Commonwealth of Australia

Convention on Nuclear Safety

Australian National Report

August 2013

Australian Government

Australian Radiation Protection and Nuclear Safety Agency

Copyright Notice

Table of Contents

Introduction

National nuclear programs

i. Australia ratified the Convention on Nuclear Safety in December 1996 but does not have any "nuclear installations" as defined in the Convention. Indeed Commonwealth, State and Territory legislation currently prohibits the construction or operation of such installations. For example, Section 10 of the *Australian Radiation Protection and Nuclear Safety Act 1998* (ARPANS Act) prohibits the Chief Executive Officer (CEO) of the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) from issuing a licence in respect of a nuclear fuel fabrication plant, a nuclear power plant, an enrichment plant or a reprocessing plant. For this report, Australia finds it useful to refer to its research reactors in describing how its obligations under the Treaty are met.

ii. ARPANSA has been designated by the Australian Government to take primary responsibility for the implementation of Australia's obligations under the Convention, working in consultation with other agencies. This document is publicly available to provide a degree of transparency and similarity of approach.

iii. The Convention obliges Contracting Parties to report to periodic Review Meetings on the implementation of their obligations. This Report also provides an opportunity for Australia to:

- evaluate the effectiveness of its regulatory framework by assessing the safety standards of Australia's research reactors, based on practices promoted by the Convention;
- promote and contribute to nuclear safety worldwide through adoption of best-practices to nuclear safety;
- promote transparency of nuclear operations within Australia and other countries; and
- better understand the Convention obligations and facilitate Australia's review of the National Reports of other Contracting Parties.

iv. The Australian Government's Australian Nuclear Science and Technology Organisation (ANSTO) is the only organisation in Australia that operates nuclear reactors. As such, this report only addresses research reactors operated by ANSTO at the Lucas Heights Science and Technology Centre in Sydney's south in the State of New South Wales.

v. In February 2004, ARPANSA varied the licence issued to ANSTO for the High Flux Australian Reactor (HIFAR) requiring ANSTO to, as soon as practicable, make a submission to ARPANSA seeking approval to operate HIFAR beyond December 2006, should ANSTO propose to do so. ANSTO made such a submission in October 2006, and ARPANSA agreed later that month that HIFAR could operate up until the end of February 2007. HIFAR shut down on 30 January 2007 after 49 years of operation. ARPANSA has subsequently issued ANSTO with a licence to possess and control HIFAR for the purposes of care and maintenance prior to final decommissioning. It is anticipated that ANSTO will apply for a decommissioning licence once arrangements

for the National Radioactive Waste Management Facility have been finalised. Detailed specifications of HIFAR were provided in Annex 1 to the 2004 national report[1].

vi. The only nuclear reactor that ANSTO currently operates is the Open Pool Australia Light-water (OPAL) reactor. OPAL is a high flux, thermal, multi-purpose pool type reactor. A licence authorising the siting of OPAL was issued by ARPANSA in September 1999 (see Article 17). A licence authorising construction of OPAL was issued by ARPANSA in April 2002 (see Article 18). Finally, a licence authorising Operation of OPAL was issued by ARPANSA in July 2006 (see Article 19).

vii. OPAL achieved its full power of 20 Megawatts in November 2006. To meet obligations in relation to non-proliferation, 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 system surrounding the core. OPAL is housed in a containment building, which also includes 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 thick-walled reinforced high density concrete construction. The reactor core sits at the bottom of the pool and is surrounded by a zircaloy reflector vessel which 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 spent fuel. A reactor beam hall within the reactor building and a neutron guide hall constructed adjacent to the reactor building contain experimental stations and instrumentation for neutron beam research purposes.

viii. 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.

Summary of significant safety issues since the last report

ix. Several events have occurred since the last national report in September 2010[2], which are explained in detail in the main body of the report. These matters are:

- Actions taken in response to the events of the Great Eastern Japan Earthquake and Tsunami in March 2011.
- ARPANSA hosted an IAEA Integrated Regulatory Review Service (IRRS) follow-up mission from 8 to 15 November 2011.
- Review of the currency and effectiveness of ARPANSA's enabling legislation, the ARPANS Act.

x. This report is a self-evaluation of Australia's compliance with the obligations of the Convention. The report draws on information contained in Australia's last national report[3]. The reporting format is based on the Articles in the Convention and is in

1 http://www.arpansa.gov.au/pubs/regulatory/conventions/cns_rpt2.pdf

2 http://www.arpansa.gov.au/pubs/regulatory/conventions/cns_rpt2007.pdf

3 http://www.arpansa.gov.au/pubs/regulatory/conventions/cns_rpt2011.pdf

accordance with IAEA guidelines[4]. The paragraph numbering corresponds to the Article numbers of the Convention. The report under each Article of the Convention addresses , to the extent necessary, addresses formal compliance and factual compliance in separate sections.

[4] Including the IAEA Information Circular, INFCIRC/572/Rev.3, published 28 September 2009 and the *Synopsis of the relevant IAEA safety requirement statements reflecting the issues addressed by Articles 6 to 19 of the Convention on Nuclear Safety* published by the IAEA secretariat.

Articles 1 to 5

These Articles cover the following:

- Article 1 – Objectives
- Article 2 – Definitions
- Article 3 – Scope of Application
- Article 4 – Implementing Measures
- Article 5 – Reporting

No report is required in respect of these Articles[5].

[5] IAEA Information Circular, INFCIRC/572/Rev.4, paragraph 5.

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.

List of existing nuclear installations at the time the Convention entered into force for Australia

6.1. The only research reactor owned by ANSTO at the time of entry into force of the Convention was HIFAR. This was a 10 MW(t) heavy water, tank type, materials testing reactor, which operated between 1958 and 2007 at Lucas Heights in New South Wales (in Sydney's south) and is permanently shut down. On 15 September 2008, ARPANSA issued a licence to ANSTO authorising it to possess or control HIFAR in a shutdown state with the fuel removed from the reactor. In the longer term, it is anticipated that ANSTO will apply for a further licence to decommission the reactor.

List of existing nuclear installations where significant corrective actions have been found to be necessary

6.2. Nothing to report.

Planned nuclear installations

6.3. There are no planned nuclear installations in Australia.

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 (ARPANS) Act 1998

7.1. The Commonwealth Parliament passed the ARPANS Act in 1998. The Act applies only to Australian Government entities, their contractors, or persons in a prescribed Commonwealth place. It provides that, under certain conditions, ARPANSA may license an entity to undertake activities in relation to radioactive material, nuclear installations (including research reactors) and prescribed radiation facilities. ARPANSA cannot, however, license nuclear power reactors.

7.2. Australia is a federation of six States and two self-governing Territories. Constitutional responsibility for radiation health and safety in each State and Territory rests with the respective State/Territory government, unless the activity is being carried on by an Australian Government agency. State and Territory legislation currently prohibits the construction or operation of nuclear installations, including research reactors, although the relevant NSW legislation contains an exception in respect of ANSTO.

7.3. Under the *Australian Nuclear Science and Technology Organisation Act 1987* (ANSTO Act), ANSTO is not subject to State legislation relating to:

- the use or proposed use of land or premises;
- radioactive materials or dangerous goods; or
- licensing.

Being a licence holder, ARPANSA regulates ANSTO's activities in respect of its research reactors.

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 1999 and other Regulatory Guidance documents

7.4. The Australian Radiation Protection and Nuclear Safety Regulations 1999 (the ARPANS Regulations) were made under the ARPANS Act. The ARPANS Act and Regulations constitute the first tier documents in the framework under which ARPANSA regulates the safety of ANSTO's research reactors.

7.5. The ARPANS Act and Regulations enable ARPANSA to produce guidance documents and principles for its regulatory functions. These documents are used by ARPANSA in evaluating a licence application and include:

- Regulatory Assessment Principles for Controlled Facilities (October 2001);
- Regulatory Guide: Applying for a Facility Licence for a Nuclear Installation (version 5, August 2012);
- Holistic Safety Guidelines (version 1, November 2012); and

- Regulatory Guide: Plans and Arrangements for Managing Safety (version 4, January 2013).

7.6. Publication of the above guidance documents on ARPANSA's website[6] ensures transparency (from the point of view of applicants and the general public) and

ii. a system of licensing with regard to nuclear installations and the prohibition of the operation of a nuclear installation without a licence:

predictability of the licensing process.

Licensing

7.7. Part 5 of the ARPANS Act deals with the regulation of radioactive material, radiation apparatus and facilities (including nuclear reactors). This Part prohibits the siting, construction, operation, possession and control, or decommissioning of nuclear reactors and other prescribed radiation facilities, without a licence issued by ARPANSA. This Part also prohibits dealing with other sources of radiation without a licence issued by ARPANSA. ARPANSA can impose conditions on a licence and the licence holder must comply with such conditions.

7.8. The OPAL operating licence was originally issued in July 2006 and was re-issued in February 2013 as part of a process of rationalising all ANSTO licences. It has generic conditions as set out in the ARPANS Act and Regulations and also has sixteen additional conditions relating specifically to OPAL. These include the requirement that ANSTO undertake a periodic safety review within two years of commencing routine operation and thereafter at intervals to be agreed to by the CEO of ARPANSA. Any significant modification to the underlying plans and arrangements for managing safety requires the prior approval of ARPANSA. The licence is framed on the basis that responsibility for ensuring the safety of a nuclear reactor rests with the licence holder.

7.9. ARPANSA is developing a guide for the drafting of a PSR that builds on the IAEA Safety Guide; Periodic Safety Review of Nuclear Power Plants, NS-G-2.10, as well as the IAEA Specific Safety Guide; Ageing Management for Research Reactors, SSG-10. The guide will incorporate lessons learned from the PSR that is expected to be finalised in 2014.

7.10. The PSR includes an assessment of OPAL's siting, design and operation. A preliminary PSR report was submitted to ARPANSA in December 2011. In April 2013, ARPANSA and ANSTO agreed on a list of actions to be undertaken to improve and finalise the PSR, including some further work on the analysis of the preliminary PSR findings and recommendations undertaken as a 'global assessment'. This further work was addressed in a PSR Supplement that was submitted to ARPANSA in June 2013. In addition to the PSR report, following the accident at Fukushima, ANSTO submitted to ARPANSA a preliminary assessment of the implications of the Fukushima accident for the OPAL Safety Case and the lessons learned. Further implications of lessons from the accident at Fukushima to the OPAL safety case will be considered under a separate Complementary Safety Assessment which will draw on and supplement the existing PSR assessment. In the

[6] www.arpansa.gov.au/Regulation/guides.cfm;

preliminary assessment, ANSTO has analysed potential safety issues for the OPAL reactor. Consideration has included loss of station power for periods in excess of 10 days. It has also revisited the impact of external events on OPAL, including spent fuel cooling and containment venting. The external events considered included bushfires, aircraft impact, transportation accidents, hydrogen explosions and military activities.

7.11. ARPANSA is currently evaluating the OPAL first Periodic Safety Review which includes the post-Fukushima action plan. ARPANSA has also been collaborating with ANSTO and local and national emergency organisations to test emergency preparedness in response to disaster events involving the OPAL reactor.

7.12. The Complementary Safety Assessment will be prepared in accordance with IAEA Safety Series Report No.80 and will be informed by the forthcoming IAEA Nuclear Safety Action Plan. In order to approve the overall PSR, ARPANSA will need to be satisfied with the revised Safety Analysis Report, which ANSTO expects to have completed by December 2013.

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

Inspection

7.13. Section 35(3) of the ARPANS Act requires licence holders to allow persons authorised by ARPANSA to enter and inspect facilities at reasonable times. ARPANSA can appoint inspectors and authorise them to undertake searches and exercise a range of powers to establish whether the licence holder is complying with the Act and Regulations, and with conditions of licence as issued by ARPANSA.

7.14. Inspectors are authorised to enter the premises of a nuclear reactor and exercise a range of powers, including issuing directions to the licence holder, if they have reasonable grounds for suspecting that the Act or the Regulations have not been complied with in relation to that nuclear reactor *and* it is necessary to exercise those powers to avoid an imminent risk of death, serious illness, serious injury or serious damage to the environment.

7.15. Internal guidance is given to inspectors on exercising their powers, including during planned announced and unannounced inspections, and in the event of an incident or accident. ARPANSA has developed a strategic, risk-based approach to its inspection program which is designed to emphasise the safety assurance role that a regulator plays. The full suite of documents related to the ARPANSA approach to compliance and the inspection program may be found on the ARPANSA website.

Assessment

7.16. The first tier documents for regulatory assessment remain the ARPANS Act and Regulations. The second tier document for regulatory assessment controlled facilities (including research reactors) is the Regulatory Assessment Principles (RAPs). The RAPs draw extensively from international publications and experience, especially those of the International Nuclear Safety Advisory Group (INSAG) and the IAEA.

7.17. The Principles, together with other guidelines and criteria, are publicly available documents that outline the criteria that ARPANSA uses for assessing plans and arrangements for managing safety in an application for a licence. These documents ensure the thoroughness and transparency of the licence assessment process.

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

Enforcement

7.18. Where it is identified that a licence holder may not be complying with the ARPANS Act or Regulations or there is a hazardous situation, ARPANSA can direct a licence holder to take any necessary steps to rectify the problem within a certain specified time frame. If the person does not act accordingly, ARPANSA may arrange for steps to rectify the problem to be taken. ARPANSA has the power to recover the costs of such steps.

7.19. An injunction (court order) may be granted by the Federal Court if a person is engaging or is proposing to engage in any conduct that is or would be an offence against the Act or Regulations.

7.20. ARPANSA may, when required, impose additional licence conditions, remove or vary conditions or extend or reduce the authority granted by a licence. ARPANSA may also suspend or cancel a licence if, among other things, the licence holder (or anyone covered by the licence) has breached a condition, committed an offence against the Act or the Regulations, or if the licence was obtained improperly. In the case of the revised OPAL operating licence issued in February 2013, sixteen additional licence conditions were imposed. These related to:

- maintaining an up to date inventory of controlled material held in the reactor in a form acceptable to the CEO of ARPANSA;
- quarterly reporting to ARPANSA covering a range of identified areas;
- training of operating and maintenance staff (including contractors);
- adequate work practices, including ensuring appropriate work procedures, records and practices are documented, maintained, subject to review and approval and followed;
- compliance with relevant standards and codes of practices;
- safety culture and safety performance indicators to support continuous improvement;
- compliance with the ANSTO site radioactive discharge authorisations and advising the CEO of ARPANSA of discharges in excess of the agreed notification levels;
- periodic safety review within two years of the completion of commissioning and thereafter at intervals agreed to by the CEO of ARPANSA;
- periodic review of physical protection within two years of the completion of commissioning and thereafter at intervals agreed with the CEO of ARPANSA, taking into account developments in the security environment;

- criticality safety and the provision of appropriate criticality safety certificates where nuclear materials are handled; and
- compliance with the limits and conditions specified in the Safety Analysis Report.

7.21. The ARPANS Act sets out the offences that may be committed by any action or omission, and the penalties that an offender could be liable for. The ARPANS Act provides that the Criminal Code applies to all offences against that Act.

7.22. Certain enforcement and licensing decisions taken by ARPANSA are subject to the review of the relevant minister (currently the Parliamentary Secretary to the Minister for Health and Ageing). The minister's decision, in turn, is subject to review by the Administrative Appeals Tribunal. Decisions of ARPANSA are also reviewable on a question of law by the Federal Court of Australia under the Administrative Decisions (Judicial Review) Act.

7.23. ARPANSA's portfolio Department, the Department of Health and Ageing, is facilitating a legislative review of the ARPANS Act. It is the general practice within the Australian Government that legislation is reviewed every ten years in order to ensure that the policy objectives set out in the Act and the means of achieving them remain appropriate, are at the forefront of regulation and consistent with similar Commonwealth legislation. The review is taking into account ARPANSA's roles in emergency preparedness and response and security of radioactive material, both of which have emerged as substantial policy issues since the Act commenced in 1998. The review is also considering whether compliance and enforcement provisions in the Act are adequate. The review of the Act is not expected to be finalised until early to mid-2014.

Article 8 – Regulatory Body

1. Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 7, and provided with adequate authority, competence and financial and human resources to fulfil its assigned responsibilities.

Australian Radiation Protection and Nuclear Safety Agency

8.1. ARPANSA was created in 1998 to be the regulatory body for all Australian Government entities (see paragraphs 7.1 and 7.2 above). The ARPANS Act:

- establishes the CEO of ARPANSA;
- prescribes the functions and powers of the CEO of ARPANSA; and
- sets up ARPANSA as an organisation that assists the CEO of ARPANSA to undertake his or her functions and exercise his or her powers.

8.2. The CEO of ARPANSA's authority is clearly enunciated in the ARPANS Act. The CEO of ARPANSA is the decision maker and has the power to issue licences, impose conditions on the licences, vary, amend or add conditions, authorise inspections of premises, monitor compliance and make enforcement decisions (see paragraphs 7.7 to 7.21 above).

8.3. The functions of the CEO of ARPANSA[7] include:

- promotion of national uniformity of radiation protection and nuclear safety policies and practices across the jurisdictions of the Commonwealth of Australia, the States and Territories;
- provision of advice on radiation protection and nuclear safety;
- undertaking research and providing services in relation to radiation protection, nuclear safety and medical exposures to radiation;
- monitoring the compliance of licence holders with the provisions of the ARPANS Act and Regulations and conditions imposed on licence holders; and
- recommending prosecutions for the breach of these requirements.

8.4. ARPANSA currently has 140 staff comprised of scientists, engineers, lawyers, policy professionals and administrative personnel. The ARPANSA Regulatory Services Branch has 28 staff.

8.5. ARPANSA's financial needs are met through budget appropriation services revenue and licence fees and charges. In 2013/2014, approximately 52% of ARPANSA's annual operating costs of A$25.811 million came from budget appropriation.

8.6. The Regulatory Services Branch of ARPANSA has primary responsibility for regulating ANSTO. The structure and organisation of ARPANSA are shown below.

[7] Prescribed in Section 15 of the ARPANS Act.

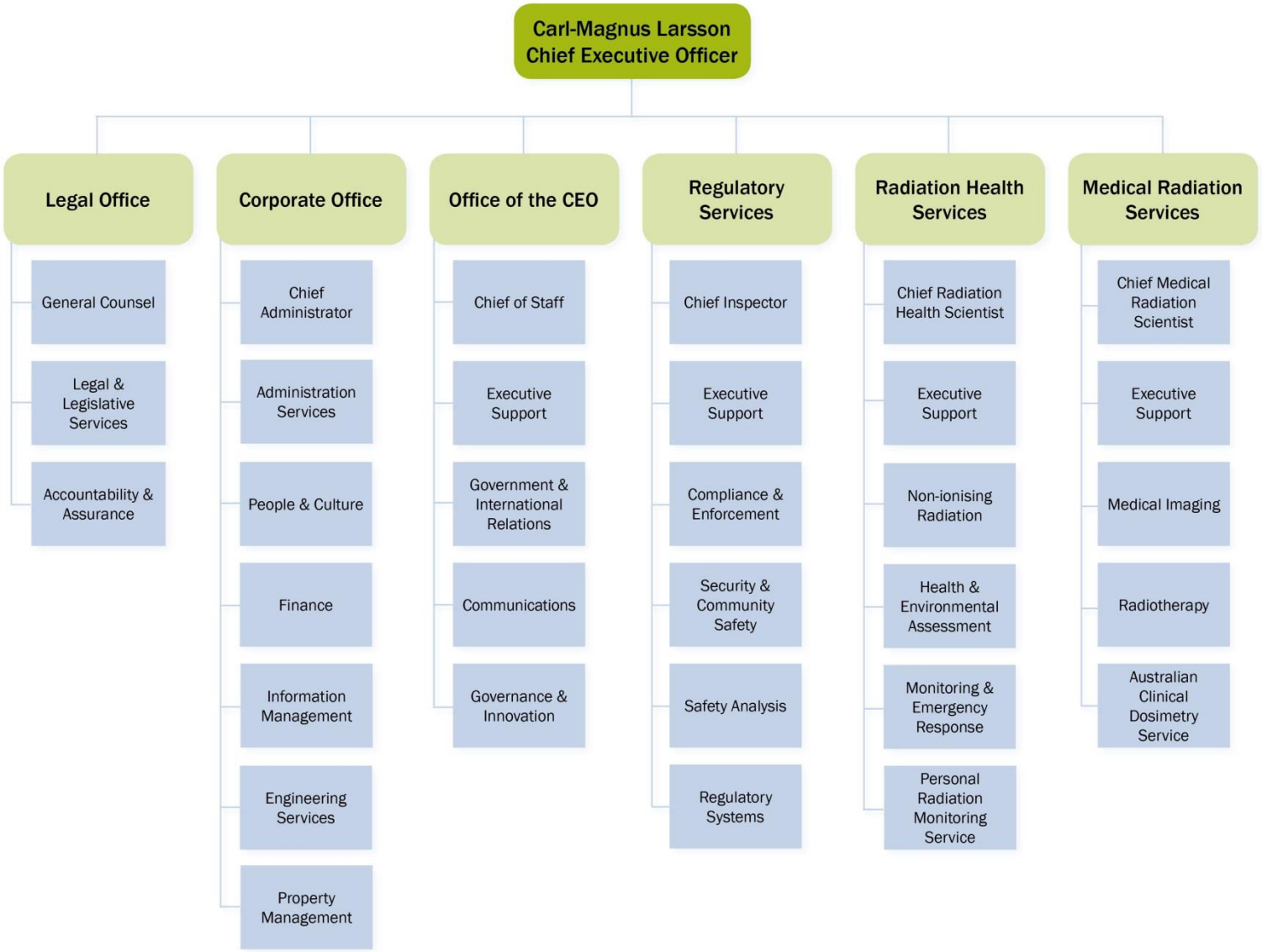

Figure 1: Structure and organisation of ARPANSA

8.7. ARPANSA may also engage external contractors and consultants to provide advice relating to its functions. This has occurred in the past for the particular aspects relating to the licensing of OPAL where the expertise was not held within ARPANSA.

8.8. The Regulatory Services Branch is led by the Chief Inspector. The Branch's functions include:

- assessing applications for licences against accepted standards for radiation protection and nuclear safety;
- making recommendations to the CEO of ARPANSA and the Chief Inspector, on licensing matters;
- monitoring compliance including undertaking inspections of licensed activities to confirm compliance with legislative requirements;
- investigating incidents;
- taking any enforcement actions required that are necessary to ensure regulatory compliance in radiation protection and nuclear safety, safety of people and protection of the environment;
- development of national codes and standards to promote national uniformity;
- management of statutory advisory committees; and
- formulating regulatory guidance documents for consideration and publishing.

8.9. The regulatory framework applies to a very wide range of nuclear and radiation facilities and radiation sources[8] including:

- nuclear reactors, large radioisotope production facilities and large radioactive waste facilities operated by ANSTO;
- prescribed radiation facilities, such as particle accelerators and irradiators incorporating large amounts of radioactive material;
- radioactive materials as sealed and unsealed sources;
- ionising radiation apparatus; and
- prescribed non-ionising radiation apparatus such as powerful UV equipment and lasers.

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.

8.10. ARPANSA is enabled by and operates under the ARPANS Act, while ANSTO is enabled by and operates under the ANSTO Act. ARPANSA is part of the Australian Government's Health and Ageing portfolio and reports to the Parliamentary Secretary for Health and Ageing. ANSTO is an independent statutory authority and reports to the Minister for Industry, Innovation, Science and Research. The independence of ARPANSA is further assured through several mechanisms established under the Act. These include:

[8] For further information see http://www.arpansa.gov.au/Regulation/Applicants/index.cfm

- a provision in the ARPANS Act that requires the CEO to take all reasonable steps to ensure that there is no conflict of interest between his regulatory role and any other roles as a service provider;
- reporting mechanisms requiring ARPANSA to report quarterly and annually to the Commonwealth Parliament through the Parliamentary Secretary for Health and Ageing;
- The CEO of ARPANSA may at any time cause a report about matters relating to his or her functions to be tabled in either House of the Parliament. Where a serious accident or malfunction occurs at a nuclear reactor, ARPANSA must table a report about the incident in each House no later than three sitting days after the incident. There has been no cause to invoke this provision;
- the requirement for the Parliamentary Secretary for Health and Ageing to table in Parliament any direction that he or she makes to ARPANSA; and
- the establishment of the Radiation Health and Safety Advisory Council, the Nuclear Safety Committee and the Radiation Health Committee, comprising independent members who have expertise relevant to, or knowledge of, radiation protection or nuclear safety to advise ARPANSA on relevant matters.

IAEA Integrated Regulatory Review Service Follow-up Mission

8.11. At the request of the Australian Government, an international team of eleven experts in radiation and nuclear safety visited the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), from 25 June to 6 July 2007 to conduct a full scope Integrated Regulatory Review Service (IRRS) mission[9]. The purpose of the mission was to undertake a peer review of ARPANSA's regulatory framework and its effectiveness against IAEA Safety Standards and to exchange information and experience on safety regulation.

8.12. In June 2010, the Australian Government requested a follow-up IRRS mission. The scope of the IRRS follow-up mission covered the review of implementation of the 2007 recommendations and suggestions, as well as the review of the IRRS module on patient protection. The follow–up mission also included policy based discussions on emergency preparedness and response, radioactive waste management and patient protection in the context of national uniformity.

8.13. The follow-up was conducted from 8 to 15 November 2011. The review team comprised five senior regulators from five Member States, three staff members from the IAEA and an IAEA administrative assistant. ARPANSA had submitted to the IAEA, in advance of the mission, an information package including a status report on actions to implement the 2007 recommendations and suggestions. The IRRS activities took place at the ARPANSA offices in Sydney and Melbourne.

8.14. The team concluded that the recommendations and suggestions from the 2007 IRRS mission had been taken into account by ARPANSA[10]. Significant progress has been made in several areas and many improvements had been carried out. While a comprehensive and coordinated action plan to address the 2007 recommendations and suggestions had not been developed, the team recognised that there were a

[9] http://www.arpansa.gov.au/pubs/regulatory/IRRS/2007IRRSreport.pdf

[10] http://www.arpansa.gov.au/pubs/regulatory/IRRS/IRRS-AULReportMarch2012.pdf

number of planning processes in place which collectively addressed many of the recommendations and suggestions. These included the business plans and the quality management system plans.

8.15. During the follow-up mission, the team determined that seven of the recommendations and 26 of the suggestions made by the 2007 IRRS mission had been effectively addressed and therefore could be considered closed. For the remaining recommendations and suggestions, ARPANSA had made progress but had not completed all the necessary actions and consequently the findings were left open. The IRRS team encouraged ARPANSA to work towards full implementation.

8.16. During the 2011 follow-up mission, the IRRS team made note of the following strengths:

- the response to the TEPCO Fukushima Dai-ichi accident;
- the high level of in-house technical expertise in radiation safety;
- a recognition of the need and willingness to reorganise ARPANSA;
- the timely development of the national sealed source register in good coordination with other relevant organizations; and
- the creation of the Australian Clinical Dosimetry Service and the national diagnostic reference level database.

8.17. The IRRS team also identified additional areas to further strengthen ARPANSA's regulatory infrastructure and to support the observed improvement activities.

- making full use of the opportunity to revise the ARPANS Act in 2012;
- completing implementation of the reorganisation of ARPANSA;

8.18. Since the follow-up IRRS mission, ARPANSA has developed an action plan for implementing the recommendations and suggestions made in the 2007 and 2011 IRRS missions[11].

[11] http://www.arpansa.gov.au/pubs/regulatory/IRRS/IRRSactionplan.pdf

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.

Formal Compliance

9.1. The ARPANS Act does not explicitly state that the operator has primary responsibility for safety.

9.2. The licence conditions in the ARPANS Act and Regulations ensure that the primary responsibility for the safety of a nuclear reactor rests with the licence holder. These conditions require the licence holder to:

- prevent breaches of the conditions;
- investigate and rectify any breaches;
- prevent, control and minimise accidents;
- report incidents and accidents to ARPANSA;
- review and update plans and arrangements for management of safety on an annual basis; and
- comply with their plans and arrangements for managing safety submitted as part of the licence application.

9.3. In addition to formal inspections and assessments, ARPANSA may also act on reports made by the licence holders' staff on safety breaches or unsafe practices for all licence holders. The Regulations require that all accidents be reported to ARPANSA within 24 hours of their occurrence (Regulation 46). Guidance published on the ARPANSA website[12] defines an accident for the purposes of the Regulations as including any event that is rated at, or has the potential to be rated at, Level 2 or above on the International Nuclear Event Scale[13] (INES).

Factual Compliance

9.4. ANSTO's responsibility for the safety at OPAL is defined under the ANSTO Work Health, Safety and Environment (WHSE) Policy and the supporting safety management system which is accredited to ISO 9001 and 14001. This system establishes responsibilities for health, safety and environmental protection. To support the safety management system, ANSTO has safety assessment, approval and audit systems overseen by internal committees that are independent of line management responsible for operation. The overarching safety body, the Safety Assurance Committee (SAC), has external membership in addition to the ANSTO staff membership. ANSTO's safety performance is reviewed regularly by its Executive and Board.

9.5. Inspectors from ARPANSA's Operations Services Branch regularly monitor and review the operations of ANSTO's nuclear reactors to ensure that the licence holder meets its responsibility for safety as required by the legislation, ARPANSA's

[12] http://www.arpansa.gov.au/regulation/licenceholders/incident.cfm

[13] http://www-ns.iaea.org/tech-areas/emergency/ines.htm

regulatory guidelines and the conditions attached to the relevant licences. In order to monitor compliance, ARPANSA inspectors undertake planned announced and unannounced inspections of nuclear reactors. The schedule of inspections is developed, reviewed and implemented using a risk-based approach.

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.

Formal Compliance

10.1. ARPANSA's RAPs and associated Regulatory Guidelines (see paragraph 7.5 above) require an applicant for a licence to demonstrate in their application a commitment to a strong safety culture through the articulation, at the highest level, of a safety policy that stresses the importance of a commitment to safety by the operating organisation (Principle 1). The Regulatory Guide: Plans and Arrangements for Managing Safety, against which licence applications are assessed, state:

> *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.*

10.2. Once a licence is issued, the Regulations require the licence holder to:

- comply with plans and arrangements for managing safety that formed part of the application for a licence[14]; and
- subsequent to the issue of a licence, review and update these plans and arrangements every 12 months thereafter.

Specific guidance is given on the plans and arrangements for:

- managing effective control
- safety management
- radiation protection
- radioactive waste management
- ultimate disposal and transport
- security, and
- emergency preparedness.

Factual Compliance

ARPANSA Review of OPAL

10.3. The licence issued to ANSTO for the operation of OPAL was based on ARPANSA's consideration of international best practice in radiation protection and nuclear safety. In order to achieve this, ANSTO was required to demonstrate to ARPANSA that:

- safety policies and strategies were in place to achieve ARPANSA's requirements outlined in the Regulations;

[14] Once the plans and arrangements have been submitted as part of a licence application, and the licence is issued subject to assessment of those plans and arrangements, they then become mandatory requirements.

- primary responsibility for safety through the use of associated guidance material would be maintained;
- a positive safety culture was promoted throughout the organisation;
- a robust safety analysis was employed; and
- the principles of defence in depth were implemented.

10.4. The operating licence issued to OPAL requires ANSTO to implement a program to support continuous improvement of the safety culture of the operating organisation, including regular surveys by an independent organisation of the safety climates within the operating organisation. The licence also requires ANSTO to maintain a set of safety performance indicators to be agreed with ARPANSA.

ANSTO Safety Policies

10.5. At the top level of its business management system, ANSTO has a WHSE Policy, which provides the framework to manage ANSTO's activities with due regard for work health, safety and the environment. The policy, issued by the Board, states that ANSTO will undertake its activities 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; and
- protects the environment.

10.6. In addition to the WHSE policy, ANSTO has several other policies to support a positive safety culture including risk management and quality policies.

ANSTO Safety Culture and Commitments

10.7. ANSTO implements its safety policy and strategies through a WHS Management System which 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 health, safety and environment policy and strategies, and line management accountable for safety.

10.8. Safety assurance at ANSTO is achieved by several mechanisms, including the requirement for prior review and approvals by the SAC and the Reactor Assessment Committee (RAC) of all proposed changes or modifications to all licensed facilities that have the potential for significant implications for safety. These functions of these committees are as follows:

- SAC reports and provides assurance to the CEO of ANSTO that activities undertaken at ANSTO are undertaken in accordance with safety policies and regulatory requirements by assessing the safety of activities at all of ANSTO's sites that have significant potential to harm humans or the environment. Before approving a new proposal (or continuation of an activity), SAC can recommend changes to monitoring and control systems to verify operations are safe, and ensure safety standards are met. SAC also reviews ANSTO safety indicators to identify any emerging trends requiring further analysis. One of the members of this committee is from outside of ANSTO, and it has the

power to require extra advisors as required. SAC undertakes scheduled audits of compliance against approved operating processes for all potentially hazardous ANSTO activities.

- RAC acts as a subcommittee of SAC in that it reviews and assesses the nuclear safety aspects of ANSTO activities, specifically OPAL activities. The RAC provides reports and recommendations to the SAC in relation to such activities. It may also provide reports or advice to the reactor management on proposed modifications to OPAL and on specific safety events and safety issues for OPAL when requested.

10.9. Additional assurance of safety is achieved through routine inspections by staff independent of the function being assessed and the review of safety performance by senior management and the ANSTO Board.

10.10. In agreement with ARPANSA, ANSTO has set several Safety Performance Indicators (SPIs) for OPAL. These SPIs measure and set objective targets for 22 safety related functions of plant operation and organisational performance and are divided into four groups:

- Reactor safety (e.g. unplanned reactor trips);
- Radiation safety (e.g. maximum individual effective dose);
- Industrial safety (e.g. lost time injuries); and
- Safety management (e.g. number of accredited operators).

Performance against the SPIs is reported quarterly to ARPANSA and monthly within ANSTO.

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

Formal Compliance

11.1. The ARPANS Regulations require that in making a licence decision, ARPANSA must take into account whether the applicant has shown a capacity to comply with the licence conditions made under the Act and Regulations.

Factual Compliance

11.2. The RAPs state that ARPANSA must assess ANSTO to be financially viable before ANSTO is issued with an operating licence. ANSTO must have detailed plans and periodic reviews with measurable outcomes to demonstrate that it has adequate managerial structure and resources, including financial capability.

11.3. The Australian Government's budget appropriation forms the bulk of ANSTO's operating revenue. For the financial year 2013/14 appropriation from the Government is forecast to form 64% of ANSTO's A$296 million operating budget, with the bulk of the remaining operating budget coming 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 its nuclear reactors, including OPAL.

11.4. In addition, ANSTO complies with a number of financially related policies set by the ANSTO Board.

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

Formal Compliance

11.5. ARPANSA's RAPs require the applicant to demonstrate:

- adequate managerial structure and resources (Principle 4(a));
- that positive safety attitudes are instituted and encouraged by senior management. Clear lines of authority and responsibility are established, procedures developed, sufficient resources provided, and a quality assurance system is implemented (Principle 6); and
- that high standards of human performance and competence are expected within the operating organisation. Staff selection and training emphasise inherent abilities, qualification, personal stability, integrity, and a responsible attitude (Principle 7).

Factual Compliance

11.6. On the job training of ARPANSA regulatory staff in technical areas relevant to each staff member's work area must be completed satisfactorily before being eligible to

be appointed as an inspector under the ARPANS Act. Regulatory staff must have a good working knowledge of the ARPANS Act and Regulations.

11.7. In addition, inspectors must have either obtained or be working towards a nationally recognised accreditation (Certificate IV in Government). Key competencies of this programme include the ability to exercise regulatory powers, promote compliance with legislation, assess compliance with legislation, investigate non-compliance with legislation, conduct and record interviews, conduct a search and possible seizure and prepare evidence.

11.8. As stipulated by the ANSTO WHS Management System, overall responsibility for safety at ANSTO rests with the Chief Executive Officer; however, day-to-day responsibility is delegated to senior managers. The General Manager, Nuclear Operations has responsibility for safe operation of OPAL. The General Manager, Human Resources and the Head of Nuclear Services is responsible for operation and continual improvement of ANSTO's general safety arrangements, including the WHS Management System.

11.9. The activities undertaken include health physics monitoring, measurement and management of internal and external ionising radiation doses received by staff, occupational health and hygiene, monitoring of radioactive airborne discharges, emergency planning and response, safety training and the safety assessment of work. ANSTO has also undertaken internal strategies to ensure that staff are continuously trained to ensure that human factors in safety is accorded proper attention. This is covered further under Article 12 below.

11.10. OPAL is operated with a rotating roster of at least two Reactor Operators and a Shift Manager. At present, Shift Managers have a minimum qualification of an appropriate university degree, usually in engineering or physics, and also a demonstrated capability to fulfil the role of a Reactor Operator.. Both 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, which includes ARPANSA involvement as observers on the accreditation panel. Reaccreditation of Reactor Operators and Shift Managers takes place every three years. Reactor Operators and Shift Managers are also required to be authorised by the Reactor Manager, which is achieved through demonstration of suitable skills and competencies.

11.11. In addition to the Reactor Operators and Shift Managers, OPAL has significant human resources in utilisation, engineering, maintenance and technical support, all under the management of the General Manager of Nuclear Operations. An organisation chart of the Nuclear Operations division relevant to OPAL operation, utilisation and support is shown below. The ANSTO Waste Operations group report to the General Manager, Nuclear Operations. The main scientific users of OPAL reside in the Bragg Institute, which is a research division dedicated to neutron beam scattering and research.

11.12. The arrangements for qualification training, accreditation and retraining of OPAL staff are summarised in Sections 13.3 and 13.4 of the OPAL Safety Analysis Report[15]. The implementation of the arrangements is detailed in various procedures,

[15] Further details on the training programme for OPAL operators are found in Sections 13.3 and 13.4 of the OPAL SAR that can be found at http://www.arpansa.gov.au/Regulation/opal/op_applic.cfm.

instructions and manuals that are part of the OPAL ISO 9001 and 14001 accredited Reactor Operations Business Management System.

11.13. OPAL operations are supported by staff from a number of other parts of ANSTO who provide services in areas such as nuclear analysis, waste management and engineering as required. These services are stipulated by a series of Service Level Agreements (SLAs) between OPAL and the respective division providing the service. The SLAs stipulate the nature, frequency and standard of the services provided.

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.

Formal Compliance

12.1. ARPANSA's human factors requirements are detailed in the RAPs and the *Regulatory Assessment Criteria for the Design of New and Modification of Existing Controlled Facilities*. Requirements that must be addressed by applicants include:

- that systems and procedures are designed with systemic consideration of human factors at the individual and organisational levels to reduce the potential for human error and violations, facilitate correct actions by operators, and reduce operator stress; and
- accounting for human factors in any probabilistic safety assessment.

Factual Compliance

12.2. The Human Factors (HF) Program at OPAL is a dynamic program that has been part of the project from its inception, and will continue to evolve until the plant is decommissioned. The ANSTO HF program has been developed to ensure the human machine interface is optimised to avoid operational/maintenance errors and violations to satisfy ARPANSA's human factors requirements. The human factor design plans for OPAL were reviewed by ANSTO and ARPANSA and include a Human Machine Interface Plan. The HF commitments are defined in various sections of the OPAL SAR[16].

12.3. ANSTO's HF independent Design Review Plan was used for the design, manufacture, installation and commissioning stages of the project, and has been revised and included in the plant design modification procedures to ensure that future plant and process changes have been appropriately analysed from a HF perspective.

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

[16] http://www.arpansa.gov.au/Regulation/opal/op_applic.cfm

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.

Formal Compliance

13.1. ARPANSA's Regulatory Services Branch has redeveloped its entire quality system for regulatory activities and in the near future will be seeking certification under ISO 9001.

13.2. ARPANSA's RAPs require an applicant for a licence to demonstrate that adequate steps have been taken for quality assurance of its nuclear facilities. The relevant principles are:

- the operating organisation has a formal QA program in place that is applied at each of the stages in the life of the reactor (Principle 13);
- the operating organisation has a recognised quality practices accreditation that is applied to the reactor (Principle 14); and
- design specifications, drawings, test, inspection and maintenance specifications and procedures are current and reflect the status of the reactor at all stages in its life (Principle 15).

Factual Compliance—OPAL

13.3. The administrative control of OPAL is undertaken in accordance with the Reactor Operations Business Management System (BMS). The system has been developed under the umbrella of the ANSTO Quality Policy and the ANSTO Business Management System (ABMS) and encompasses ANSTO policies, overarching processes and supporting guidance. Both systems meet and are certified to the ISO 9001 quality system

13.4. The head document of the Reactor Operations BMS is the *Reactor Operations Business Management System Manual*, and below this lie the range of manuals, procedures, instructions, and forms for operational and maintenance activities. The instructions include response to alarms and emergency operating instructions.

13.5. ARPANSA reviewed these documents as part of the licence application assessment process and undertakes inspections to determine that reactor operation is consistent with the documentation contained in the Reactor Operations BMS.

13.6. ANSTO undertakes regular internal management system audits in accordance with its ISO 9001 quality system certification that verify activities are compliant with the documented Reactor Operations BMS and to identify process improvements.

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 Assessments

Formal Compliance

14.1. The ARPANS Regulations require an operating organisation to submit an updated safety case whenever a new authorisation under a licence is sought throughout the lifecycle of a nuclear reactor. ARPANSA requires that:

- for siting, the safety case includes a detailed site evaluation, a consideration of the extent to which the site may be affected by natural and man-made events and environmental impact assessments as required by government agencies.
- for construction and operation, the safety case includes the design information for the reactor, including the operational limits and conditions (OLC) within which the reactor must operate, and a safety analysis that is documented in an SAR and plans and arrangements for safety.
- for possession and control, the safety case includes the arrangements for safe storage of radioactive material and maintaining the nuclear reactor.
- for decommissioning and abandoning a nuclear reactor, the safety case includes the decommissioning plans and results (respectively) and the details of any environmental monitoring program proposed for the site.

14.2. ARPANSA's RAPs list the safety analysis principles which apply to a nuclear reactor before its construction and commissioning and during each principal stage in the life of the reactor. The relevant principles are Principles 17 to 38. Further details on the implementation of the principles are provided in the regulatory guidance documents (*Regulatory Assessment Criteria for the Design of New Controlled Facilities and Modifications to Existing Facilities* and *Regulatory Guideline on Review of Plans and Arrangements*).

14.3. The preliminary SAR (PSAR) must be included in an application for a licence to construct a reactor. A final SAR (FSAR) is an updated version of the PSAR and must be submitted when applying for a licence to operate a reactor. The PSAR and FSAR are thus progressive versions of one SAR. The SAR is a living document that requires updating throughout the life of the reactor (including the decommissioning stage) to reflect its current state.

14.4. The SAR must include deterministic safety analyses at several levels of defence in depth to determine if the safety limits and objectives will be met for design-basis accidents. Probabilistic assessment may supplement deterministic assessment of design-basis and beyond-design-basis accidents. The principles require that the OLC be determined from the safety analyses (Principle 63).

14.5. The ARPANS Regulations require a licence holder to submit a request for approval (RFA) to construct an individual item important to safety during the construction of a nuclear installation prior to installation. The ARPANS Regulations also require a licence holder to obtain approval from the CEO of ARPANSA prior to making a change[17] with significant implications for safety.

Factual Compliance for OPAL

14.6. The PSAR submitted in May 2001 as part of the application for a Construction Licence was revised into the FSAR during the detail engineering, construction and commissioning phases. The FSAR was submitted in the third quarter of 2004 as part of the application for an Operating Licence. Further revisions of the SAR will be submitted as indicated in paragraph 7.20 above.

14.7. The licence authorising construction of OPAL was subject to specific licence conditions. Those specific to the assessment and verification of safety were described in the 2004 report. All of these matters were addressed by ANSTO and taken into account in ARPANSA's decision to issue a Licence to Operate OPAL in July 2006.

14.8. The SAR revision together with the RFAs formed the main safety review task of ARPANSA during construction from April 2002 until the issue of the Operating Licence in July 2006.

14.9. For each OPAL RFA (131 in total over 4 years), ANSTO submitted information in a standard format that addressed the relevant part of the PSAR submitted as part of the Construction Licence and identified any variations from it in terms of materials used, codes and standards, equipment function or other aspects. The construction approval process also identified relevant recommendations that had been made in the ARPANSA regulatory review report associated with the OPAL construction licence.

14.10. ARPANSA is satisfied that comprehensive and systematic safety assessments were carried out before the construction of OPAL and maintained during the construction and commissioning phases.

14.11. The operating licence issued to ANSTO requires that periodic safety reviews be conducted on a regular basis. The first such PSR was to be conducted within two years of the completion of commissioning and then thereafter at intervals agreed to by the CEO of ARPANSA. The initial PSR report was submitted to ARPANSA in December 2011 and a Supplement PSR report addressing comments identified by ARPANSA on the initial PSR report was submitted in June 2013.

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.

Safety Verification

Formal Compliance

14.12. The ARPANS Regulations require the licence holder to be compliant with the Plans and Arrangements for Managing Safety that are specified in the application (Regulation 49). Once the licence is issued, a licence holder must also review their

[17] This includes changes to plans and arrangements that form part of the application for a licence.

plans and arrangements for managing safety every 12 months thereafter (Regulation 50). Any changes to Plans and Arrangements for Managing Safety that have significant implications for safety must have the approval of ARPANSA prior to implementation (Regulation 51).

14.13. ARPANSA conducts planned announced and unannounced inspections of the nuclear reactors at ANSTO which include both plant and procedural aspects, including maintenance, testing, training and event management.

Factual Compliance for OPAL

14.14. A staged approach was adopted for the commissioning of OPAL, commencing with individual testing of systems and components (Pre-Commissioning), extending to testing the integration of all systems and components without nuclear fuel in the core (Stage A or cold commissioning) and finally testing with fuel in the core (Stage B and C or hot commissioning).

14.15. During Stage A Commissioning, ARPANSA inspectors witnessed all the Safety Category 1 tests and many Safety Category 2 tests. The results of cold commissioning, and subsequent reviews by ARPANSA, informed the July 2006 decision of ARPANSA to issue an operating licence.

14.16. ARPANSA reviewed the proposals for Hot Commissioning as part of its consideration of an application to operate OPAL. ARPANSA accepted that the organisational, management and quality arrangements were consistent with IAEA and ARPANSA guidance on commissioning and that it represented best practice for commissioning of research reactors. ARPANSA inspectors witnessed all the Safety Category 1 tests and many Safety Category 2 hot commissioning tests, and were present for all the key hot commissioning milestones, such as first criticality, low power operation, and the power ascension stages up to the full power of 20 MW. These were controlled through a system of witness points and hold points approved by ARPANSA.

14.17. ANSTO has adopted the strategic approach that maintaining safety in all operations and uses of OPAL will be necessary in order to achieve high levels of reactor availability and reliability. Underpinning safe operation and utilisation are the existence of a strong and robust safety culture, efficient operational practices, systems and processes, and regularly planned maintenance programmes. An event reporting, investigation and action tracking system is used to address safety and operational events at OPAL.

14.18. Supporting this approach is the adoption of modern engineering Asset Management practice with defined asset objectives and asset performance conditions and targets. This practice is integrated, with modifications being controlled through an approved change management process, predictive and preventative maintenance programs, human resource plans, development and training programs and performance monitoring in safety and operations.

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.

Formal Compliance

15.1. The objective of the ARPANS Act is to protect the health and safety of people, and to protect the environment from the harmful effects of radiation.

15.2. The radiation protection system in Australia is based on the justification, optimisation and dose limitation provisions of ICRP and the IAEA Basic Safety Standards. This system is currently being updated to incorporate the 2007 Recommendations of ICRP (Publication 103) and the new Basic Safety Standards (GSR Part 3).

15.3. When assessing an application for a licence, ARPANSA must be satisfied that the applicant has shown that radiation protection is optimised to ensure that:

- the magnitude of individual doses;
- the number of people who are exposed; and
- the likelihood of incurring exposures to radiation

are as low as reasonably achievable, having regard to social and economic factors.

15.4. Division 5.2 of the ARPANS Regulations sets out statutory effective dose limits. ARPANSA monitors whether ANSTO ensures that radiation doses arising from normal operation and anticipated operational occurrences throughout the life of the reactor do not exceed those limits.

Factual Compliance

OPAL Reactor

15.5. The OPAL Radiation Protection Plan was included in Part B of the Submission for an Operating Licence as one of the Plans and Arrangements for Managing Safety. Chapter 12 of the SAR also describes operational radiological safety. Information in the OPAL radiation protection plan includes:

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

15.6. Radiation protection in OPAL is managed by Reactor Management 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 OPAL management and staff on the continuing effectiveness of controls against identified radiological hazards within OPAL; and
- oversees and co-ordinates radiation monitoring programs.

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 N-16, dedicated hot cells for handling irradiated materials and the definition of areas of restricted access during reactor operation.

The effective doses for the different staff groups at OPAL are shown below

Effective dose for OPAL staff groups: 2012/13 FY

Group	Collective Dose (person mSv)	Average Effective Dose (mSv)	Maximum Annual Effective Dose (mSv)
Shift Managers and Reactor Operators	16.7	0.70	1.11
Utilisation Operators (including support staff but not managers)	10.2	0.54	0.95
Engineering and Maintenance Staff (including managers)	26.6	0.63	1.57
All OPAL Personnel	63.9	0.58	1.57

The ‘All OPAL Personnel’ group includes the first three cohorts displayed in the table

.

Article 16 – Emergency Preparedness

1. 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.

2. 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.

Formal Compliance

16.1. The ARPANS Regulations prescribe the need for emergency plans. The ARPANSA RAPs address the various aspects of the emergency plans, procedures and preparedness to be assessed in reviewing the plans and arrangements (Principles 122 and 123). These cover operating licences for existing reactors and other controlled facilities, as well as siting and construction licences for new reactors and other controlled facilities.

16.2. The Regulatory Guideline on the Review of Plans and Arrangement of Management safety covers emergency planning as one of the plans for effective control and management of safety under incidents and accident conditions. The aspects of emergency preparedness covered in this guideline can be summarised as follows:

- detailed emergency plans for any action that could give rise to a need for emergency intervention. These plans should be based on an assessment of the consequences of reasonably foreseeable accidents, including accidents with off-site consequences, and should aim to minimise the consequences and ensure the protection of on-site personnel, the public and the environment.
- comprehensive emergency procedures are to be prepared in accordance with the objectives of the emergency plan.
- all external organisations identified in the emergency plan are to be prepared for such emergencies, and adequate facilities and equipment are to be available and maintained.

Factual Compliance

OPAL Reactor

16.3. ANSTO submitted an OPAL Reactor Emergency Plan as part of the Application for an Operating Licence. Emergency planning and preparedness are also covered in Chapter 20 of the OPAL SAR. The plan places responsibility for testing and review of the plan on the OPAL Reactor Manager, and indicates that there would be a major exercise every two years, with emergency drills on specific aspects of the plan performed more frequently. Major exercises were held in May 2006 as part of the reactor's precommissioning, in February 2008, in December 2009, and in December 2011. An emergency exercise within the recently built HWIPS building was also performed in May 2011 as part of that facility's precommissioning, whilst an emergency demonstration drill of a station blackout event was performed in December 2012. These exercises were witnessed by ARPANSA inspectors but to

date, ARPANSA have not participated in OPAL emergency exercises. 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.

ANSTO Site as a Whole

16.4. The implementation of these plans is regularly discussed with emergency response agencies, the local council and others at the ANSTO Local Liaison Working Party. This involves discussions on exercises, public information and changes to emergency plans or arrangements. ARPANSA has an observer role on the Local Liaison Working Party. The ANSTO general emergency plans and arrangements are available in the local public libraries.

16.5. In addition to the OPAL Emergency Plan, ANSTO has an all-encompassing Emergency Response Plan for the whole site. This plan has been accepted by the relevant NSW emergency service organisations (ESOs) including the NSW Police, Fire & Rescue NSW and the Ambulance Service. An important feature of ANSTO's Emergency Response Plan is its integration with existing New South Wales emergency management arrangements, such as the NSW Emergency Plan (EMPLAN) and a specific sub-plan covering a major incident at ANSTO which may involve local evacuations.

16.6. All ANSTO and NSW state emergency management arrangements have been collaboratively developed and reviewed by all the relevant ESOs and regular meetings are held to plan exercises and discuss changes.

16.7. Assessments of the radiological consequences of acts of sabotage and terrorism in relation to OPAL have been undertaken by ANSTO and reviewed by ARPANSA. It has been 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.

16.8. ARPANSA, as the advisor to the Australian Government on preparedness and response to radiological and nuclear emergencies, has a key role in any emergency that may occur on the ANSTO site. Consistent with the IAEA *Safety Requirements Preparedness and Response for a Nuclear or Radiological Emergency* (GSR 2), ARPANSA acts as an advisory body to government and response organisations in respect of nuclear safety and radiation protection.

16.9. The geographical isolation of Australia from neighbouring States precludes any possibility that an emergency in OPAL will impact on the population of neighbouring States. Notwithstanding this, 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 Crisis Coordination Centre, located in the Attorney General's Department, is the designated National Warning Point.

3. 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.

16.10. Australia is not geographically close to any States currently operating a nuclear installation, and this minimises the possibility that an emergency in such an installation would impact on the Australian population. Nevertheless, Australia has appropriate precautions in place in relation to radiation emergencies in other countries, including the monitoring of imported foodstuffs.

16.11. Since the devastating earthquake and tsunami that struck Japan in March 2011, ARPANSA and the Department of Health and Ageing have been continually assessing the nuclear situation in Japan in order to properly advise the Australian Government and public on radiation protection and nuclear safety issues associated with the nuclear emergency. During the nuclear emergency phase, ARPANSA provided around the clock technical advice to the Australian Government response that was coordinated by the Australian Department of Foreign Affairs and Trade.

16.12. ARPANSA used weather prediction data provided by the Australian Bureau of Meteorology to model on a daily basis the movement of airborne radioactive plumes, both potential and real, to ensure that Australians are given adequate advice while in Japan. Through its links with the International Atomic Energy Agency, the World Health Organization and other International and Australian government agencies, ARPANSA was able to monitor the radiation situation in Japan and beyond. Radiation protection advice was provided through the ARPANSA website and updated on a regular basis. ARPANSA also established an information service to ensure that individual enquiries on the nuclear emergency situation in Japan were responded to in an effective and timely manner.

16.13. For the weeks after the accident, Comprehensive Nuclear-Test-Ban Treaty (CTBT) radionuclide monitoring stations throughout the northern hemisphere measured trace quantities of radioactive material in air coming from Japan. Trace amounts of xenon-133 were detected at the CTBT noble gas monitoring station maintained by ARPANSA at Darwin in northern Australia. No other detections were made in any of the six CTBT air monitoring stations maintained by ARPANSA (with the network since being expanded to include a station at Mawson, Antarctica).

16.14. Foods produced in the areas affected by the nuclear emergency at the Fukushima nuclear power plant have the potential to be contaminated with radioactive materials. ARPANSA worked with Australia's food standards regulator Food Standards Australia New Zealand in assessing the available information on the levels of contamination levels in water, milk and foodstuffs in Japan and to screen foodstuffs from Japan, to ensure that Australians were properly informed and protected.

16.15. ARPANSA has conducted a review of its response to the nuclear accident and identified opportunities to improve its incident response planning. The agency established an Emergency Planning and Response working group to consider:

- the lessons learned from the agency's response to the accident (garnered through interviews/survey from staff directly involved in our response);
- the recommendations that pertain to emergency preparedness and response identified in the 2007 and 2011 IRRS missions to Australia, and
- Australian and international best practice in incident and emergency response plans.

16.16. The working group reported back to the CEO of ARPANSA in July 2012, and subsequently coordinated the preparation of an Incident Management Plan that

documents ARPANSA's processes and procedures for undertaking its roles and responsibilities during a radiological or nuclear emergency.

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;

Formal Compliance

17.1. The ARPANS Regulations provide requirements that an application must satisfy before ARPANSA will issue a licence authorising preparation of a site for a nuclear reactor. ARPANSA's RAPs and Siting Guideline identify matters it will consider in its assessment of such an application. These are specified at two levels of defence in depth, the concept of which is considered further under Article 18. At defence in depth level 1, applicants must take into account site characteristics which may impact on the safety of the reactor (Principle 54). These site characteristics are:

- the site's seismology, geology, topography, demography (population distribution and existing population centres), ecology, hydrology, and meteorology;
- the effect of nearby facilities and land usage;
- the availability and reliability of offsite services such as electricity, water, transportation, and communication systems; and
- the feasibility of emergency response.

17.2. Siting assessment principles are also provided at defence in depth level 5 to address off-site radiological consequences that might result from the failure of steps taken at different defence in depth levels to protect the public and the environment from a beyond-design basis accident. The principles are as follows:

- siting assessment is to be performed early in the planning stages of a proposed reactor, so that the selected site provides adequate protection of individuals, society and the environment against hazards arising from potential accidents at the reactor (Principle 117);
- if a detailed design is not yet established, the siting assessment is to be based on a reference design for the reactor, and the assessment is to determine the consequences of a postulated accident called the Reference Accident, which involves some degradation of the safety systems of the reference design for the proposed reactor, and includes conservative assumptions on the release of radioactive materials (Principle 118);
- the consequences of the Reference Accident are to be determined for meteorological conditions which result in the maximum consequences of the accident, but which occur no less than 10% of the time. For these consequences, it is to be determined that:

  - emergency intervention would be feasible at any location around the site, at the radiological intervention levels agreed with ARPANSA.
  - the maximum collective effective dose would be less than 200 person Sv.
  - the long-term use of any land surrounding the site would not be disrupted due to radioactive contamination (Principle 119).

- in calculating collective effective doses, no allowance is to be made for the imposition of short-term emergency interventions. A calculation cut-off may be set so those individual doses representing very low levels of risk are not included in the collective dose (Principle 120); and
- where the siting assessment has been based on a reference design of a proposed reactor, the Reference Accident is to be compared to the analyses of the final design in the SAR, to check the validity of the siting assessment (Principle 121).

17.3. ARPANSA also has a regulatory assessment document (*ARPANSA Criteria for the Siting of Controlled Facilities*) that is used to assess application for the siting of new nuclear reactors. This document was used to assess the siting of OPAL - see below. These principles and siting criteria are based on international standards and recommendations, particularly those of the International Atomic Energy Agency (IAEA), and the contemporary practices in the nuclear industries of developed countries.

17.4. The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* contains provisions forbidding Commonwealth agencies from undertaking "nuclear actions" which might have a significant impact upon the environment without the consent of the Minister for the Environment. The definition of "nuclear actions" includes establishing or significantly modifying a nuclear reactor, such as decommissioning. The Act lays out principles for the assessment of whether a "nuclear action" should be approved.

Factual Compliance

OPAL Research Reactor

17.5. In its application for a licence to prepare the site for OPAL, ANSTO demonstrated to ARPANSA's satisfaction[18] that the Lucas Heights 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; and
- the natural characteristics of the site and man-induced phenomena can be accommodated safely in the design bases of the reactor.

[18] See http://www.arpansa.gov.au/Regulation/opal/siting.cfm for an outline of the site licensing process and significant documents.

17.6. On 22 September 1999 ARPANSA issued a licence (with certain conditions) to ANSTO to prepare the site for OPAL. ANSTO surrendered the Siting Licence in July 2003[19].

17.7. The environmental assessment of the proposal to site a replacement research reactor at Lucas Heights was undertaken under the *Environment Protection (Impact of Proposals) Act 1974*[20] and included the preparation of an Environmental Impact Statement, the consideration of public submissions and an independent assessment involving international experts from the IAEA and elsewhere. As a result of that process, the Minister for the Environment approved the proposal, subject to several conditions. ANSTO made six-monthly reports to the Minister (which were subsequently made public) on the implementation of the conditions. In mid-2006, the Minister indicated his satisfaction that all the conditions had been implemented satisfactorily and removed the requirement for ongoing reporting.

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 isolation and the low power level of the OPAL reactor, its operation could not affect any other Contracting Parties or other states. Notwithstanding this, 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, and would provide appropriate information to neighbouring states in the event of an accident.

19 Further details of the site licensing process, including the assessment of the reference accidents for the site, are contained in the Australian National Report to the 3rd Review meeting.

20 The predecessor of the *Environmental Protection and Biodiversity Conservation Act 1999*.

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;

Formal Compliance

18.1. ARPANSA's RAPs and its *Regulatory Assessment Criteria for the Design of New Facilities* are structured in terms of internationally accepted principles of defence in depth.

18.2. The RAPs (Principle 2) require defence in depth to be implemented at nuclear reactors to provide diverse layers of protection at successive levels, as shown below:

Level	Objective	Means
1	Prevent failures and ensure that anticipated operational occurrences/disturbances are infrequent.	Conservative, high quality, proven design and high quality in construction
2	Maintain the intended operational states and detect failures.	Process control and limiting systems, other surveillance features and procedures.
3	Protect against design-basis accidents.	Safety systems and accident procedures.
4	Limit the progression and mitigate the consequences of beyond-design-basis accidents.	Accident management and mitigation.
5	Mitigate the radiological consequences of beyond-design-basis accidents.	Off-site emergency response.

18.3. The need for proven engineering practice and standards in the siting, design, manufacture, construction, installation, commissioning, inspection, training, operation, testing, maintenance, modification, criticality control, life extension, and decommissioning of a reactor is specifically stated as a RAP (Principle 46).

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.

Formal compliance

18.4. ARPANSA's RAPs highlight the need to take into account human factors at the design stage (at defence in depth level 1). These principles are:

- 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 (Principle 48);
- safety systems at nuclear reactors are designed to be automatically initiated and to require no immediate operator action within thirty minutes, while

permitting operator initiation or action where necessary to ensure or enhance safety (Principle 49);

- control and control room layout provides ergonomic disposition of data and controls for actions important to safety, including accident management (Principle 50);
- diagnostic aids are provided to speedily resolve questions important to safety and to monitor the status of the reactor (Principle 51);
- a reliable and redundant communications system is provided for all operations staff (Principle 52); and
- maintenance and inspection aspects such as access are considered in the design of equipment and systems (Principle 53).

Factual Compliance for the OPAL Research Reactor

18.5. The factual compliance for OPAL with respect to Article 18 was discussed in the previous national report. The most significant change to design during the current reporting period was the addition of a Heavy Water Upgrade System designed to remove light water contamination from the heavy water in the reflector vessel surrounding the reactor core.

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;

Formal Compliance

19.1. The ARPANSA licensing process requires the applicant to furnish certain defined information, including an SAR, in support of an application for authorisation to operate a nuclear reactor. The applicant must also demonstrate:

- that the reactor, as constructed, is consistent with the design and safety case approved in the construction licence requirements; and
- the successful completion of the commissioning plan and program.

In assessing a licence application, ARPANSA must take into account international best practice in radiation protection and nuclear safety. This was recognised as good practice by the IAEA IRRS mission to ARPANSA in 2007.

19.2. ARPANSA may require additional information from the applicant to that outlined in the Act and Regulations to facilitate the assessment of a licence application.

Factual Compliance

OPAL

19.3. A description of the licence approval process and the actual authorisation issued to ANSTO to operate OPAL was reported in a previous Australian report of September 2007.

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;

Formal Compliance

19.4. The ARPANS Regulations (Schedule 3 Part 1) require an applicant to provide the OLC for the reactor covered by the application. The Principles emphasise that the OLC must be determined from the safety analyses (Principle 63). Further guidance on the bases for and the details to be provided in OLC is provided in the principles and guidelines. The OLC that form part of an application for an operating licence therefore, through Regulation 49 (see paragraph 7.8 above) become mandatory limits for the operation of the reactor upon issuance of the licence.

19.5. In addition, under Principle 39, periodic reviews are undertaken to confirm that any changes to the design or operation of the reactor do not invalidate the assumptions and conditions on which the safety analyses are based. Any change to the details in the application for a licence or a modification to the reactor mentioned in the licence is considered a 'relevant change'. The Regulations require ANSTO to seek prior authorisation from ARPANSA prior to making a relevant change with significant implications for safety. Changing an OLC is one such change. ARPANSA must be informed of all other relevant changes at least quarterly.

Factual Compliance

OPAL Reactor

19.6. Part D of the Submission for an OPAL Operating Licence consisted of the OPAL OLC. This document expanded on the OLC description in Chapter 17 of the SAR and was developed using the guidance of the U.S. Nuclear Regulatory Commission (NRC) NUREGs 1430 through 1434 (Standard Technical Specifications for Light Water Power Reactors), Revision 2, April 2001, as modified to reflect the specific design and licensing basis presented in the SAR and applicable regulatory processes. Part D also included a separate document that gave the bases for the OPAL OLC, consistent with the US NRC guidance. These limits and conditions became mandatory upon the issuing of the operating licence on 14 July 2006 (see paragraph 19.4 above).

19.7. ARPANSA considers the OLCs to be fundamental to the safe operation of OPAL, and compliance with the OLCs is monitored during planned announced and unannounced inspections.

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

Formal Compliance

19.8. The Regulations require applications to contain plans and arrangements to ensure the safety of a reactor throughout all stages of its life (see paragraph 14.1 above). 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. As discussed above, the measures in these plans and arrangements become mandatory once a licence is issued in respect of a particular application. Further details of what are required with respect to safety in the plans and arrangements for operation, maintenance and inspection are provided in the RAPs and other ARPANSA regulatory guidelines.

19.9. In particular, the principles address the need for an applicant to demonstrate that inspection, testing and maintenance procedures are documented and implemented; and that such undertakings will ensure the availability and reliability of systems at the levels used in the safety analysis and avoid common cause failure (Principle 65). This Principle necessarily addresses the need for appropriate frequencies of inspection, testing and maintenance tasks, to avoid degradation of safety.

Factual Compliance

OPAL

19.10. The administrative control of OPAL is undertaken in accordance with the Reactor Operations Business Management System (BMS). The head document of the BMS is the *Reactor 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.

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

Formal Compliance

19.11. Applications must demonstrate that limits of normal operation and anticipated operational occurrences, and safety systems settings including the minimum plant configuration[21], will be derived from safety analyses (Principle 63) and that the operation of the reactor will be constrained within the settings of the safety sittings or otherwise shut down (Principle 64).

19.12. The principles emphasise that at defence in depth level 4, applicants should demonstrate how, to an extent that depends on the conditions and with assistance from equipment, it is possible for operators to diagnose the status of the reactor and to make management arrangements. Accident management arrangements may include maintaining or restoring at least one barrier for the confinement of radioactive material. The principles note that accident management arrangements should be based on the outcomes of the safety analysis (Principle 113) and that 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 (see paragraph 7.8 above).

Factual Compliance

OPAL

19.14. Within the Reactor Operations BMS, there are sixteen procedures dealing with arrangements for specified 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. There are more detailed procedures and instructions contained within the Reactor Operations BMS that provide a systematic approach for responding to anticipated operational occurrences.

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

Formal Compliance

19.15. In determining whether to issue a licence to an applicant, the Regulations require ARPANSA to consider whether the applicant has shown capacity for complying with the Regulations and licence conditions imposed under the Act. A licence condition imposed by regulation 49 as discussed above (see paragraph 7.8 above) requires compliance with the plans and arrangements that form part of the operating licence application. A component of demonstrating that the licence holder is complying with its plans and arrangements for managing safety is the demonstration

[21] Minimum plant configuration: the minimum summary set of reactor systems important to safety (including Engineered Safety Provisions, the Reactor Protection system and the Instrumentation Power Supply System etc) that must be operable during specified reactor states. The Minimum Plant Configuration also defines the maximum allowable time for at each system may be inoperable during any yearly period.

of the availability of all necessary engineering and technical support resources in all safety-related fields.

19.16. ARPANSA's RAPs require that the applicant demonstrate adequate managerial structure and resources through the use of detailed plans and periodic reviews with measurable outcomes.

19.17. The Regulatory Guideline on the review of plans and arrangements covers effective control and management of safety under normal operation, incidents and accident conditions (see paragraph 10.1 above).

Factual compliance

19.18. 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 Reactor Operations, which is reviewed annually.

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

Formal Compliance

19.19. Regulation 46(2)(c) of the ARPANS Regulations requires every licence holder to report any accident to ARPANSA within 24 hours of its occurrence. Guidance published on the ARPANSA website[22] defines what is regarded as an accident for the purposes of the Regulations.

19.20. 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; and

Factual Compliance

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

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;

Formal Compliance

19.22. ARPANSA's Regulatory Assessment Principles, which are referred to when assessing an application to operate, require that the operating organisation has mechanisms for:

- assessment, verification and feedback, including through utilisation of independent reviews.
- review and audit to be conducted for all activities important to safety and an ongoing safety assessment program established.

[22] http://www.arpansa.gov.au/regulation/licenceholders/incident.cfm

- lessons to be learned from operating experience and safety research, both within the organisation and internationally,
- analysis of abnormal occurrences, incidents and safety performance of similar reactors worldwide, the results of periodic testing, safety system performance testing, maintenance and modifications, and emergency preparedness exercises, to be reviewed and fed back as appropriate into:
  - revised safety analyses, design modifications, revised procedures and revised quality assurance systems; and
  - personnel performance assessment and counselling and retraining

Factual Compliance

19.23. The Reactor Operations Event Management System (ROEMS) is used to notify and record all events, including abnormal occurrences, incidents and near misses, and details the investigations and analyses related to those events. ANSTO reports to ARPANSA all nuclear safety related events at INES Level 0 and above. Australia supports the IAEA research reactor incident reporting system. Programmes for corrective actions and learning lessons from incidents are integral to ANSTO's event reporting system.

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.

Formal Compliance

19.24. In relation to the handling, storage, transport, discharge and disposal of any radioactive waste attributable to a nuclear reactor, ARPANSA's RAPs require 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; and
- where relevant, the safety analysis is to include consideration of radioactive waste and to confirm compliance with the radiation dose limits specified in the 'Radiation Protection' section of the RAPs.

19.25. The Regulatory Guideline on the review of plans and arrangement of management systems covers radiation protection, radioactive waste management and ultimate disposal. Guidance is given 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.

Factual Compliance

The subsections below outline the factual compliance of ANSTO in relation to the various aspects of radioactive waste management.

Management of spent fuel and radioactive waste

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

19.27. 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. The low-level liquid waste is managed under the existing Waste Operations 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 through guidance documents and work instructions in the WHS management system and the Reactor Operations BMS.

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. There is a program in place for the solidification of radioactive liquids from molybdenum 99 production using ANSTO's patented SYNROC process. A combined siting and construction licence application for this SYNROC plant is currently with ARPANSA for review and approval. Prior to discharge, all radioactive liquid waste is stored in appropriate containment vessels and subject to appropriate treatment methods.

Interim storage of spent fuel and radioactive waste

19.30. After removal from OPAL, the spent fuel elements are transferred to the service pool, which has a capacity to store spent fuel arising from ten years of reactor operation. Used uranium silicide fuel from the operation of OPAL discharged before 2016 will be returned to the US. After that period, the intention is that the spent fuel will be sent to France for reprocessing with the waste to be solidified and returned to Australia, although alternative arrangements have been identified in the event that this is not possible.

Discharge reports

19.31. A quarterly report on airborne radioactivity discharges arising from all of ANSTO's activities is submitted to ARPANSA as required by the Regulations and licence conditions.

19.32. The low-level liquid waste generated by OPAL is initially stored within the reactor building, followed by storage if required in the various Waste Operations facilities on the ANSTO site. The waste is then ultimately discharged to the Sydney Water

sewer as part of the site general discharges (see paragraph 19.27 above) as agreed with ARPANSA. Wastes are characterised both before discharge from OPAL to the site Waste Operations facilities and from the site. The discharge limits under the TWA along with the liquid discharges for the reporting period are shown in the table below.

Sydney Water Trade Waste Agreement Limits and Average Discharges

	Alpha Emitters (Bq/L)	Beta Emitters (Bq/L)	Tritium (Bq/L)
Discharge Limit	12.5	125	195000
2010-11	0.16	5.01	1280
2011-12	0.36	9.48	671
2012-13	0.43	11.63	2500

19.33. The existing stack monitoring equipment continuously samples gaseous discharges using MayPack filters. The filters are measured weekly to provide information on gaseous discharges. The following table shows the Notification Levels and Correction Levels specified by ARPANSA and the actual values for the last three years from ARPANSA Annual Reports for OPAL. The Correction Level for a particular nuclide is defined as five times the notification level, and formally ANSTO is required to take immediate action to halt further discharges. Currently, discharges are well within the Notification Levels.

Annual Notification Levels and actual levels for OPAL airborne discharges

Isotope	Ar-41 (TBq)	I-131 (MBq)	Tritium (GBq)
Notification Level	45	120	155
Correction Level	225	600	775
Actual 2010-11	Not Detected (ND)	1.17	20.6
Actual 2011-12	ND	ND	46.7

Routine discharge of solid radioactive waste to the municipal tip

19.34. Routine discharge in this manner does not occur. Some material discharged to the municipal tip was originally classified as radioactive waste but was subsequently reclassified as non-radioactive following appropriate radioactive decay.

Routine discharge of radioactive waste by incineration

19.35. Routine discharge in this manner does not occur.

Management of ultimate disposal or transfer of radioactive wastes

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

Spent fuel management strategy

19.37. The Australian Government decided in 1997 that part of an appropriate management strategy for HIFAR spent fuel involved shipping it overseas and storing any resulting long-lived intermediate level reprocessing wastes in Australia in a form suitable for acceptance into a national storage facility. A budget was allocated for this purpose.

19.38. Reprocessed wastes from those shipments are scheduled to be returned to Australia starting around 2015. Regulatory approval has been sought to construct an Interim Waste Store (IWS) at ANSTO's Lucas Heights site to temporarily store this reprocessed waste until establishment of a centralised national storage facility. The *National Radioactive Waste Management Act 2010* provides for the establishment of such a centralised national storage facility.

19.39. Storage, transfer and ultimate disposal of OPAL spent fuel is addressed in paragraph 19.30 above.

Articles 20 to 35

These Articles cover the following areas:

- Article 20 – Review Meetings
- Article 21 – Timetable
- Article 22 – Procedural Arrangements
- Article 23 – Extraordinary Meetings
- Article 24 – Attendance
- Article 25 – Summary Reports
- Article 26 – Languages
- Article 27 – Confidentiality
- Article 28 – Secretariat
- Article 29 – Resolution of Agreements
- Article 30 – Signature, Ratification, Acceptance, Approval, Accession
- Article 31 – Entry in Force
- Article 32 – Amendments to the Convention
- Article 33 – Denunciation
- Article 34 – Depositary
- Article 35 – Authentic Texts

No report is required in respect of these Articles.

Planned Activities Related to Safety

Article 14—Assessment and Verification of Safety

Before the submission of the next National Report, it is expected that ARPANSA will have completed the first periodic safety review of the OPAL reactor. In addition it is expected that ANSTO will have submitted a periodic review of the physical security systems of OPAL. This is required by the operating licence to be undertaken two years following the formal completion of hot commissioning, which occurred in November 2009.

ARPANSA plans to request an IAEA Emergency Preparedness Review service mission before the next National Report is submitted.

ANSTO plans to commence radiological characterisation of its shutdown, de-fuelled HIFAR research reactor prior to decommissioning, which will require assessment and approval by ARPANSA.

ARPANSA is in the process of assessing licence applications for planned new nuclear installations by ANSTO at its Lucas Heights site, viz.

- Siting and construction of an Interim Waste Store (described in 19.38 above) to store waste resulting from the reprocessing of HIFAR fuel. If these licences are granted it is expected that ARPANSA will subsequently receive a licence application to operate the Interim Waste Store at Lucas Heights.
- Siting of an expanded Mo-99 production facility at Lucas Heights. If this licence is granted it is expected that ARPANSA will receive a licence application to construct, and then operate the Mo-99 production nuclear installation.

ARPANSA will continue its planned inspection programme of the ANSTO nuclear installations, including the operating OPAL research reactor, the shutdown HIFAR reactor, ANSTO radiopharmaceutical production activities, and ANSTO waste operations.

ARPANSA is preparing to receive an application to prepare a site for a national near surface disposal facility for low-level waste, co-located with a national storage facility for intermediate level waste.

Annex 1 Glossary and Acronyms

ABMS	ANSTO Business Management System
AHSEF	ANSTO's Health, Safety and Environment Forum
ALARA	As low as reasonably achievable
ANSTO	Australian Nuclear Science and Technology Organisation
ANSTO Act	*Australian Nuclear Science and Technology Organisation Act 1987*
ARPANS Act	*Australian Radiation Protection and Nuclear Safety Act 1998*
ARPANS Regulations	Australian Radiation Protection and Nuclear Safety Regulations 1999
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
BMS	Business Management System
Bq	Becquerel (1 disintegration per second)
CEO	Chief Executive Officer
DISPLAN	Disaster Plan of the State of New South Wales
FSAR	Final Safety Analysis Report
HIFAR	High Flux Australian Reactor
HF	Human Factors
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
INES	International Nuclear Event Scale
INSAG	International Nuclear Safety Advisory Group
IRRS	Integrated Regulatory Review Service – a peer review of an IAEA Member State designed to strengthen and enhance the effectiveness of the national regulatory infrastructure of that State for nuclear, radiation, radioactive waste and transport safety and security of radioactive sources whilst recognizing the ultimate responsibility of the State to ensure safety in these areas.
ISO	International Organization for Standardization
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 prescribed radiation facility.
mSv	millisievert
MW	megawatt
ND	Not detected
NSW	New South Wales – one of the states in Australia and the one in which ANSTO is located

Nuclear installation	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 addresses Australia's only operating nuclear research reactor.
WHSE	Work Health, Safety and Environment
OLC	Operational Limits and Conditions
OPAL	Open Pool Australia Light-water reactor
PSAR	Preliminary Safety Analysis Report
QA	Quality Assurance
RAC	ANSTO's Reactor Assessment Committee
RAP	ARPANSA's Regulatory Assessment Principles for Controlled Facilities (October 2001)
Regulatory body	Any body 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
RFA	Request for approval (to construct an item important for safety under an authorisation to construct a nuclear reactor)
RPA	Radiation Protection Adviser
SAC	ANSTO's Safety Assurance Committee
SAR	Safety Analysis Report
SLA	Service level agreement
SPI	Safety Performance Indicator
Sv	Sievert – unit of radiation dose
TWA	Trade waste agreement
WHO	World Health Organisation