pool, contiguous with the reactor pool, stores the irradiated materials and provides for the interim storage of irradiated fuel. A reactor beam hall within the reactor building and a neutron guide hall adjacent to the reactor building contain experimental stations and instrumentation for neutron beam research purposes.

6.5. Other activities related to the operation of OPAL include the handling and storage of new and irradiated nuclear fuel and nuclear materials and the production of commercial quantities of

[17] See http://www.ansto.gov.au/AboutANSTO/OPAL/index.htm

radiopharmaceuticals and radioisotopes for use in medicine, industry and research within Australia and overseas.

Overview of significant safety related issues

New information for 9th Review Meeting

6.6. A safety significant event rated as an International Nuclear and Radiological Event Scale Level 3 'serious incident' previously occurred at the ANSTO Health Products Radiopharmaceutical Production Facility. The event comprised skin contamination of a worker on 22 August 2017 that exceeded statutory dose limits.

- On 29 June 2018, ARPANSA issued a direction to ANSTO to initiate an independent review under section 41(1A) of the ARPANSA following this and another three less significant separate events with safety implications at ANSTO Health in less than 10 months.
- In accordance with the direction, ANSTO engaged an independent expert review team that was approved by ARPANSA. The team was drawn from a cohort of international and national experts in the fields of nuclear safety, safety and organisational culture, radiation protection and human factors. The team reviewed ANSTO Health's approach to occupational radiation safety of processes and operational procedures at its nuclear medicine facility, in particular those associated with quality control of molybdenum-99 samples.
- ARPANSA approved the action plan with 85 recommendations in December 2019. ARPANSA requires reports on the implementation of the plan every 6 months. As of August 2022, the majority of actions have been addressed. The Independent report, Direction and Plan are published on the ARPANSA website[18].
- ANSTO Reactor Operators conducted a review against the report with a view to implementing any relevant findings to the design and operation of the OPAL reactor. No significant actions were identified as being required for OPAL as a result.

Overview of planned programs and measures for continued safety

6.7. ANSTO continues to take part in a collaboration agreement with operators of the SAFARI-1 reactor (South Africa) and High Flux Reactor (HFR - The Netherlands) (since 2016). The aim is to work together to increase safety and reliability through cooperation as OPAL, SAFARI-1 and HFR are similar reactors. Meetings are held every 12 to 18 months to exchange ideas, experiences and good practices.

6.8. ARPANSA has working relationships with a number of overseas regulators, including with the US Nuclear Regulatory Commission and the Dutch Authority for Nuclear Safety and Radiation Protection to exchange information and lessons learnt. Overseas consultants are also engaged on short term projects to learn from and adapt good regulatory practices from international counterparts.

[18] See https://www.arpansa.gov.au/news/progress-actions-ansto-safety-review

Article 7 – Legislative and regulatory framework

1. *Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of nuclear installations.*

Australian Radiation Protection and Nuclear Safety Act 1998 (the Act)

7.1. The Act applies only to Australian Government entities and their contractors. It enables the regulatory framework to govern the safety of, among others, OPAL and HIFAR. The Act was amended in 2015 to provide the CEO with additional powers to direct a licence holder, issue improvement notices, and compel the provision of information.

2. *The legislative and regulatory framework shall provide for:*
   (i) the establishment of applicable national safety requirements and regulations;

The Australian Radiation Protection and Nuclear Safety Regulations 2018 and other regulatory publications

7.2. The Australian Radiation Protection and Nuclear Safety Regulations 2018 (the Regulations) replaced the Australian Radiation Protection and Nuclear Safety Regulations 1999 on the 9 December 2018. There was no change to the effect of the regulations, but the numbering and formatting has changed and in some parts the wording has changed to simplify the regulations in accordance with modern drafting practices.

7.3. The Regulations set up the framework for licensing, inspection and enforcement. The Regulations also contain licence conditions and specify dose limits.

7.4. In assessing licence applications, ARPANSA must, under the Act, take into account international best practice in radiation protection and nuclear safety.

7.5. ARPANSA publishes a range of publications (codes, fundamentals, guides and recommendations) under the Radiation Protection Series[19], as well as regulatory guides to assist licence applicants and licence holders. These publications are based on best international practice. Stakeholders (including public) are invited to make comment on new publications and significant amendments to existing ones.

New information for 9th Review Meeting

7.6. In 2021, ARPANSA published a Regulatory Guide for *Preparation of the Safety Analysis Reports for Non-Reactor Facilities*[20] to assist with licence applications from non-reactor licence applicants. ARPANSA also requested stakeholder feedback on a draft technical document on the public health considerations for the disposal of radioactive waste which will be published in advance of an application for the NRWMF.

[19] See https://www.arpansa.gov.au/regulation-and-licensing/regulatory-publications/radiation-protection-series

[20] See Regulatory Guide - Preparation of the safety analysis report for non-reactor facilities (ARPANSA-GDE-1924WEB) | ARPANSA

(ii) a system of licensing with regard to nuclear installations and the prohibition of the operation of a nuclear installation without a licence;

Licensing

7.7. The Act prohibits the siting, construction, operation, possession and control, or decommissioning of nuclear installations by a Commonwealth entity without a licence issued by the CEO of ARPANSA. Applicants for a licence are required to submit, among others, 'plans and arrangements' to demonstrate how the applicant will maintain effective control, manage safety and security, and protect the environment. Licences may contain conditions that the licence holder must comply with.

(iii) a system of regulatory inspection and assessment of nuclear installations to ascertain compliance with applicable regulations and the terms of licences;

Inspections

7.8. The Act provides powers of entry for inspectors to enter OPAL (and any other licensed facility) and inspect it at reasonable times. Inspectors are authorised to undertake searches and exercise a range of powers. An inspection manual[21] is available to guide inspectors on the exercise of their powers. ARPANSA has developed a risk-informed approach to the planning of its inspection program, which is designed to emphasise its safety assurance role.

7.9. A baseline inspection program defines the minimum level of planned inspections to evaluate performance over a defined period. The program aims to monitor all facilities to provide assurance that performance of the licence holder meets safety and security objectives. There are eight inspection areas. Each of these areas must be inspected at least once during the baseline period. Although the approach will be the same, the specifics will vary and each facility will have to be looked at individually. The nature and scope of inspections is tailored to the facility.

(iv) the enforcement of applicable regulations and of the terms of licences, including suspension, modification or revocation.

Enforcement

7.10. The aim of ARPANSA's regulatory activities is to verify that licence holders and controlled persons comply with the Act, the Regulations and licence conditions.

7.11. ARPANSA adopts a graded and risk-based approach to compliance and enforcement as reflected in Regulatory Guide: *Graded approach to dealing with licence holder non- compliance*[22] and the ARPANSA Compliance and Enforcement Manual which details options for enforcement[23]. When non-compliance is identified the regulatory response is graded and proportionate to the actual or potential significance of the non-compliance. The minimum response necessary is used to achieve the desired result which in most cases will be a return to compliance.

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21 See https://www.arpansa.gov.au/sites/default/files/arpansa-reg-ins-man-280w.pdf

22 See https://www.arpansa.gov.au/sites/g/files/net3086/f/reg-com-sup-270j.pdf

23 See https://www.arpansa.gov.au/sites/default/files/arpansa-reg-com-man-270w_compliance_enforcement_manual.pdf

Encourage and assist compliance

7.12. ARPANSA may provide information to encourage and support a licence holder return to compliance, while being mindful that the ultimate responsibility for safety rests with the operator. ARPANSA may accept a written commitment from the licence holder that action will be taken to rectify non-compliance within a defined timeframe. If resolution efforts prove unsuccessful in achieving a return to compliance, the regulatory response may be escalated.

Improvement notice (s80A)

7.13. Under section 80A of the Act, an inspector may issue an improvement notice in response to non-compliance or where non-compliance is likely to occur.

Direction by the CEO of ARPANSA (s41)

7.14. Section 41 of the Act gives the CEO the power to issue a direction. Under section 41(1), before issuing a direction the CEO must believe on reasonable grounds that a controlled person is not complying with the Act or regulations in respect of a thing, and that it is necessary to protect the health and safety of people or to avoid damage to the environment.

7.15. Under section 41(1A), the CEO has the power to issue a direction if the CEO believes on reasonable grounds that there is a risk of death, serious illness, serious injury or serious damage to the environment, arising from radiation, in connection with a controlled facility, controlled material or controlled apparatus and there is an urgent need to minimise the risk. A copy of any direction issued by the CEO must be provided to the Minister, who must table it in each House of Parliament. In 2018, ARPANSA issued a direction under section 41(1A)) to ANSTO[24].

Amendment of licence (s36)

7.16. Under section 36 of the Act, the CEO may impose additional licence conditions, remove or vary licence conditions that were imposed by the CEO or extend or reduce the authority granted by the licence. Depending on the nature of the non-compliance, it may be considered appropriate to amend the licence to facilitate compliance or address any new risks that have been identified.

Suspension or cancellation of licence (s38)

7.17. Under section 38 of the Act, the CEO may decide to suspend or cancel a licence in circumstances where a condition of the licence has been breached by the licence holder or by a person covered by the licence where there are reasonable grounds to believe that an offence has been committed against the Act or regulations by the licence holder or by a person covered by the licence, or where the licence was obtained improperly.

Referring matters to the Director of Public Prosecutions

7.18. The laws administered by ARPANSA create a number of offences. The Office of the Commonwealth Director of Public Prosecutions (CDPP) is an independent prosecution service responsible for prosecuting alleged offences against Commonwealth Law. The decision to refer a matter to the CDPP for prosecution will be made by ARPANSA in light of the facts and the

[24] See https://www.arpansa.gov.au/news/arpansa-issues-direction-ansto

Prosecution Policy of the Commonwealth. The CDPP will then make the ultimate decision whether or not to commence a prosecution in accordance with the Prosecution Policy of the Commonwealth.

Injunction

7.19. Under section 43 of the Act, the CEO can make an application to the Federal Court of Australia for an injunction in circumstances where a controlled person has engaged, is engaging, or proposing to engage in any conduct that would be an offence against the Act, or where there has been or is proposed to be a refusal or failure to do a thing, which refusal or failure would be an offence against the Act.

For a full summary of how Australia meets the Vienna Declaration on Nuclear Safety Principle 3 See Article 14

Article 8 – Regulatory body

> 1. *Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of nuclear installations.*

ARPANSA

8.1. The Act establishes the office of the CEO of ARPANSA. The CEO has both regulatory and non-regulatory functions. The non-regulatory functions include promoting national uniformity in radiation protection policy and processes among states and territories, providing scientific advice, providing radiation monitoring and calibration services, and undertaking research.

8.2. The RSB assists the CEO to perform their regulatory functions. The RSB has primary responsibility for the day-to-day regulatory oversight of the safety and security of OPAL and HIFAR. In addition to licensing, compliance monitoring and enforcement, the RSB also investigates accidents and incidents and prepares regulatory guidance material. The RSB's functions also include regulatory oversight of other facilities such as radioisotope production facilities, radioactive waste management facilities, accelerators, and irradiators. The delivery of regulatory outcomes is governed by the Regulatory Activities Policy[25].

Human resources and competencies

Response to the Challenge from the 7th CNS Review Meeting: Acquire and maintain adequate resourcing and competence within the regulator to cope with additional/new work and activities.

8.3. Since 2016, RSB's staff numbers decreased from 28 to 23, due to retirements and resignations. The previous shortfall was managed by allocating resources to inspection and compliance monitoring using a graded, risk-informed approach under what at the time was termed the Regulatory Delivery Model.

New information for 9th Review Meeting

8.4. As of August 2022, the RSB staff number is 21 (plus 3 non-ongoing staff members). ARPANSA continues to make best use of human resources in performing regulatory oversight of the licence holders by implementing the Inspection Manual, Review and Assessment Manual and Compliance and Enforcement Manual). Collectively, these manuals superseded the Regulatory Delivery Model and continue to apply a graded, risk-informed approach to inspection and compliance monitoring. Measures have been put in place as part of the ARPANSA work force plan to increase resources. For example, secondment of regulatory staff from State and Territory regulators is in place.

8.5. RSB personnel have competency in a wide variety of technical fields related to radiation protection and nuclear safety. The CEO of ARPANSA can also for specific purposes draw on expertise from other branches of ARPANSA (e.g. dosimetry, emergency management, communication) and is also supported by the Legal Office, Office for Business Support and by the

[25] see https://www.arpansa.gov.au/regulation-and-licensing

Office of the CEO. ARPANSA's corporate policies and procedures apply across the whole Agency, including RSB. If ARPANSA requires specialist technical advice to support regulatory activities and this is not available within the agency or in other partner organisations, financial resources and contracts are available to source such expertise externally.

New information for 9th Review Meeting

8.6. ARPANSA's overall staffing level at the time of submission of this report was 136 full-time equivalents (FTE) and 6 non-ongoing staff with current vacancies being recruited. The staff levels are capped at 146.

8.7. An example of where external expertise was employed to conduct independent modelling for the assessment of the OPAL submission to increase the analytical limit used in the safety analysis contained in the SAR from 26 MW to 28 MW which was approved by ARPANSA in 2018. In addition, external expertise is being employed to assist with the review of the OPAL PSSR (submitted to ARPANSA in November 2021).

8.8. The 2018 IRRS mission made the following recommendation which is being addressed by ARPANSA as part of its response to the IRRS mission report and through revision to the work force plan.

Recommendation: *ARPANSA should enhance its human resource management to include an assessment of the number and capabilities of staff required to effectively perform their regulatory and emergency response duties and enhance their training programme based on an analysis of the necessary skills and competencies.*

New information for 9th Review Meeting

8.9. ARPANSA has developed an updated Workforce Strategy and supporting Program Plan for 2022-25. The Plan notes that capability and workforce planning including operational workforce planning is one of the key areas for focus and this includes reviewing the identification, development and maintenance of competency requirements. The IAEA *Methodology for the Systematic Assessment of the Regulatory Competence Needs (SARCoN) for Regulatory Bodies of Nuclear Installations* has been used to perform this review for staff in RSB. In addition, ARPANSA has completed a comprehensive review of all positions in the organisation as part of ongoing succession planning. This included identification of vulnerable areas and priority areas for strengthening resilience of some key competencies.

8.10. ARPANSA is also capturing the knowledge and experience of staff leaving ARPANSA within an exit interview and therefore an innovative and systematic approach has been considered for knowledge management and knowledge transfer initiatives focussing on the technical and regulatory knowledge held in specialist areas. ARPANSA is working on knowledge management approaches including knowledge management and knowledge transfer plan and is developing a knowledge resilience map based on critical and/or core knowledge. ARPANSA has identified key areas of concern for knowledge loss by conducting a skills audit and mapping out the current and future operational needs. A draft knowledge management plan is being developed, taking

into account the deliverables in light of key strategic activities and the results of the knowledge resilience map and knowledge risk assessment.

8.11. The 2018 IRRS mission noted the following good practice in relation to ARPANSA's succession plan: *ARPANSA has a well-developed strategy to compensate for the departure of qualified staff that systematically assessed succession risks for every position in the organization and prioritised the development of competencies that were found to be vulnerabilities to the long-term capability of the organisation.*

8.12. RSB staff competence has been maintained through targeted training. This is done through annual formal training as well as on-the-job training and supervision. Staff also undertake ongoing professional development through participation in international meetings, workshops and technical consultancies.

8.13. ARPANSA has developed and implemented a Qualification Card system with associated defined competencies that all regulatory officers must meet before being appointed as an inspector. Competencies of each candidate are formally assessed prior to their appointment under section 62 of the Act. This continues to be used when new regulatory officers are hired.

8.14. The cost for ARPANSA's regulatory activities are recovered from the licence holders through licence charges and through direct cost recovery for licence application assessment as relevant. ARPANSA tracks expenditure of resources on regulatory activities, and the annual charges are adjusted accordingly. Proposed changes that are not simply machinery in nature (an example of a machinery change is indexation), are communicated to licence holders and their responses taken into account.

Quality management

8.15. ARPANSA has an Integrated Management System (IMS) to develop and maintain policies, procedures, forms and guides of a regulatory nature. The IMS provides assurance to stakeholders that regulatory processes are open and accountable and services are provided in an effective and efficient manner and subject to continuous improvement. The IMS meets the requirements of AS/NZS ISO 9001 standard and is certified to ISO17025.

New information for 9th Review Meeting

8.16. At the time of this report, ARPANSA has continued to maintain its ISO17025 accreditation and has finished the first phase in implementing an Integrated Management System across the agency.

Advisory committees

8.17. The CEO of ARPANSA receives advice on radiation protection and nuclear regulatory matters from three committees. These are the Radiation Health and Safety Advisory Council, the Nuclear Safety Committee and the Radiation Health Committee. Each committee's functions are established under the Act.

8.18. The Radiation Health and Safety Advisory Council has the following functions:

- to identify emerging issues relating to radiation protection and nuclear safety and to advise the CEO on them
- to examine matters of major concern to the community in relation to radiation protection and nuclear safety and to advise the CEO on them
- to advise the CEO on the adoption of recommendations, policies, codes and standards in relation to radiation protection and nuclear safety
- to advise the CEO, at the CEO's request, on other matters relating to radiation protection and nuclear safety
- to advise the CEO on such other matters relating to radiation protection and nuclear safety as the Council considers appropriate
- to report to the CEO on matters relating to radiation protection and nuclear safety

8.19. The Nuclear Safety Committee has the following functions:

- to advise the CEO and the Council on matters relating to nuclear safety and the safety of controlled facilities
- to review and assess the effectiveness of standards, codes, practices and procedures in relation to the safety of controlled facilities
- to develop detailed policies and to prepare draft publications for the promotion of uniform national standards in relation to the safety of controlled facilities
- to report to the CEO on matters relating to nuclear safety and the safety of controlled facilities

8.20. The Radiation Health Committee has the following functions:

- to advise the CEO and the Council on matters relating to radiation protection
- to develop policies and to prepare draft publications for the promotion of uniform national standards of radiation protection
- to formulate draft national policies, codes and standards in relation to radiation protection for consideration by the Commonwealth, the States and the Territories
- to review national policies, codes and standards in relation to radiation protection to ensure that they continue to substantially reflect world best practice
- to consult publicly in the development and review of policies, codes and standards in relation to radiation protection

2. Each Contracting Party shall take the appropriate steps to ensure an effective separation between the functions of the regulatory body and those of any other body or organisation concerned with the promotion or utilisation of nuclear energy.

Independence and conflict of interest

8.21. Although ARPANSA and ANSTO are government entities, they are separated by portfolios managed by separate ministers. ARPANSA is within the Health portfolio, while ANSTO is a government-owned business within the Industry, Science, Energy and Resources portfolio. Besides this structural separation, ARPANSA's independence is further assured through requirements in the Act. These include:

- A requirement to report quarterly and annually to Parliament on the operations of ARPANSA and any finding of breach of licence condition or legislation

- A requirement to report to Parliament about any serious accident or malfunction that occurs at a nuclear installation, including the OPAL and HIFAR reactors
- A requirement for the Minister to table in Parliament any direction that he or she makes to the CEO of ARPANSA
- The right of the CEO to, at any time, cause a report about matters relating to the CEO's functions to be tabled in Parliament.

8.22. The integrity of ARPANSA's regulatory decision-making is governed by the aforementioned ARPANSA Regulatory Activities Policy which applies to all ARPANSA staff and regulatory activities. It provides the principles according to which the regulatory activities are carried out. The CEO of ARPANSA is ultimately responsible for the regulatory decisions. The CEO, or delegate, makes regulatory decisions to fulfil the object of the Act, being 'to protect the health and safety of people, and to protect the environment, from the harmful effects of radiation', without regard to any external pressures but being mindful of consequences of the regulatory decisions for third parties. The Minister can issue directions to the CEO. However, a direction must be tabled in Parliament and the Minister can only direct the CEO if it is in the public interest to do so.

New information for 9th Review Meeting

8.23. In the 24 years ARPANSA has been in existence, no such direction has been issued.

8.24. The CEO of ARPANSA has multiple functions in addition to being the nuclear and radiation regulator, and is required by Section 15 (2) of the ARPANS Act to take all reasonable steps to avoid any conflict of interest between their regulatory function and other functions. Establishment of the RSB which has delegated regulatory functions for licensing, inspections, compliance management, and enforcement, provides structural clarity to the regulatory function. All staff members across the agency are required to make annual declarations of interests that could potentially conflict with the performance of their duties. The General Counsel makes the final determination of whether a conflict (perceived or real) exists and what mitigation strategy to put in place. In addition, the CEO ensures that any regulatory function exercised over other parts of ARPANSA is independently overseen by external personnel. On the matter of conflict of interest, see *Regulatory Intersection with Other Functions* on ARPANSA's website[26].

Openness and transparency

8.25. The ARPANS Regulations provide that if a facility licence application relates to a nuclear installation, the CEO of ARPANSA must invite people and bodies to make submissions about the application, provide a period for making submissions, and provide procedures for making submissions. This was done for the OPAL Reactor and the ANM Facility.

[26] See https://www.arpansa.gov.au/regulation-and-licensing

New information for 9th Review Meeting

8.26. ARPANSA recently published a notice of the intention to make a decision on a new waste storage facility (Intermediate Level Waste Capacity Increase - ILWCI)[27] which included details of ANSTO's submission. Similarly, the outcome of the licence decision was announced[28] along with the report detailing the regulatory assessment of the application[29] and a statement of reasons[30] published by the CEO when making the decision. The submissions made by the public[31] were also made available on the ARPANSA website.

8.27. ARPANSA continues to undertake a detailed stakeholder engagement project for the NRWMF. This is not required under the Act or Regulations but ARPANSA believes this is best practice. Activities include engaging in outreach activities with the communities that were identified in the site selection process to inform the public and local organisations on the regulatory process, ARPANSA's role, and what the public can expect in terms of interaction with the regulator during review and assessment of an application to prepare a site for a waste facility. This is continuing to be done for the community around and along transport routes for the selected site of Napandee (announced in 2021).

8.28. The RSB's regulatory processes are fully transparent. The regulatory assessment reports that form the basis for licensing decisions for nuclear installations are published on ARPANSA's website and are available for public scrutiny. The CEO also publishes a 'statement of reasons' for all licence decision in relation to nuclear installations.

8.29. Inspection reports and findings of breach are also published on the web. The Act makes it mandatory for the CEO to report to Parliament quarterly and annually on operations of the CEO, ARPANSA and the advisory bodies. Such reports include findings of breach. The CEO can also at any time table a report in Parliament on any matter that relates to the CEO's functions.

8.30. Annual self-assessments under the Regulator Performance Framework are published on the ARPANSA website[32]. The ARPANSA Safety Culture Assessment has also been published[33]. Minutes of the NSC[34], RHC[35] and RHSAC[36] are also published on the ARPANSA website.

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27 See https://www.arpansa.gov.au/notice-intention-make-decision-facility-licence-application

28 See https://www.arpansa.gov.au/news/arpansa-approves-siting-licence-ansto-waste-facility

29 See https://www.arpansa.gov.au/sites/default/files/regulatory_assessment_report_-a0339_siting_licence_rar_-_ilwci_facility.pdf

30 See https://www.arpansa.gov.au/sites/default/files/a0339_ilwci_facility_licence_application_-_ceo_statement_of_reasons_1.pdf

31 See https://www.arpansa.gov.au/regulation-and-licensing/regulation/our-regulatory-services/who-we-regulate/major-facilities/ansto-intermediate-level-waste

32 See https://www.arpansa.gov.au/about-us/corporate-publications/regulator-performance-framework

33 See https://www.arpansa.gov.au/regulation-and-licensing/regulation/regulatory-integrity/safety-culture-assessment

34 See https://www.arpansa.gov.au

35 See https://www.arpansa.gov.au/about-us/advisory-council

36 See https://www.arpansa.gov.au/RHC

Article 9 – Responsibility of the licence holder

Each Contracting Party shall ensure that prime responsibility for the safety of a nuclear installation rests with the holder of the relevant licence and shall take the appropriate steps to ensure that each such licence holder meets its responsibility.

9.1. The Regulations place prime responsibility for safety on the licence holder. This is primarily done through section 60, which provides as follows:

> *Managing safety*
>
> *(1) The holder of a facility licence must take all reasonably practicable steps to manage the safety of the facility described in the licence, including:*
>
> *(a) having in place plans and arrangements described in paragraph 46(1)(d); and*
>
> *(b) ensuring that such plans and arrangements are implemented to the extent reasonably practicable.*

9.2. Other provisions in the Act and Regulations reinforce that primary responsibility for safety rests with the licence holder. These include requirements on the licence holder to proactively investigate and rectify any breaches, prevent, control and minimise accidents, and report accidents to ARPANSA within 24 hours.

9.3. ANSTO's responsibility for safety is defined in its Work Health and Safety Policy[37] and the supporting safety management system which is certified to ISO 9001 and 14001 standards and consistent with ISO 45001. To support the safety management system, ANSTO has safety assessment and audit systems that are independent of line management responsible for OPAL operation. The overarching safety process, the Safety Reliability and Assurance (SRA) process provides assurance to the CEO of ANSTO that ANSTO is meeting its obligations under the Work Health and Safety Act and Regulations and the ARPANSA Act and Regulations.

9.4. As part of the application for a facility licence to authorise the operation of OPAL, ANSTO submitted a suite of safety related documentation including how appropriate effective control is maintained (resourcing, technical expertise etc.) and emergency response is handled. This suite of safety documents is reviewed as part of the ongoing inspection program. Any proposal to change ANSTO's arrangements for managing safety that has significant implications for safety requires ARPANSA's prior approval.

9.5. ARPANSA inspectors regularly monitor and review the operations of ANSTO's nuclear operations. The inspectors undertake planned inspections of the nuclear facilities and frequent site visits and/or virtual meetings. Inspectors use these opportunities to emphasise and stress the licence holder's primary responsibility for safety.

[37] See https://www.ansto.gov.au/media/1615/download?inline

Article 10 – Priority to safety

Each Contracting Party shall take the appropriate steps to ensure that all organisations engaged in activities directly related to nuclear installations shall establish policies that give due priority to nuclear safety

10.1. ARPANSA has a Work Health and Safety Policy which outlines the means by which the agency complies with legislative requirements, namely the *Work Health and Safety Act 2011*.

Safety culture

10.2. ARPANSA requires applicants for a licence and licence holders to demonstrate a commitment to a strong safety culture. The *Regulatory Guide: Plans and Arrangements for Managing Safety*[38], against which licence applications are assessed, states:

> *The Licence Holder or Applicant is responsible for establishing safety as the organisation's highest priority, consistent with international best practice in radiation protection and nuclear safety and overriding, if necessary, the demands of production or project schedules.*

10.3. The plans and arrangements are required to provide sufficient details on how the applicant will exercise effective control and manage safety, including measures to foster a safety culture. Specific plans are required to be submitted on how the applicant will monitor and assess safety, including undertaking independent safety assessments for radiation protection, radioactive waste management, security, emergency preparedness and decommissioning.

10.4. Once a licence is issued, the Regulations require the licence holder to take all reasonably practicable measures to manage safety. Specifically, the licence holder must continue to have in place plans and arrangements that are reviewed and updated at least once every three years. The licence holder must also take all reasonably practicable measures to implement the plans and arrangements. Non-compliance with these requirements may be a breach of licence condition.

10.5. ARPANSA places a very strong emphasis on safety culture. Safety culture is one of the three 'cross-cutting' areas in the performance objectives and criteria that inspectors' use.

10.6. In 2019 in response to a recommendation from the 2018 IRRS mission, ARPANSA, in conjunction with an external consultant in safety culture and organisational psychology, developed and piloted a custom-built safety culture maturity model in the RSB. The model ranks performance in five elements each with four sub-elements. Maturity is ranked on a five-point scale from 'pathological' to 'holistic'.

10.7. The model was based on the OECD Nuclear Energy Agency (NEA) publication *the Safety Culture of an Effective Nuclear Regulatory Body*. The model was adapted from the 'Safety Culture Maturity Matrix' and framework developed by Bel V (2018). Bel V is a subsidiary of the Belgian Federal Agency for Nuclear Control (FANC), which acts as an expert for the safety assessments of nuclear projects and carries out inspections of nuclear installations in Belgium. Bel V reviewed and commented on the ARPANSA model.

[38] See https://www.arpansa.gov.au/regulation-and-licensing/licensing/information-for-licence-holders/regulatory-guides

10.8. The assessment was carried out in the spirit of International Atomic Energy Agency (IAEA) General Safety Requirements No. GSR Part 2 *Leadership and Management for Safety*. The model is consistent with the guidance for safety culture assessment of IAEA Safety Standard GS-G-3.5 *The Management System for Nuclear Installations*. However, it has been modified to be more targeted at the role of the regulator rather than the operator.

10.9. Survey results for the five elements showed an overall positive safety culture, ranging in maturity from 'Individual' to 'Cooperative' levels. The more detailed sub-elements spanned a broader range of responses and highlight successful attributes of RSB's safety culture maturity, as well as areas which deserve attention.

10.10. This study led to two recommendations, four areas for improvement and one good practice, including:

- RSB should explore how to foster a positive culture where all employees are encouraged and provided opportunities for influence in decision-making and feel included at work.
- Strategies for enhancing individual responsibility and accountability should be investigated in relation to procedural adherence and the management system. The core objective in this activity would be to examine such things as the interface between employees and the management system that impacts on efficiency and effectiveness in meeting key outcomes.
- Communication and the relationship with licensees were found to be a good practice. RSB employees clearly recognise the value of cultivating and maintaining high quality interactions with licence holders in order to promote their safety performance.

10.11. The safety culture assessment report has been finalised and published[39] along with an action plan to address the areas for improvement and recommendations.

New information for 9th Review Meeting

10.12. The action plan following the safety culture assessment has not yet been completed due to a delay because of the COVID-19 pandemic.

ANSTO's safety policies

10.13. As part of its business management system, ANSTO has a work health safety (WHS) policy[40], under which it operates in a manner that places the protection of human health and safety and the environment as its highest priority, promotes a positive safety culture and environmental awareness; and strives for continual improvement in safe work practices using a blame-free learning approach. In addition to the WHS policy, ANSTO also supports a positive safety culture through risk management and quality management policies and systems.

ANSTO safety management and culture

10.14. ANSTO implements its safety policy and strategies through a work health and management system that covers radiological, nuclear and occupational health and safety. The system makes every member of ANSTO's staff responsible for ensuring compliance with the organisation's work

[39] See https://www.arpansa.gov.au/regulation-and-licensing/regulation/regulatory-integrity/safety-culture-assessment

[40] See https://www.ansto.gov.au/media/1615/download?inline

health, safety and environment policy and strategies, and line management accountable for safety.

10.15. Safety assurance at ANSTO is achieved by several mechanisms. Changes at the OPAL reactor that have any impact on nuclear safety are reviewed by the Reactor Assessment Committee (RAC) who remain independent of OPAL line management. Additional assurance of safety is achieved through routine inspections by staff, who are independent of the function being assessed, and the review of safety performance by senior management and the ANSTO Board. In undertaking its assessments, the RAC has regard to applicable IAEA Safety Standards.

10.16. Safety culture within OPAL was also assessed under Safety Factor 10 of the Periodic Safety and Security Review (PSSR) of OPAL. This assessment including the use of an independent external consultant specialising in reviewing the safety management and safety culture within organisation.

Safety performance indicators

10.17. ANSTO has, in consultation with ARPANSA established Safety Performance Indicators (SPIs) for OPAL. These SPIs measure and set objective targets for 15 safety related functions of plant operation. Performance against the SPIs is reported monthly within ANSTO and reported quarterly to ARPANSA. These SPIs are themselves also subject to regular review to verify their continued suitability and applicability.

For a full summary of how Australia meets the Vienna Declaration on Nuclear Safety Principle 3 - See Article 14

Article 11 – Financial and human resources

> 1. *Each Contracting Party shall take the appropriate steps to ensure that adequate financial resources are available to support the safety of each nuclear installation throughout its life.*

Financial resources

11.1. In making a licence decision, the CEO of ARPANSA must consider whether the applicant has shown a capacity to comply with the Regulations and any licence condition that may be imposed. ANSTO must provide evidence of adequate resources, including financial capability, before it is issued with an operating licence as per *Regulatory Guide: Applying for a licence for a nuclear installation*[41]. Since ANSTO is a government agency, its funding for nuclear safety and reliability of its installations, including decommissioning, will be underwritten by the Commonwealth Government throughout its life.

11.2. The bulk of ANSTO's operating revenue is provided by the Australian Government. ANSTO also generates revenue from the sale of goods and services, particularly radiopharmaceuticals. ANSTO has demonstrated to ARPANSA's satisfaction that it has adequate financial capability to support the safety of OPAL and HIFAR, including in the event of an emergency.

> 2. *Each Contracting Party shall take the appropriate steps to ensure that sufficient numbers of qualified staff with appropriate education, training and retraining are available for all safety-related activities in or for each nuclear installation, throughout its life.*

Human resources – ARPANSA

11.3. The RSB's Facility Safety Section is primarily responsible for the compliance and inspection program for safety related aspects of the operation of OPAL. A dedicated lead inspector for OPAL is supported by several other staff who assist the lead inspector.

11.4. Regulatory staff must complete on the job training in relevant technical areas before being eligible to be appointed as an inspector. In addition, inspectors must have either obtained or be working towards a nationally recognised accreditation, namely, Certificate IV in Government Investigations (or equivalent).

11.5. Competencies that this program offers are the ability to exercise regulatory powers, promote and assess compliance with legislation, investigate non-compliance, conduct and record interviews, conduct a search and possible seizure and prepare evidence. Additional training is conducted periodically for all regulatory staff in inspection reporting, conflict of interest, security, and legal awareness.

11.6. ARPANSA has developed a Workforce Plan which notes the identification, development and maintenance of competency requirements. In addition, in 2017, ARPANSA undertook a comprehensive review of all positions in the organisation as part of ongoing succession planning. This included identification of vulnerable areas and priority areas for strengthening resilience of some key competencies.

[41] See https://www.arpansa.gov.au/sites/default/files/legacy/pubs/regulatory/guides/REG-LA-SUP-240G.pdf

New information for 9th Review Meeting

11.7. ARPANSA has benchmarked the regulatory framework against IAEA General Safety Guides 12 and 13 which resulted in an action plan regarding further resourcing through the increased use of contractors for specialised work and secondment of regulatory staff from the state and territories.

Human resources – ANSTO

11.8. ARPANSA requires ANSTO to demonstrate adequate managerial structure and resources to ensure positive safety attitudes and high standards of human performance and competence. This includes demonstrating clear lines of authority as well as systems for staff selection, training, and personnel stability.

11.9. OPAL is operated with a rotating 12-hour shift roster of at least two reactor operators and a Shift Manager. Shift Managers have, as a minimum, an appropriate university degree, often in engineering or physics. Reactor operators and Shift Managers undergo a period of intensive training at the start of their employment and are required to demonstrate competence in reactor operation and safety through an accreditation process. Reactor operators and Shift Managers are re-accredited every three years.

11.10. In addition to reactor operators and Shift Managers, OPAL has significant human resources in utilisation, engineering, maintenance, nuclear analysis and technical support under the management of the Group Executive, Nuclear Operations and Nuclear Medicine.

11.11. The arrangements for qualification training, accreditation and retraining of OPAL staff are summarised in the OPAL Safety Analysis Report and detailed in a Training Manual. OPAL reactor training is designed to provide personnel with the knowledge and skills needed to perform their roles, a healthy respect for nuclear safety and radiation protection issues, and an awareness of the impact that actions have on safety and performance. The three components of training at the OPAL reactor are induction, role-specific, and ongoing training.

11.12. OPAL operations are supported by staff from other parts of ANSTO who provide services in radiation protection, waste management and engineering as well as finance and procurement, site services, human resources and general administration as required. These services are defined by the ANSTO Business Management System (ABMS) in relation to the scope, nature, frequency and standard of the services provided, including a range of performance metrics to assess and verify the quality of the services provided.

11.13. ARPANSA's inspections of OPAL include training. ARPANSA inspectors are invited to observe shift operator and manager accreditation panels to ensure that the process is robust.

Article 12 – Human factors

Each Contracting Party shall take the appropriate steps to ensure that the capabilities and limitations of human performance are taken into account throughout the life of a nuclear installation.

New information for 9th Review Meeting

12.1. ARPANSA Regulatory Services Branch created a full time equivalent position in 2020 for an organisational psychologist, whose role amongst other areas, is to assist in developing and implementing a human organisational factors (HOF) integration program.

12.2. The HOF Integration Program will enhance the capability of ARPANSA in identifying, assessing, analysing, and providing feedback to licence holders regarding their performance in human and organisational factors. Through ARPANSA's increased capability in HOF, licence holders are expected to gain further insights into their own organisation and consider more ways to improve performance and meet organisational objectives. The intention is that ARPANSA will be able to detect risk areas early and trends in licence holder safety and compliance performance.

12.3. The basis of the plan is to collect quality data on HOF from licence holders and input it into existing systems for analysis by ARPANSA. The data will indicate whether a HOF specialist is required to attend inspections and which specific areas should be focussed on.

12.4. Other activities described in the plan are designed to encourage licence holders' active participation in provision of information relating to HOF. They include updates to legislation, guidance and education for licence holders.

12.5. To support inspectors in increasing their capability in HOF, resources and training are being rolled out for ARPANSA staff.

12.6. ARPANSA has developed a set of *Holistic Safety Guidelines*[42] to provide guidance on key technological, human, and organisational aspects that are necessary to create and maintain optimal safety. Guidelines contain a range of key principles considered relevant to holistic (or systemic) safety. The key principles of holistic safety are arranged under seven 'characteristics'. Within each 'characteristic' are 'attributes' that more specifically outline the ways in which the key principles of holistic safety can be achieved.

12.7. The seven characteristics are human aspects, non-technical skills, defence-in-depth, management system, resilience, safety culture, and security. Human factors are covered in every inspection of the OPAL reactor.

12.8. In 2019, ARPANSA, in response to a recommendation from the 2018 IRRS mission, developed and piloted a custom-built safety culture maturity model in the Regulatory Services Branch (RSB). See Article 10 for more information.

OPAL

12.9. OPAL has had a human factors (HF) program from its inception that will continue to evolve until the reactor is decommissioned. The program aims to optimise the human-machine interface to

[42] See https://www.arpansa.gov.au/holistic-safety/guidelines

avoid operational/maintenance errors and violations. The HF design plans for OPAL were proposed by ANSTO and reviewed by ARPANSA. The HF commitments are defined in various sections of the OPAL Safety Analysis Report (SAR). All safety related events/incidents are reported and investigated following the *Incident Management and Incident Response Process*. This process also captures incidents and abnormal occurrences, suggestions for improvement, and includes human factor and organisational related issues.

12.10. ANSTO is required by the Regulations to analyse the causes of incidents (abnormal safety occurrences) and lessons learned.

New information for 9th Review Meeting

12.11. Since the last CNS report, there have been a number of nuclear safety related events reported for OPAL, but none have been identified as significant by ARPANSA. In its Quarterly Report to ARPANSA, ANSTO provides a list of incidents that have occurred within OPAL in the previous quarter. These incidents are reviewed and discussed by both organisations at a quarterly meeting.

12.12. Human factors were also assessed under Safety Factor 12 of the Periodic Safety and Security Review (PSSR) of OPAL in conjunction with an independent specialist human factors review conducted by an external expert.

Article 13 – Quality assurance

Each Contracting Party shall take the appropriate steps to ensure that quality assurance programs are established and implemented with a view to providing confidence that specified requirements for all activities important to nuclear safety are satisfied throughout the life of a nuclear installation.

13.1. ARPANSA has a quality policy which articulates the commitment to high quality service delivery and describes the responsibilities of management and staff in achieving the quality objectives. The policy guides the development and implementation of the ARPANSA Integrated Management System (IMS) and the application of the IMS to all agency activities.

13.2. ARPANSA uses an Integrated Management System (IMS) to develop and maintain policies, procedures, forms and guides of a regulatory nature. The IMS provides assurance to stakeholders that regulatory processes are open and accountable and services are provided in an effective and efficient manner and subject to continuous improvement. The IMS meets the requirements of AS/NZS ISO 9001 standard and is certified to ISO17025.

New information for 9th Review Meeting

13.1. ARPANSA has continued to maintain its ISO17025 Accreditation and as of August 2022 has finished the first phase in implementing their Integrated Management System across the agency.

13.2. As per *Regulatory Guide: Plans and Arrangements for Managing Safety,* a licence applicant must demonstrate that arrangements are in place to establish and manage a facility and the interdependencies between such arrangements should be documented in a management system. The management system must be designed to support the object of the Act and integrate safety, health, environmental, security, quality, societal and economic elements.

OPAL

13.3. The administrative control of OPAL is undertaken in accordance with the Nuclear Operations Business Management System (BMS). This system sits within the ANSTO Quality Policy and ANSTO Business Management System (ABMS) framework. The ABMS covers ANSTO policies, overarching processes and supporting guidance. The ABMS (and hence, the Nuclear Operations BMS) is ISO 9001 certified.

13.4. The lead document of the Nuclear Operations BMS is the *Nuclear Operations Business Management System Manual* and below this lies a range of manuals, procedures, instructions, and forms for operational and maintenance activities. The documents include response to alarms and emergency operating instructions. ARPANSA reviewed these documents as part of the licence application assessment process and regularly undertakes inspections to determine if OPAL operation is consistent with the documentation contained in the Nuclear Operations BMS.

13.5. ANSTO undertakes regular internal management system audits in accordance with its ISO 9001 quality system, ISO 14001 environmental system and ISO 45001 occupational health and safety system certifications that verify activities are compliant with the Nuclear Operations BMS and to identify process improvements. ANSTO is also subject to regular surveillance and re-certification audits by an accredited external organisation in order to maintain its ISO 9001 quality system,

ISO 14001 environmental management system and ISO 45001 occupational health and safety system certifications.

Article 14 – Assessment and verification of safety

Each Contracting Party shall take the appropriate steps to ensure that:

i. comprehensive and systematic safety assessments are carried out before the construction and commissioning of a nuclear installation and throughout its life. Such assessments shall be well documented, subsequently updated in the light of operating experience and significant new safety information, and reviewed under the authority of the regulatory body;

Safety Analysis Reports (SAR)

14.1. ARPANSA's licensing process is staged. A separate licence is required for each stage of a nuclear reactor's lifecycle from the preparation of a site to decommissioning. ARPANSA requires a SAR to be included in an application for a licence to construct a reactor. A final SAR must be submitted when applying for a licence to operate a reactor. The SAR is treated as a living document and is required to be updated throughout the life of the reactor.

14.2. The SAR must include deterministic safety analyses to determine if the safety limits and objectives will be met for design-basis accidents. A probabilistic safety assessment may supplement the deterministic safety assessment of design-basis and beyond-design-basis accidents. The operational limits and conditions (OLC) are determined from the safety analyses.

14.3. ARPANSA's requirements for each phase of a nuclear reactor's lifecycle can be summarised as follows:

 **Siting**	Detailed site evaluation, including a consideration of the extent to which the site may be affected by natural and man-made events, and environmental impact assessments.
 **Construction and operation**	Design information, including the OLC within which the reactor must operate, the safety analysis, and detailed plans and arrangements for safety.
 **Possession or control**	Arrangements for safe storage of radioactive material and maintaining the nuclear reactor.
 **Decommissioning and abandoning**	Decommissioning plans and results (respectively) and the details of any proposed environmental monitoring program for the site.

OPAL

14.4. ARPANSA issued the operating licence to OPAL in 2006 following a detailed assessment of the SAR and the plans and arrangements for managing safety submitted by ANSTO[43]. Any change to the SAR or the plans and arrangements with significant implications for safety requires approval by ARPANSA under section 63 of the Regulations, before implementation.

14.5. ANSTO has a well-developed and sophisticated system for safety assessment and verification, including the requirement for prior review and approvals of modifications to all licensed facilities that have the potential for significant implications for safety. Changes at the OPAL reactor that have any impact on nuclear safety must be reviewed by the Reactor Assessment Committee (RAC) independent of OPAL line management.

ii. verification by analysis, surveillance, testing and inspection is carried out to ensure that the physical state and the operation of a nuclear installation continue to be in accordance with its design, applicable national safety requirements, and operational limits and conditions.

Verification of safety

14.6. The Regulations require a licence holder to take all reasonably practicable measures to implement its plans and arrangements for managing safety. The licence holder is also required to review those plans and arrangements at least once every three years. Any change to plans and arrangements that may have significant implications for safety must be approved prior to implementation.

14.7. ARPANSA conducts planned inspections to verify the safety of OPAL and HIFAR and other facilities. The inspections aim to assess the safety performance of ANSTO and provide reasonable assurance to the Australian Government and the public that activities involving radiation facilities and sources do not pose a threat to human health or the environment. The inspections focus on compliance with the Act and Regulations. A set of performance objectives and criteria (PO&C)[44] are used by inspectors for a transparent and graded approach to assess licence holders' practices and is consistent with the risk of the facility.

14.8. The PO&Cs reflect international best practices and are organised under eight 'baseline modules' and three cross cutting areas. One or more of these modules is used for the inspection of facilities. The eight baseline modules cover:

- performance reporting
- configuration management
- inspection, testing and maintenance
- training
- event protection
- security
- radiological protection

[43] See https://www.arpansa.gov.au/regulation-and-licensing/regulation/about-regulatory-services/who-we-regulate/major-facilities/open-pool-light-water-reactor/operating-licence-application

[44] See https://www.arpansa.gov.au/regulation-and-licensing/licensing/information-for-licence-holders/inspections/performance-objectives-and-criteria

- emergency response and preparedness

14.9. The cross cutting areas are safety culture, human performance and performance improvement.

14.10. ARPANSA also undertakes routine site visits/holds virtual meetings with OPAL, HIFAR and other facilities. Site visits supplement the inspection program and are regular, frequent and informal visits to the premises of a licence holder for regulatory oversight and discussions.

14.11. Requirements for the assessment and reporting of design extension conditions (DECs) for the OPAL reactor were stipulated in the revised OPAL licence issued in May 2019 following submission of detailed plans by ANSTO. This was following a suggestion from the 2018 IRRS mission. The DECs were submitted by ANSTO in June 2021 in the form of a revision to the OPAL Safety Analysis Report (SAR).

New information for 9th Review Meeting

14.12. No additional mitigations are considered to be required at OPAL as a result of the analysis of DECs and the revision of the SAR has been approved by ARPANSA.

OPAL

New information for 9th Review Meeting

14.13. The OPAL In-Service Inspection (ISI) program, which was implemented in 2019 to achieve systematic inspection of in-pool reactor components related to safety, noted defects/cracks in the reactor upper chimney (or riser) on 10 November 2020. The chimney function is to collect and bound primary cooling system water flowing through the reactor core. The chimney comprises of the lower chimney that is part of the reflector vessel and the upper chimney, also called the riser. The lower chimney is made of zircaloy-4 and the riser is made of stainless steel.

- Investigation into the defects determined the root cause to be the hard automatic closure of the primary coolant system (PCS) flap valves. The PCS flap valves open and establish a path for natural circulation cooling when the reactor is shutdown (amongst other safety functions) and forced circulation is stopped. The automatic closure upon start-up of the PCS pumps (so that forced cooling circulation can be established when the reactor is at operation) was determined to cause a pressure pulse which resulted in the damage to the riser.
- Justification for continued operation of OPAL was granted by the CEO of ARPANSA following submission of the investigation report, consequence analyses and fracture mechanics assessment, as well as a rectification and mitigation action plan.
- These actions include plans to repair/remediate and/or replace the riser and to redesign the PCS flap valves. ARPANSA imposed a licence condition that requires periodic visual inspections of the riser internal and external surfaces to be provided to the CEO, as part of ongoing monitoring of the situation. To date, the action plan is on target.

14.14. In October 2021, the CEO of ARPANSA approved a modification to the wide range nucleonics channels (namely a change to the capacitor in the pre-amplifiers) to correct a design fault.

Operational experience showed that an electronic module in the channels could measure neutron flux incorrectly under certain high flux conditions and hence, the first reactor protection system under these circumstances would not perform as intended. Whilst failure of the FRPS is within design basis with a second reactor protection system specifically provided for such scenarios, once the fault was discovered (March 2021), ARPANSA issued a licence condition to require the correction as soon as practicably possible.

Periodic Safety and Security Review

14.15. The OPAL operating licence requires ANSTO to undertake Periodic Safety and Security Reviews (PSSR). The first periodic safety review (PSR) report was submitted to ARPANSA in December 2011 and a supplementary PSR report was submitted in June 2013. ARPANSA reviewed and accepted the PSR in October 2014. The first periodic security review was submitted in 2014 and approved by ARPANSA in 2015. The reviews identified a high degree of conformity by ANSTO with the current international safety and security standards and practices. The licensing basis was found to be valid.

14.16. OPAL submitted a PSSR to ARPANSA in November 2021. This is currently under review by ARPANSA. This PSSR covered 15 Safety Factors and 18 Security Factors and included an assessment of the integration between safety and security.

14.17. The new ANM facility also has a licence condition requiring a full PSSR within 5 years and ANSTO Health is required to perform a graded approach to a PSR (security is not included) at least once every 10 years.

Summary of how Australia meets the Vienna Declaration on Nuclear Safety Principle 2

Australia meets the Vienna Declaration Principle 2 in relation to Research Reactors: *Comprehensive and systematic safety assessments are to be carried out periodically and regularly for existing installations throughout their lifetime in order to identify safety improvements that are oriented to meet the above objective. Reasonably practicable or achievable safety improvements are implemented in a timely manner*.

This is achieved through:

- Requiring a licence holder to take all reasonably practicable measures to implement its plans and arrangements for managing safety. The licence holder is also required to review those plans and arrangements at least once every three years. Any change to plans and arrangements that may have significant implications for safety must be approved by ARPANSA prior to implementation.
- OPAL is required to undertake periodic safety and security reviews (PSSR).
- OPAL submitted full DEC Analyses in June 2021 as part of a revision of the SAR.
- The requirement to undertake a PSSR and assess and report on the DECs also applies to the ANM Facility which was issued a full operating licence in May 2019. A graded approach to a PSR (security is not included) is also required for ANSTO Health.
- Reasonably practicable/achievable safety improvements arising from these reviews are required to be implemented in a timely manner.

Summary of how Australia meets the Vienna Declaration on Nuclear Safety Principle 3 (see also Articles 7 and 10)

Australia meets the Vienna Declaration Principle 3 in relation to Research Reactors: *taking into account IAEA Safety Standards and other good practises identified in Review Meetings of the CNS* in the following ways: (summary from Articles 7,10 and 14)

- In assessing a licence application, ARPANSA must, under the Act, take into account international best practice in radiation protection and nuclear safety. The relevant international best practice documents (primarily IAEA Safety Standards) are listed on the ARPANSA website.
- Publishing of ARPANSA Regulatory Guide: *Periodic Safety and Security Review for Research Reactors* (based on IAEA SSG-10) in 2016 and Regulatory Guide*: Decommissioning of Controlled Facilities* published in 2018 based on IAEA SSG-47. In addition publishing of Regulatory Guide: *Applying for a licence for radioactive waste storage or disposal facility* based on the IAEA Safety Series including GSG-1 *Classification of Radioactive Waste* and SSR-5 *Disposal of Radioactive Waste*.
- A set of performance objectives and criteria (PO&C) are used by inspectors for a transparent and graded approach to assess licence holders' practices and is consistent with the risk of the facility. The PO&Cs reflect international best practice.
- Hosting of a full scope IRRS mission in 2018 which reviewed Australia's national, legal and governmental framework for nuclear and radiation safety against the IAEA's Safety Standards.
- Imposing a licence condition to require OPAL to assess and report on DECs as per the IAEA SSR-3 *Safety of Research Reactors* Requirement 22. The DECs were submitted to ARPANSA in June 2021 in the form of a revision to the OPAL Safety Analysis Report.
- Implementing a licence condition on the new ANSTO ANM Facility to assess DECs as associated with a graded approach to the implementation of SSR-4.

Article 15 – Radiation protection

Each Contracting Party shall take the appropriate steps to ensure that in all operational states the radiation exposure to the workers and the public caused by a nuclear installation shall be kept as low as reasonably achievable and that no individual shall be exposed to radiation doses which exceed prescribed national dose limits.

15.1. The Regulations require ARPANSA to be satisfied that licence holders optimise radiation protection. The Regulations also set out statutory effective dose limits, as well as equivalent dose limits for the skin, extremities and eye. The dose limits to the lens of the eye specified in the Regulations implements the most recent recommendations from the International Commission on Radiological Protection. ARPANSA monitors whether ANSTO ensures that radiation doses arising from normal operation and anticipated operational occurrences throughout the life of the reactor are optimised and do not exceed the dose limits.

OPAL

15.2. ANSTO's plans and arrangements for OPAL include a radiation protection plan, as required by the Regulations and further elaborated in ARPANSA's Regulatory Guide: *Plans and Arrangements for Safety* which covers the following:

- roles and responsibilities for radiation protection
- an evaluation and safety assessment of the main radiological hazards in OPAL
- access control to areas with radiological hazards
- administrative controls for management of radiological hazards
- radiological monitoring programs for plant, individuals and the environment
- transportation of radioactive materials
- training requirements for radiation protection
- arrangements for reviewing the radiation protection plan

15.3. Radiation protection in OPAL is managed with advice from a dedicated radiation protection adviser (RPA). The RPA is supported by a group of radiation protection personnel working in OPAL, including health physics surveyors. The RPA advises on the continuing effectiveness of controls against identified radiological hazards within OPAL and co-ordinates radiation monitoring programs.

15.4. Doses associated with OPAL are typically low, due to design features which limit operational exposure. These features include a reactor pool incorporating a hot water layer which reduces ambient dose-rates associated with activation and contamination products. Other features include dedicated hot cells for handling irradiated materials and the demarcation of areas of restricted access during reactor operation.

15.5. Dose records are submitted quarterly to ARPANSA and recorded in the Australian National Radiation Dose Register maintained by ARPANSA.

New information for 9th Review Meeting

15.6. The 2018 IRRS mission made the following recommendation: ARPANSA should make provision for an independent monitoring programme to confirm the monitoring results submitted by licensees and should consider basing the programme on an assessment of the nuclides that make a major contribution to public dose**.** ARPANSA is addressing this recommendation as part of the response to the IRRS mission and has rolled out an environmental monitoring programme to assess airborne discharges and radiation dose rates near major nuclear installations to verify public doses are low.

Article 16 – Emergency preparedness

Each Contracting Party shall take the appropriate steps to ensure that there are on-site and off-site emergency plans that are routinely tested for nuclear installations and cover the activities to be carried out in the event of an emergency. For any new nuclear installation, such plans shall be prepared and tested before it commences operation above a low power level agreed by the regulatory body.

16.1. The Regulations require a licence applicant to include its emergency plans in its submissions that support a licence application. The Regulations also require the plans and arrangements to be reviewed at least once every three years. Under the regulatory guide on review of plans and arrangements, ARPANSA expects emergency plans to be in place for any action that could give rise to a need for urgent protective measures or other actions and be based on an assessment of the consequences of reasonably foreseeable accidents including those with off-site consequences.

16.2. Emergency plans must also aim to minimise consequences and ensure protection of on-site personnel, the public and the environment; have comprehensive procedures, and require all external organisations identified in the emergency plan to be prepared for emergencies with adequate and well-maintained facilities and equipment.

16.3. The 2018 IRRS mission made the following recommendation which ARPANSA is addressing as part of the response to the IRRS report - *ARPANSA should develop criteria for evaluation of licensee exercises, to include the observation of exercises as part of the inspection process and ensure that licensees exercise all aspects of their emergency plan over an agreed time period and in line with a graded approach.*

New information for 9th Review Meeting

16.4. ARPANSA continues to address this recommendation as part of the response to the IRRS mission.

16.5. ARPANSA has published a *Guide for Radiation Protection in Emergency Exposure Situations* (RPS G-3, Parts 1 and 2, 2019). This guide provides the framework in Australia for the protection of emergency workers, helpers, the public and the environment in emergency exposure situations as well as providing guidance for the planning, preparedness, response and transition required to effectively respond to an emergency

OPAL

16.6. ANSTO has an emergency response plan for its entire site, which is integrated with the emergency plans of the State of New South Wales. There is a sub-plan covering a major incident at ANSTO which may involve local evacuations. An emergency plan exists for OPAL, with the requirement for a major exercise every two years and more frequent drills on particular aspects of the plan. Major exercises have been held regularly in accordance with the plan. These exercises were witnessed by ARPANSA inspectors. In addition, desktop drills are performed once a week by the duty shift, such that every shift completes a drill once every four to six weeks.

16.7. The implementation of these emergency plans for the ANSTO site is regularly discussed with emergency response agencies, local council and others at the ANSTO Local Liaison Working Party, in which ARPANSA is an observer. The plans are also available in local public libraries.

16.8. OPAL has conducted two emergency exercises and a number of emergency drills in the last reporting period. One exercise was security based and one involved the combination of a simulated bushfire, loss of power, local fire alarm requiring building evacuation and an injured person.

16.9. The exercises targeted effectiveness of the interfaces between ANSTO and external responders, adequacy of the processes at the OPAL reactor and site-wide protocols, and capabilities of personnel and equipment. The lessons learnt identified improvements in a number of areas, such as communications and evacuation procedures.

16.10. Assessments of the radiological consequences of acts of sabotage and terrorism in relation to OPAL have been undertaken by ANSTO and reviewed by ARPANSA. Both ANSTO and ARPANSA concluded that the current emergency plans and arrangements, including adoption of the World Health Organisation (WHO) guidelines for the dissemination of iodine tablets, provide adequate protection of the public for such events.

Each Contracting Party shall take the appropriate steps to ensure that, insofar as they are likely to be affected by a radiological emergency, its own population and the competent authorities of the States in the vicinity of the nuclear installation are provided with appropriate information for emergency planning and response.

16.11. The geographical location of Australia means that an emergency in OPAL is unlikely to result in a transboundary release but could result in a transnational emergency. Australia is a party to the *Convention on the Early Notification of a Nuclear Accident* and the *Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency*. ARPANSA is the designated national competent authority for these conventions and the Australian Government National Situation Room (NSR), operated by Emergency Management Australia a Division of the Department of Home Affairs, is the designated national warning point. ARPANSA maintains capabilities registered in RANET that can be deployed to other countries under the Assistance Convention, and has agreement from ANSTO to include further capabilities during the next update.

New information for 9th Review Meeting

16.12. Australia responded to the Ukraine's 2022 request for assistance with the provision of equipment in partnership with the IAEA.

16.13. The ARPANSA Emergency Operations Centre can be activated in response to a radiological or nuclear emergency and provides 24 hour access to expert radiation protection and nuclear safety advice. This capability has been enhanced over the last 18 months with adoption of the Australasian Inter-Service Incident Management Framework (AIIMS) and associated incident management software. The operations centre maintains communication links with the Australian Government Department of Home Affairs NSR ensuring the Australian Government and public are provided with appropriate and timely information during an emergency. This information would also be sent to the IAEA Incident and Emergency Centre as required to inform affected Member States on the situation.

Contracting Parties which do not have a nuclear installation on their territory, insofar as they are likely to be affected in the event of a radiological emergency at a nuclear installation in the vicinity, shall take the appropriate steps for the preparation and testing of emergency plans for their territory that cover the activities to be carried out in the event of such an emergency.

16.14. Australia is not geographically close to any State operating a nuclear installation as defined under the CNS. Nevertheless, Australia has appropriate precautions in place in relation to radiation emergencies in other countries, including the provision of information to the public and decision makers and the monitoring of imported foodstuffs. For example, during the Fukushima nuclear emergency, ARPANSA provided continuous technical advice to the Australian Government. Using weather prediction data, ARPANSA modelled the movement of airborne radioactive plumes, both potential and real, on a daily basis to ensure that Australians were given adequate advice while in Japan. ARPANSA also worked with Australia's food standards regulator to assess the available information on contamination levels in water, milk and foodstuffs in Japan and to screen foodstuffs imported to Australia from Japan and made the information available publicly.

16.15. Whilst not a nuclear installation as defined under the CNS, Australia does receive visits by foreign nuclear powered warships (NPW) and arrangements have been established including conditions of entry to ensure that the safety of the general public is maintained during visits by such vessels. The Australian Government requires emergency arrangements to be in place at all Australian ports visited by NPW in the unlikely event of a radiological emergency, including a requirement that there be the capability to undertake radiation monitoring of the port environment. The responsibility for the conduct of these procedures is shared between the Australian Government and State/Territory Governments.

Lessons learnt from the Fukushima Daiichi accident

- A preliminary assessment of the implications of the accident for the OPAL reactor identified minor areas for improvement. These were reported after the first periodic safety review between December 2011 and June 2013. An example is the installation of a quick connector to provide emergency water supply to the OPAL reactor.
- ANSTO has since undertaken a formal safety reassessment in accordance with IAEA Safety Report Series No. 80 *Safety Reassessment for Research Reactors* in the light of the accident at the Fukushima Daiichi Nuclear Power Plant. A number of recommendations were made, none of which require immediate corrective action but all of which are opportunities for improvement. Examples include extension of the existing design basis and beyond design basis accident analyses in the SAR to explicitly consider combinations of events and to improve emergency response and management. ANSTO has also reviewed its emergency operating instructions to ensure they cover the additional fault scenarios identified. As of August 2022, the majority of these actions are complete.
- In addition, OPAL and the new ANM facility have been issued licence requirements to assess and report on applicable design extension conditions as result of lessons learnt from the Fukushima Daiichi accident. OPAL completed this in June 2021 in the form of a revision to the SAR and it was concluded no additional safety mitigation measures are required as a result of the analyses.

Article 17 – Siting

Each Contracting Party shall take the appropriate steps to ensure that appropriate procedures are established and implemented:

i. for evaluating all relevant site-related factors likely to affect the safety of a nuclear installation for its projected lifetime;

ii. for evaluating the likely safety impact of a proposed nuclear installation on individuals, society and the environment;

iii. for re-evaluating as necessary all relevant factors referred to in sub-paragraphs (i) and (ii) so as to ensure the continued safety acceptability of the nuclear installation;

17.1. In addition to the general requirements for licensing (see Article 7), the Regulations provide that an application for a siting licence must contain:

- A detailed site evaluation establishing the suitability of the site
- The characteristic of the site, including the extent to which the site may be affected by natural and man-made events
- Any environmental impact statement prepared for the site[45]

17.2. The regulatory guide, *Applying for a Licence for a Nuclear Installation* and related guidance, provides detailed guidance on meeting the requirement of the Regulations and relevant IAEA guidelines including the requirement to provide detailed information on:

- The site's seismology, geology, topography, demography, ecology, hydrology, and meteorology
- The effect of nearby facilities and land usage
- The availability and reliability of off-site services such as electricity, water, transportation, and communication systems
- The feasibility of emergency response

17.3. The ANSTO site was authorised for the construction of OPAL only after ANSTO demonstrated to ARPANSA's satisfaction that the site is suitable for the construction and operation of a reactor while providing adequate protection of the health and safety of people and the environment. ANSTO demonstrated that:

- the site provides acceptable radiological protection during normal operation and in the event of severe accidents, through the evaluation of a Reference Accident
- the natural characteristics of the site and man-induced phenomena can be accommodated safely in the design bases of the reactor

[45] The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* prohibits Commonwealth agencies from undertaking "nuclear actions" which might have a significant impact upon the environment without the consent of the Minister for the Environment, who may require the preparation of an environmental impact statement before approval is granted.

New information for 9th Review Meeting

17.4. During the question and answer process in preparation for the 8th CNS review meeting, a number of questions were asked by the country groups regarding the safety of the OPAL reactor in relation to bush fire. Although the bushfires experienced across many parts of Australia in early 2020 did not reach the site boundary, additional information has been provided as follows: Large bushfires can be expected every 8–12 years at ANSTO with the potential to burn to the site boundary. Site characteristic studies have determined that the intensity of any approaching bushfire would be reduced by the flatness of the site and the sparse vegetation. It was demonstrated that radiant heat on facilities from a typical bushfire would be less than solar heating and could only heat the reactor containment building to a modest level.

17.5. During 2001, the site was close to a large bushfire in the surrounding area, with a severe rating and gale force wind. The ANSTO site was closed and isolated, but no damage occurred to any onsite building or licensed facility. The results of an extreme bushfire are considered to result in a loss of off-site power. This does not present a challenge to the safety of the OPAL reactor (or other facilities at ANSTO) and is within design basis.

17.6. In April 2018, a severe bushfire originating to the north-west of the Lucas Heights site did come close but did not reach the site boundary. Site access was restricted, principally to reduce traffic volume on local roads but both OPAL and radiopharmaceutical production continued unaffected throughout this event. In both cases, ANSTO provided logistic support at the Lucas Heights site to the external emergency responders, including the use of the site hydrant system for refilling water tankers and the ANSTO canteen for food and rest facilities.

17.7. ANSTO maintains bushfire management plans which are stipulated in the plans and arrangements and monitored by ARPANSA. These plans include the requirement for an annual ANSTO site bushfire review and hazard reduction program which is carried out in conjunction with the NSW Rural Fire Services and onsite trained bushfire responders.

iv. for consulting Contracting Parties in the vicinity of a proposed nuclear installation, insofar as they are likely to be affected by that installation and, upon request providing the necessary information to such Contracting Parties, in order to enable them to evaluate and make their own assessment of the likely safety impact on their own territory of the nuclear installation.

17.8. Due to Australia's geographical location and the low power level of the OPAL reactor, its operation has a very low likelihood of affecting any other contracting parties. As stated above, Australia is a party to the *Convention on the Early Notification of a Nuclear Accident* and the *Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency*.

17.9. The Lucas Heights site characteristics continue to be periodically assessed. For example, a site evaluation was conducted and reviewed by ARPANSA when ANSTO applied for a licence to site the ANM facility in 2013.

New information for 9th Review Meeting

17.10. In 2022, when ANSTO applied for a licence to site the Intermediate Level Waste Increase Capacity facility, ARPANSA conducted an assessment against the requirements of IAEA Safety Standards Series – *Site Evaluations for Nuclear Installations* (2019).

See Article 18 for a Summary of how the Vienna Declaration on Nuclear Safety Principle 1 is met

Article 18 – Design and construction

Each Contracting Party shall take the appropriate steps to ensure that:

i. the design and construction of a nuclear installation provides for several reliable levels and methods of protection (defence in depth) against the release of radioactive materials, with a view to preventing the occurrence of accidents and to mitigating their radiological consequences should they occur;

ii. the technologies incorporated in the design and construction of a nuclear installation are proven by experience or qualified by testing or analysis;

iii. the design of a nuclear installation allows for reliable, stable and easily manageable operation, with specific consideration of human factors and the man-machine interface.

18.1. ARPANSA's Regulatory Guide - *Applying for a Licence for a Nuclear Installation*[46] is structured to reflect and guide licence applicants to internationally accepted principles of defence in depth. The guide refers to the need for proven engineering practice and standards in the siting, design, manufacture, construction, installation, and commissioning of a nuclear installation and specifically refers to IAEA Specific Safety Guide, *Safety Assessment for Research Reactors* SSG-20.

18.2. The OPAL licence application was assessed against the ARPANSA Regulatory Assessment Principles (now retired). The principles set the following expectations for human factors at the design stage:

- facilities are designed with systematic consideration of human factors and ergonomic principles to reduce the potential for human error, facilitate correct actions by operators, and reduce operator stress
- safety systems at nuclear reactors are designed to be automatically initiated and to require no immediate operator action within 30 minutes, while permitting operator initiation or action where necessary to ensure or enhance safety
- control and control room layout provide ergonomic disposition of data and controls for actions important to safety, including accident management
- diagnostic aids are provided to speedily resolve questions important to safety and to monitor the status of the reactor
- maintenance and inspection aspects such as access are considered in the design of equipment and systems
- reliable and redundant communications systems are provided for all operations staff

OPAL

18.3. A significant change to design reported at the 7th CNS Review meeting was the addition of a Heavy Water Upgrade System to remove light water from the heavy water in the reflector vessel**.** Although the operation of the reactor was adapted to the modification, the safety effect was demonstrated to be minimal and fully within the safety design capabilities.

[46] See https://www.arpansa.gov.au/regulation-and-licensing/licensing/information-for-licence-holders/regulatory-guides/regulatory-guide-applying-licence-nuclear

Summary of how Australia meets the Vienna Declaration on Nuclear Safety Principle (see Article 17 also)

Australia meets the Vienna Declaration Principle 1 in relation to Research Reactors: *New nuclear power plants are to be designed, sited, and constructed, consistent with the objective of preventing accidents in the commissioning and operation and, should an accident occur, mitigating possible releases of radionuclides causing long-term off site contamination and avoiding early radioactive releases or radioactive releases large enough to require long-term protective measures and actions.*

- The siting of OPAL took into account the elements covered by Principle 1 of the Vienna Declaration, namely, the prevention of accidents during the commissioning and operations phase.
- ARPANSA's Regulatory Guide - *Applying for a Licence for a Nuclear Installation* is structured to reflect internationally accepted principles of defence in depth. The guide states the need for proven engineering practice and standards in the siting, design, manufacture, construction, installation, and commissioning of a reactor.
- ARPANSA's Regulatory Guide - *Applying for a Licence for a Nuclear Installation* sets out international best practice applicable to siting of nuclear installations and is based on IAEA Safety Standards – *Site Evaluations for Nuclear Installation* SSR -1 (2019)
- The siting of OPAL took into account the elements covered by Principle 1 of the Vienna Declaration, namely, the prevention of accidents during the commissioning and operations phase.

Article 19 – Operation

Each Contracting Party shall take the appropriate steps to ensure that:

i. the initial authorization to operate a nuclear installation is based upon an appropriate safety analysis and a commissioning programme demonstrating that the installation, as constructed, is consistent with design and safety requirements;

19.1. The ARPANSA licensing process, laid out in Regulatory Guide Applying for a licence for a nuclear installation and associated guides, requires the applicant to furnish specific information when applying for a licence to operate a nuclear research reactor. These include:

- Arrangements for maintaining criticality safety during loading, moving or storing nuclear fuel and other fissile materials.
- A description of the structures, components, systems and equipment of the reactor as they have been constructed.
- A safety analysis report (SAR) that demonstrates the adequacy of the design, the operating limits and conditions, and arrangements for commissioning and operations.

19.2. In assessing a licence application for a nuclear research reactor, ARPANSA must, under the Act, take into account international best practice in radiation protection and nuclear safety.

ii. operational limits and conditions derived from the safety analysis, tests and operational experience are defined and revised as necessary for identifying safe boundaries for operation;

19.3. The Regulations require an applicant for an operating licence to specify the operational limits and conditions (OLC). Failure to comply with an OLC may be a breach of a condition of licence. ARPANSA continues to monitor that OLCs are derived from the SAR. The licence holder may not make any change to the design or operation of the reactor that would invalidate the assumptions and conditions on which the current SAR is based without prior approval from ARPANSA.

New information for 9th Review Meeting

19.4. Recent amendments to the OPAL OLCs include a change to the requirement for the Primary Coolant Flap Valves to be operable when the reactor is shutdown. This was implemented to enable a short-term rectification to the Riser defect issue, effectively comprising of the PCS flap valves being held manually shut prior to and during the start of the Primary Coolant System pumps. Usually, the PCS pump starts and the PCS Flap valves automatically close. By holding the flap valves shut manually, it avoids the hard automatic closure which creates the pressure pulse that was identified as the root cause of the damage to the OPAL riser. Note that this is an interim measure implemented in advance of a longer-term action to redesign the flap valves.

19.5. The Regulations require licence applications to contain plans and arrangements to ensure the safety of a reactor throughout all stages of its life, including a decommissioning plan. Procedures and instructions for operation, maintenance, inspection and testing of the reactor must form part of these plans and arrangements and are reviewed and approved by ARPANSA before a licence is issued.

19.6. ARPANSA's Regulatory Guide *Plans & Arrangements for managing safety* set expectations on how to demonstrate that procedures for inspection, testing and maintenance are documented and implemented. The licence holder should also demonstrate that inspection, testing and maintenance throughout the life of the facility ensure the availability and reliability of systems at the levels mentioned in the SAR and avoid common cause failures.

19.7. Approved procedures for the operation, maintenance, inspection and testing of OPAL is undertaken in accordance with the Nuclear Operations Business Management System (BMS). The head document of the BMS is the *Nuclear Operations Business Management System Manual,* and below this lies the range of manuals, procedures, instructions, and forms for all operations, maintenance, testing and inspection activities.

iii. operation, maintenance, inspection and testing of a nuclear installation are conducted in accordance with approved procedures;

New information for 9th Review Meeting

19.8. ARPANSA continues to conduct inspections of the OPAL reactor (and other licensed facilities) on a regular basis and in line with a regulatory inspection program based on risk to monitor ongoing compliance with the regulations and licence conditions. Due to the covid pandemic, the inspection program has adopted a more deliberate approach to ensuring that the frequency of inspections are risk informed.

19.9. The latest Periodic Safety and Security Review (PSSR) of OPAL was submitted to ARPANSA in 2021 and is currently under review.

19.10. In response to a suggestion arising from the 2018 IRRS mission, ARPANSA issued a licence condition requiring DECs to be submitted for the OPAL reactor. These were submitted to ARPANSA in the form of a revision to the OPAL Safety Analysis Report in June 2021. No additional mitigations are considered to be required at the OPAL reactor as a result of the DEC analyses and the revision of the SAR has been approved by ARPANSA.

iv. procedures are established for responding to anticipated operational occurrences and to accidents;

19.11. ARPANSA's regulatory guidance, which references latest international best practice, set the expectations on how OPAL should demonstrate that limits of normal operation and anticipated operational occurrences and safety systems settings, including the minimum plant configuration, are derived from safety analyses. The applicant is expected to demonstrate that the operation of the reactor will be constrained by the safety settings.

19.12. The applicant must also demonstrate how, at defence in depth level 4, it is possible for operators to diagnose the status of the reactor and to make accident management arrangements. Accident management arrangements may include maintaining or restoring at least one barrier for the confinement of radioactive material and should be based on the outcomes of the safety analysis. The instrumentation important for monitoring the status of the reactor and to undertake effective accident management arrangements is regularly inspected, tested and maintained.

19.13. As with other plans and arrangements that form part of the application, the measures relating to the procedures for responding to anticipated operational occurrences and accidents become mandatory upon issue of licence.

19.14. The Nuclear Operations BMS has 18 procedures dealing with arrangements for symptom-based incidents/emergencies ranging from minor abnormal occurrences to major events, including reactor transients, water leaks and radiation events such as airborne releases or the failure of fuel cladding. These procedures provide guidance on actions which should be taken within the OPAL operations environment and the circumstances under which a wider ANSTO site response is required.

v. necessary engineering and technical support in all safety-related fields is available throughout the lifetime of a nuclear installation;

19.15. In determining whether to issue a licence to an applicant, the Regulations require ARPANSA to consider whether the applicant has the capacity to comply with the Regulations and any licence condition. ARPANSA's Regulatory Guide *Applying for a licence for a nuclear installation* and associated guides and associated guides set expectations on what an applicant should consider when developing an appropriate management structure and resources. For example, the regulatory guideline on *Plans and Arrangements* provides guidance on how to demonstrate effective control and management of safety under normal operation, incidents, and accident conditions. To demonstrate this, the licence holder should show the availability of all necessary engineering and technical support resources in all safety-related fields.

19.16. ANSTO has a corporate plan which identifies the development and retention of technical and engineering skills in its human resources, which will support safe operation of all its facilities. There is a human resource plan for Nuclear Operations, which is reviewed annually.

19.17. ANSTO has a corporate Strategic Asset Management Plan and facility specific Asset Management Plans applicable to all the ANSTO facilities, including the OPAL reactor. These plans are based on best international practice, specifically ISO 55000: Asset Management, and are intended to maximise the net benefit to public health, society, science and industry from ANSTO's landmark nuclear science and technology assets by safely and sustainably realising value from assets throughout the life of the assets. The Asset Management Plan for the OPAL Reactor is integrated with other business planning processes as part of the OPAL reactor integrated management system and addresses the ageing of the OPAL reactor during its lifetime.

vi. incidents significant to safety are reported in a timely manner by the holder of the relevant licence to the regulatory body;

19.18. The Regulations requires every licence holder to report any significant incident to ARPANSA within 24 hours of its occurrence. Guidance on reporting incident is provided in the ARPANSA website[47], including what constitutes a reportable incident. In addition, a licence holder is required to report the breach of any licence condition to ARPANSA within a reasonable time after the breach is first discovered.

19.19. Under the Nuclear Operations BMS, ANSTO implements a process for identifying, recording, analysing and reporting abnormal occurrences and accidents to ARPANSA within appropriate timeframes.

[47] See https://www.arpansa.gov.au/regulation-and-licensing/licensing/information-for-licence-holders/reporting-an-accident

vii. programmes to collect and analyse operating experience are established, the results obtained and the conclusions drawn are acted upon and that existing mechanisms are used to share important experience with international bodies and with other operating organizations and regulatory bodies;

19.20. ARPANSA's Regulatory Guide *Plans & Arrangements for managing safety* set expectations for an operating organisation to have mechanisms:

- for assessment, verification and feedback, including through utilisation of independent reviews
- to review and audit all activities important to safety and establish an ongoing safety assessment program
- to learn lessons from operating experience and safety research from within the organisation and internationally
- to analyse abnormal occurrences, incidents and safety performance of similar reactors worldwide
- to ensure that results of periodic testing, maintenance and modifications, and emergency preparedness exercises are fed back into safety analyses, design modifications, procedures and quality assurance systems

19.21. ANSTO uses a Governance Risk and Compliance (GRC) system for incident management. The system is used to manage and record all incidents, including abnormal occurrences, accidents and near misses. The system is also used to detail the investigations and analyses related to those events. ANSTO is required to report to ARPANSA within 24 hours all events at (or potentially at) INES Level 2 and above. However, ANSTO also voluntarily sends quarterly reports to ARPANSA on all nuclear safety-related events at INES level 1. Australia supports the IAEA Incident Reporting System for Research Reactors (IRSRR). Programs for corrective actions and learning lessons from incidents are integral to ANSTO's Event Management System.

19.22. ANSTO has, since 2006, taken part in a collaboration agreement with operators of the SAFARI-1 reactor (South Africa) and High Flux Reactor (HFR - The Netherlands). The aim of the agreement is to work together to increase safety and reliability through cooperation as OPAL, SAFARI-1 and HFR are similar reactors. Meetings are held every 12 to 18 months to exchange ideas, experiences and good practices.

viii. the generation of radioactive waste resulting from the operation of a nuclear installation is kept to the minimum practicable for the process concerned, both in activity and in volume, and any necessary treatment and storage of spent fuel and waste directly related to the operation and on the same site as that of the nuclear installation take into consideration conditioning and disposal.

19.23. In relation to the handling, storage, transport, discharge and disposal of any radioactive waste attributable to a nuclear reactor, ARPANSA's guidelines set expectations that:

- suitable provisions, including waste management facilities, must exist for radioactive waste arising from operations
- where radioactive waste is stored prior to being discharged or disposed of, there are to be suitable provisions for its interim containment

- handling facilities for radioactive waste are to be sufficiently flexible to cope with faulty containers, and radioactive waste of non-standard physical or chemical composition
- the form, locations and quantities of any radioactive waste or discharges, are to be specified, monitored and recorded
- where relevant, the safety analysis is to include consideration of radioactive waste and to confirm compliance with the radiation dose limits

19.24. ARPANSA provides guidance on a range of radioactive waste and disposal matters, drawing on IAEA guidance. It includes a requirement for the applicant to provide documentation detailing procedures for the minimisation of the generation of radioactive waste.

Management of spent fuel and radioactive waste

19.25. Detailed procedures for waste management at OPAL are included in the Nuclear Operations BMS. Solid and liquid radioactive wastes are managed across the whole of the ANSTO site by ANSTO's Waste Management Services within the Nuclear Operations and Nuclear Medicine Division.

19.26. OPAL's radioactive waste management plan addresses waste minimisation, segregation and classification of the different waste types and waste streams. Intermediate level solid waste is stored in the OPAL service pool and then transported to France for reprocessing.

19.27. The low-level liquid waste is managed under the existing Waste Management Services arrangements for discharge to the sewer under the trade waste agreement (TWA) with Sydney Water as approved by ARPANSA. The TWA requires that, by the time discharges from Lucas Heights reach the sewage treatment plant, the levels of radioactivity comply with the WHO derived concentration limits for drinking water. OPAL liquid discharges are part of the site general discharges.

Limiting exposure during handling, treatment, transport, storage and transfer or ultimate disposal of spent fuel and radioactive waste

19.28. Limitation of exposure is implemented by ANSTO through guidance documents and work instructions in the WHS management system and the Nuclear Operations BMS. The guidance and instructions comply with all applicable ARPANSA and international codes and standards.

Packaging and containment of radioactive waste

19.29. All solid waste is stored on-site in approved packaging in facilities specifically designed and licensed for this purpose. Prior to discharge, all radioactive liquid waste is stored in appropriate containment vessels and subject to appropriate treatment methods.

19.30. A program is also in place for the solidification of intermediate level radioactive liquid wastes from molybdenum-99 production using ANSTO's patented SYNROC process at the proposed ANSTO SyMo Facility. A siting and construction licence for this facility was issued in 2014.

New information for 9th Review Meeting

19.31. The SyMo facility is currently under construction as of the time of writing this report. The waste from the ANSTO SyMo facility will primarily be from the ANM Facility which was licensed for operations in May 2019. A licence application to operate the SyMo facility is expected in mid-2022.

Discharge reports

19.32. The OPAL operating licence has conditions requiring quarterly and annual reports to ARPANSA on airborne radioactive discharges arising from all of ANSTO's activities. The existing stack monitoring equipment continuously sample gaseous discharges using TC45 cartridges. The filters are measured weekly by ANSTO's Nuclear Assurance Group to provide information on gaseous discharges. Notification and correction levels are set by ARPANSA.

New information for 9th Review Meeting

19.33. Currently, discharges are well within the notification levels set by ARPANSA in the licence.

Management of ultimate disposal or transfer of radioactive wastes

19.34. In accordance with its Radioactive Waste Management Policy, ANSTO stores its radioactive wastes on site until suitable disposal routes are available. There is currently no disposal route for radioactive waste within Australia and this limits the options to on-site storage or return to manufacturer. See Introduction section for more information on the NRWMF.

Spent fuel management strategy

19.35. The Australian Government decided in 1997 that an appropriate management strategy for HIFAR spent fuel was to ship it overseas and store any resulting long-lived intermediate level wastes in Australia in a form suitable for acceptance into a national storage facility. Reprocessed wastes from those shipments were returned to Australia in 2015 and in 2022, to an Interim Waste Store (IWS) at ANSTO's Lucas Heights site to temporarily store these wastes until establishment of a centralised national storage facility. (See Summary section above)

19.36. In 2018, the first shipment of spent fuel assemblies from the OPAL reactor were shipped to the AREVA La Hague facility in France for reprocessing in 4 TN-MTR casks (236 spent fuel assemblies). Residual waste from the reprocessing will be returned to Australia in around 2035-2040 as per the waste from HIFAR.

19.37. The Australian Government continues to seek an appropriate site for Australia's National Radioactive Waste Management Facility (NRWMF) in order to provide a single purpose built facility to permanently store low level waste and temporarily store intermediate level waste. See Summary of this report for more information.

Action taken from lessons learnt from the Fukushima Daiichi accident

19.38. ANSTO undertook self-assessment against the lessons learnt from Fukushima accident. The actions arising from the self-assessment, which coincided with the OPAL PSR, were not significant for safety and did not require immediate action.

19.39. The self-assessment was revised in 2014 in line with the IAEA Safety Reports Series No. 80 *Guidance on Safety Reassessment for Research Reactors in the Light of Accident at the Fukushima Daiichi NPP*. This review is complete and at the time of this report, the majority of the actions are completed although it was concluded none were significant for safety.

Glossary and acronyms

Term	Definition
ABMS	ANSTO Business Management System
ANM	ANSTO Nuclear Medicine
ANSTO	Australian Nuclear Science and Technology Organisation
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
BMS	Business Management System
CEO	Chief Executive Officer
CNS	Convention on Nuclear Safety
DISR	Department of Industry, Science, and Resources
FSAR	Final Safety Analysis Report
GRS	ANSTO's Governance Risk and Compliance system
HF	Human Factors
HIFAR	High Flux Australian Reactor
IAEA	International Atomic Energy Agency
ILSW	Intermediate Level Solid Waste
ILWCI	Intermediate Level Waste Capacity Increase Facility
INES	International Nuclear and Radiological Event Scale
IRRS	Integrated Regulatory Review Service
IRSRR	Incident Reporting System for Research Reactors
ISO	International Organization for Standardization
IWS	Interim Waste Store
LEU	Low Enriched Uranium
Licence	A legal authorisation issued to an applicant by ARPANSA to site, construct, operate, decommission, dispose of or abandon a nuclear research reactor or other radiation facilities or sources.
LLW	Low Level Waste

MW	Megawatt
NRWMF	National Radioactive Waste Management Facility
Nuclear installation	'Nuclear installation' is defined in the CNS as any land-based civil nuclear power plant under the jurisdiction of the Contracting Party including such storage, handling and treatment facilities for radioactive materials as are on the same site and are directly related to the operation of the nuclear power plant. Such a plant ceases to be a nuclear installation when all nuclear fuel elements have been removed permanently from the reactor core and have been stored safely in accordance with approved procedures, and a decommissioning program has been agreed by the regulatory body. Australia has no nuclear power plant, and none are planned. This report mainly addresses Australia's only operating nuclear research reactor.
OLC	Operational Limits and Conditions
OPAL	Open Pool Australia Light-water reactor
POC	Performance Objectives and Criteria
PSR	Periodic Safety Review
PSAR	Preliminary Safety Analysis Report
PSSR	Periodic Safety and Security Review
QA	Quality Assurance
QMS	Quality Management System
RAC	ANSTO's Reactor Assessment Committee
Regulatory body	'Regulatory body' is defined in the CNS as anybody or bodies given the legal authority by the Contracting Party to grant licences and to regulate the siting, design, construction, commissioning, operation or decommissioning of nuclear installations
ROEMS	ANSTO's Reactor Operations Event Management System
RPA	Radiation Protection Adviser
RSB	ARPANSA's Regulatory Services Branch
SAR	Safety Analysis Report
SLA	Service Level Agreement
SPI	Safety Performance Indicator

SYNROC	SYNROC (synthetic-rock) is an ANSTO-developed technology to transform the intermediate level liquid wastes generated from the Mo-99 production process into a stable immobilised glass ceramic form. The technology greatly reduces the waste volume and converts it into a long-term stable form.
SyMo Facility	A facility under construction by ANSTO to apply Synroc technology for immobilisation of waste from ANSTO's Mo-99 production processes
the Act	*Australian Radiation Protection and Nuclear Safety Act 1998*
the Regulations	Australian Radiation Protection and Nuclear Safety Regulations 2018
TWA	Trade Waste Agreement
US NRC	US Nuclear Regulatory Commission
WHO	World Health Organization
WHSE	Work Health, Safety and Environment