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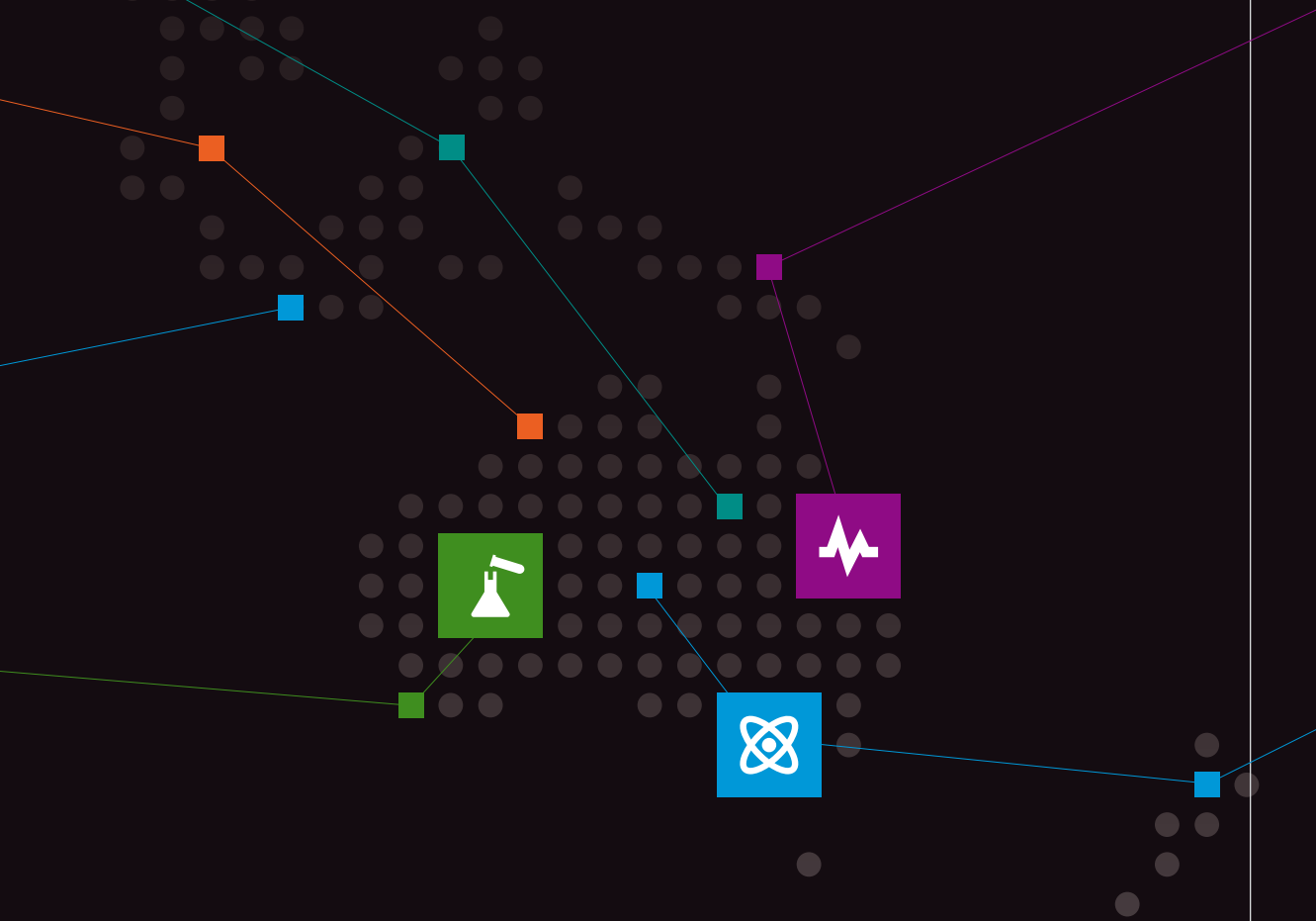
Australian Safeguards and Non-Proliferation Office



# ANNUAL REPORT

2020–2021

**PRODUCED BY**

Director General ASNO
Australian Safeguards and Non-Proliferation Office (ASNO)
RG Casey Building, John McEwen Crescent
BARTON ACT 0221, Australia

PHONE +61 (2) 6261 1920
MEDIA +61 (2) 6261 1555

asno@dfat.gov.au http://www.dfat.gov.au/asno
http://www.dfat.gov.au/international-relations/security/asno/pages/annual-reports

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Australian Government

Australian Safeguards and Non-Proliferation Office

# ANNUAL REPORT

2020–2021

# Guide to the Report

This report complies with the formal reporting obligations of the Director General ASNO. It provides an overview of ASNO's role and performance in supporting nuclear safeguards and the non-proliferation of weapons of mass destruction.

The report has five parts:

1. report by the Director General ASNO on key developments in 2020–21 and a preview of the year ahead
2. a review of selected topics in ASNO's work
3. functional overview of ASNO, including its operating environment and outcomes – outputs structure (the first outcome demonstrates accountability to Government, and the second outlines public outreach and education)
4. report on ASNO's performance during 2020–21 and
5. key features of ASNO's corporate governance and the processes by which ASNO is directed, administered and held accountable.

As ASNO is funded as a division of the Department of Foreign Affairs and Trade (DFAT), some mandatory annual report information for ASNO is incorporated in the DFAT Annual Report. This includes:

- financial statements
- corporate governance and accountability framework
- external scrutiny
- human resource management, including work health and safety
- asset management
- purchasing
- agency-specific social inclusion strategies
- advertising and market research and
- ecologically sustainable development and environmental performance.

# Letter of Transmittal

Australian Government

Australian Safeguards and Non-Proliferation Office

1 October 2021

The Hon Marise Payne
Minister for Foreign Affairs
Parliament House
CANBERRA ACT 2600

Dear Minister

I submit the Annual Report on the operations of the Australian Safeguards and Non-Proliferation Office (ASNO) for the financial year ended 30 June 2021. This report is made in accordance with section 51 of the *Nuclear Non-Proliferation (Safeguards) Act 1987*, section 96 of the *Chemical Weapons (Prohibition) Act 1994* and section 71 of the *Comprehensive Nuclear-Test-Ban Treaty Act 1998*.

During the reporting period all relevant statutory and treaty requirements were met, and ASNO found no unauthorised access to, or use of, nuclear materials or nuclear items of safeguards or security significance in Australia. All requirements were met under Australia's safeguards agreement with the International Atomic Energy Agency and under the Chemical Weapons Convention, and further progress was made with activities in anticipation of the entry into force of the Comprehensive Nuclear-Test-Ban Treaty. All Australian Obligated Nuclear Material was satisfactorily accounted for.

As outlined in this Report, ASNO continued its major contribution to advancing Australia's interests in effective measures against the proliferation of weapons of mass destruction through our activities at the domestic, regional and international levels, and through working closely with colleagues in the Department of Foreign Affairs and Trade in Canberra and Australia's diplomatic missions, and in other departments and agencies.

Yours sincerely

Dr John Kalish
Acting Director General

R G Casey Building, Barton ACT 0221 www.dfat.gov.au Telephone: 02-62611111

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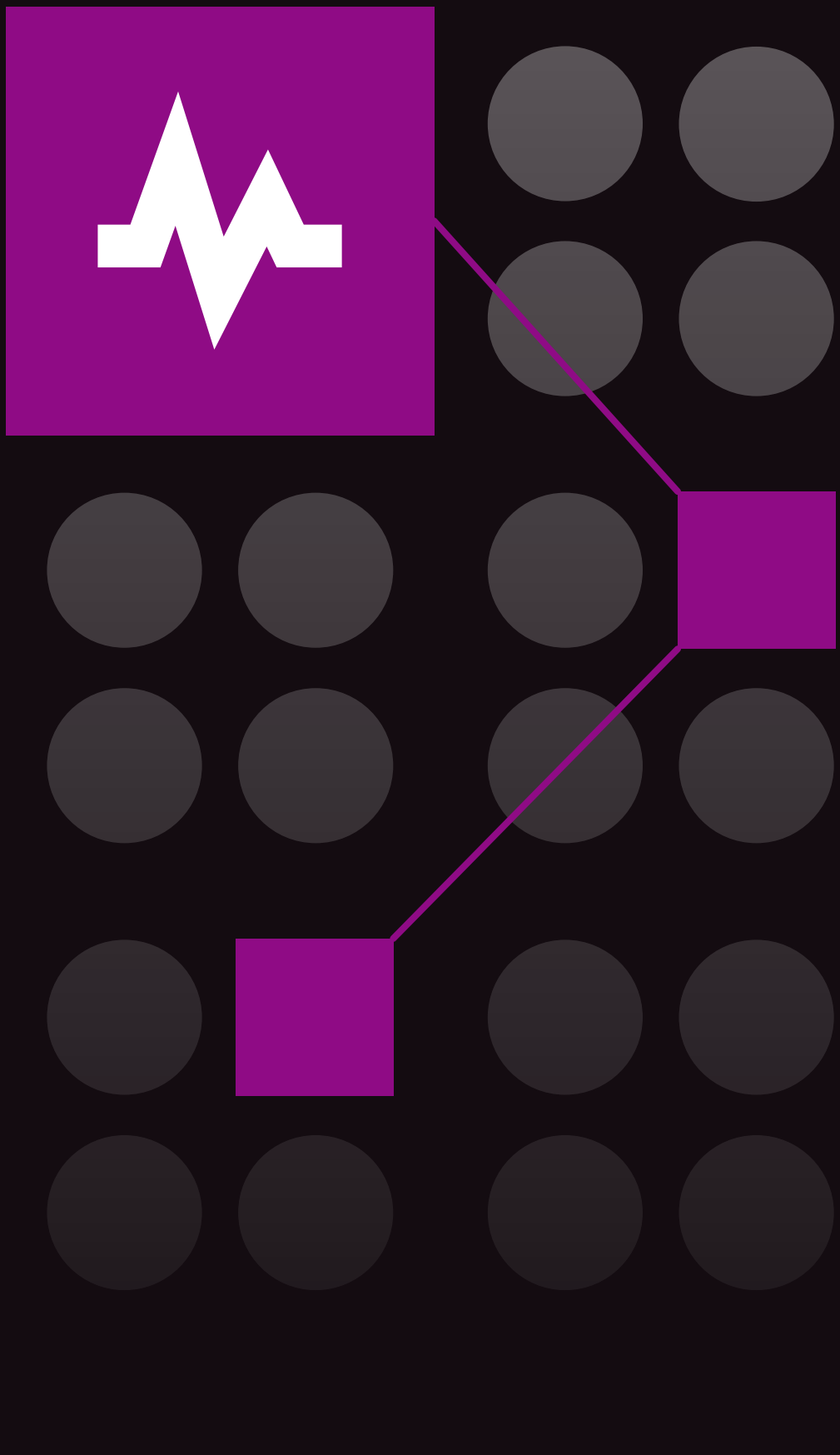


SECTION 1

# DIRECTOR GENERAL'S REPORT

# The Year in Review

## The International Non-Proliferation Environment

Non-proliferation challenges escalated during the 2020–21 reporting period, highlighting further the importance of global non-proliferation efforts and the need for continued engagement in work towards the ultimate goal of eliminating chemical and nuclear weapons.

In December 2020, Iran escalated its stepwise rollbacks of cooperation under the Joint Comprehensive Plan of Action (JCPOA) by passing a law called "Strategic Action Plan to Lift Sanctions and Protect Iranian Nation's Interests". This led to the cessation of what Iran has called "voluntary transparency measures as envisaged in the JCPOA" in February 2021, including provisions of the Additional Protocol to its Comprehensive Safeguards Agreement with the International Atomic Energy Agency (IAEA). Iran also declared it would no longer implement modified code 3.1[1] of the subsidiary arrangements to its Safeguards Agreement. This severely curtailed the IAEA's access to sites, verification tools and information required to assure the international community of the absence of undeclared nuclear materials and activities in Iran. Over the period 1 January – 8 March 2021, the IAEA issued no fewer than ten reports on Iranian nuclear activities, including on uranium enrichment up to 20 per cent, research and development on uranium metal, and increased numbers of centrifuge cascades installed and used for nuclear enrichment activities.

On 21 February 2021, the Atomic Energy Organization of Iran (AEOI) and the IAEA reached a temporary bilateral technical understanding, whereby the IAEA would continue with its necessary verification and monitoring activities for up to three months, as set out in a technical annex. The technical understanding was later extended to 24 June 2021. On 13 April 2021, Iran informed the IAEA of its intention to start producing 60 per cent enriched uranium and, by 11 May 2021, the IAEA reported its analysis showing enrichment levels up to 63 per cent. Producing uranium at such high enrichments significantly reduces the breakout time to producing 90 per cent weapons-grade uranium.

Aside from reporting on the JCPOA, the IAEA Director General reported on findings[2] in relation to four undeclared locations in Iran with respect to Iran's Comprehensive Safeguards Agreement. The report noted that following inspections, Iran had failed to provide necessary, full and technically credible explanations for the presence of nuclear material particles at those sites. The IAEA registered its deep concerns that undeclared nuclear material may have been present at these undeclared locations. The IAEA also reiterated that implementation of modified code 3.1 is a legal obligation for Iran under the subsidiary arrangements to its Safeguards Agreement which cannot be modified unilaterally and there is no mechanism in the Safeguards Agreement for the suspension of

1 Modified Code 3.1 requires countries to submit design information for new nuclear facilities to the IAEA as soon as the decision is made to construct, or authorize construction, of the facility.
2 Report by the Director General, NPT Safeguards Agreement with the Islamic Republic of Iran, GOV/2021/15 and GOV/2021/29 IAEA.

implementation of provisions agreed to in the subsidiary arrangements.

By the end of June 2021, six rounds of indirect talks on the JCPOA (between the Parties of the JCPOA and the United States) had taken place, the seventh seemingly pending the inauguration of Iran's President elect, Ebrahim Raisi.

The Democratic People's Republic of Korea (DPRK) continued its WMD-related activities and posed a direct threat through the build-up of its arsenal and proliferation activities. Satellite imagery of the DPRK's Nuclear Scientific Research Centre at Yongbyon provided evidence that the centre's Radiochemical Laboratory may have recommenced spent fuel reprocessing to extract plutonium in February 2021. The 5 MWe nuclear reactor at Yongbyon that provides spent fuel for reprocessing has not operated since December 2018, based on analysis of satellite imagery. The time between the last observed operation of the 5 MWe reactor and the start-up of the Radiochemical Laboratory would provide some time for the spent fuel to cool before reprocessing. In addition, the DPRK continues to test reportedly WMD-capable delivery vehicles including in March 2021, tests of solid-propellant short range ballistic missiles (SRBMs), highlighting the DPRK threat to its near neighbours, the Republic of Korea (ROK) and Japan.

Sanctions on the DPRK have not stopped Kim Jong Un's regime from developing WMD and have likely not stopped the regime's attempts to trade in WMD-related goods and technology, but they have certainly made it more difficult. The Panel of Experts established pursuant to United Nations Security Council Resolution 1874 reported in March 2021, allegations of technical cooperation between the DPRK and Iran on long-range ballistic missile development. The Panel also reported on DPRK efforts to procure key items for its ballistic missile program.

During the 2020–21 reporting year, ASNO assessed that the IAEA continued to effectively fulfil its objective of verifying that States are upholding their respective nuclear non-proliferation commitments, using the tools available under safeguards agreements and under the Additional Protocol (where in place). In its verification activities, the IAEA uses a combination of in-field inspections of nuclear material, facilities, and related activities, as well as analysis of information at its headquarters in Vienna.

The IAEA has continued to draw soundly based safeguards conclusions for States with safeguards agreements. In 2020, Libya regained the broader conclusion[3] (lost in 2019) through the implementation of safeguards activities there. Ukraine lost its broader conclusion as circumstances there prevented the IAEA from verifying certain nuclear materials in Crimea. Notwithstanding the loss of the broader conclusion, on the basis of the IAEA's evaluation of all safeguards relevant information available, the IAEA did not find indications that would give rise to proliferation concern.

The IAEA has overcome COVID-related travel disruptions to continue conducting safeguards inspections worldwide, including at the Australian Nuclear Science and Technology Organisation (ANSTO). Australia strongly supports the continued application of safeguards, as a cornerstone of the international nuclear non-proliferation regime, while fulfilling local health requirements to prevent the spread of COVID–19.

Plans to develop new nuclear power reactors plummeted globally following the Fukushima Daiichi accident in March 2011, but ten years later interest in nuclear power as a zero-carbon emission energy source has increased. There are approximately 50 nuclear power reactors under construction in 19 countries and many more are planned or proposed. The expansion of interest in nuclear reactors makes clear the ongoing importance of reinforcing key

3 The IAEA can draw the "broader conclusion" for a State as a whole that "all nuclear material remained in peaceful activities". This is a more fulsome assessment for a State than "declared nuclear material remained in peaceful activities". See also Appendix C.

principles of non-proliferation and the need to ensure that sensitive nuclear technologies such as uranium enrichment are managed to minimise proliferation risks. This includes ensuring that nuclear safeguards and monitoring are fully supported, and the IAEA is appropriately resourced for this important work, including the ongoing development of safeguards systems and technologies.

Recent use of chemical weapons continued to be addressed by the international community. The Organisation for the Prohibition of Chemical Weapons (OPCW) concluded in April 2021 that there were reasonable grounds to believe that the Syrian Arab Air Force, under the control of the Tiger Forces, dropped at least one cylinder of chlorine on eastern Saraqib on 4 February 2018. The OPCW found that the cylinder ruptured and released chlorine over a large area, affecting 12 individuals. Syria is a State Party to the Chemical Weapons Convention (CWC), and it is imperative that Syria uphold its obligations under the Convention.

At the 25th Session of the Conference of the States Parties to the CWC in April 2021, the Conference suspended certain rights and privileges of the Syrian Arab Republic under the Convention pursuant to paragraph 2 of Article XII of the Convention. The Decision was co-sponsored by 46 Member States, including Australia, and condemned "in the strongest possible terms the use of chemical weapons by anyone, under any circumstances, emphasising that any use of chemical weapons […] is unacceptable and contravenes international norms and standards".

In August 2020, Russian opposition figure Alexei Navalny, was poisoned by a nerve-agent from the Novichok class. The finding was confirmed by an OPCW Technical Assistance Visit in September 2020 and three independent laboratories. Serious questions remain regarding how a person came to be exposed to a dangerous nerve agent on the territory of a State Party to the CWC.

Australia's engagement with the OPCW continues with its two-year term on the OPCW Executive Council extending until May 2022.

Australia's continuing commitment to the Comprehensive Nuclear-Test-Ban Treaty (CTBT) and ASNO's contribution to the work of that organisation was underlined with the election of Dr Robert Floyd as Executive Secretary of the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) in May 2021. Dr Floyd achieved the support of two-thirds of CTBTO Member States following an extended campaign. Dr Floyd served as the Director General ASNO for more than ten years (from 29 November 2010) and commenced as CTBTO Executive Secretary on 1 August 2021. We know the CTBTO will be in good hands and we wish Rob all the best in his new role.

# Nuclear Non-Proliferation and Safeguards Developments

## International Atomic Energy Agency Safeguards

Australia uses its expertise and resources to make tangible contributions to developing safeguards technology and approaches, delivering safeguards training, and providing technical services. ASNO coordinates the Australian Safeguards Support Program (ASSP), which comprises long-standing partnerships between the IAEA and Australian government agencies, ANSTO, the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australian universities and private companies. Increasingly, the ASSP is also helping the IAEA apply knowledge from technical fields that evolved for applications quite unrelated to safeguards, such as data analytics and robotics. In 2021, ASNO accepted an opportunity to contribute to the IAEA's new COMPASS initiative (see Output 1.4).

IAEA safeguards are fundamentally about maintaining international confidence in the compliance of States with non-proliferation commitments, so there is an important role for States to assist each other in maintaining effective domestic systems and promoting good practice. The IAEA continues to work with States to address specific issues and conduct outreach and awareness-raising activities through workshops and meetings. Australia plays a role in regional capacity building and experience sharing through the Asia-Pacific Safeguards Network (APSN). Dr Floyd also contributed to reviews of approaches to safeguards implementation through his role as chair of the Standing Advisory Group on Safeguards Implementation (SAGSI) until June 2021. ASNO's work in these areas is outlined in Output 1.4.

## Domestic Developments

In 2021, the IAEA continued to report that it found no indication of the diversion of declared nuclear material from peaceful nuclear activities and no indication of undeclared nuclear material or activities in Australia. The IAEA has drawn this 'broader conclusion' that all nuclear material remained in peaceful activities for Australia every year since 2000.

During the reporting period, the IAEA conducted various verification activities (i.e. inspections) in Australia under the Comprehensive Safeguards Agreement and the Additional Protocol. As it did in June 2020, ASNO worked with the IAEA and Commonwealth and NSW agencies to overcome challenges posed by COVID–19 restrictions to hold inspections in Australia in August 2020, April 2021 and June 2021. For each visit, the IAEA inspectors spent two weeks in quarantine in Sydney before carrying out the inspections. Additional health and safety measures were applied during the inspections. In total, sixteen separate IAEA inspections were carried out, mostly at ANSTO. The inspectors were able to meet their inspection goals while fulfilling national and state health requirements. The IAEA's findings (where available at the time of publication of this Annual Report) are described in Output 1.1 and Appendix B.

Another focus of ASNO's work was contributing to the Australian Radioactive Waste Agency's (ARWA's) National Radioactive Waste Management Facility (NRWMF) project. ASNO assisted ARWA in their efforts to establish a Common National Inventory for Radioactive Waste which will help ensure the NRWMF can manage the types and quantities of radioactive waste anticipated.

## Nuclear Security Developments

Despite ongoing travel and logistical difficulties due to the COVID–19 pandemic, ASNO conducted eight nuclear security inspections and visits including at ANSTO, SILEX, Ranger and Olympic Dam uranium mines and uranium ore concentrate (UOC) transporters. These are described in detail in Output 1.2.

For the fifth time in succession, Australia ranked first globally on the Nuclear Threat Initiative's (NTI) 2020 Nuclear Security Index[4], having also improved our performance measures since 2018. Australia was ranked first for measures against the theft of nuclear material among 24 states with more than one kilogram of high enriched uranium or separated plutonium. Australia also ranked first out of 47 states for measures to prevent the sabotage of nuclear facilities.

The preparatory process for the Article 16 Conference of States Parties for the Amended Convention on the Physical Protection of Nuclear Material (A/CPPNM) continued in 2020 and 2021. Dr Floyd co-chaired the Preparatory Commission meetings with Mr Vilmos Cserveny of Hungary. Despite the delays in holding the Review Conference, it was heartening to see the desire of all States Parties to the A/CPPNM for a thorough and robust review process. The process was positively concluded in early 2021 and the work will be continued by the designated Co-Presidents of the Review Conference.

## Bilateral Safeguards Developments

During 2020–21, all Australian Obligated Nuclear Material (AONM) was accounted for in accordance with the procedures and standards prescribed in Australia's network of 25 Nuclear Cooperation Agreements (NCAs) covering 43 countries, plus Taiwan.

All NCAs contain treaty level assurances that AONM will be used exclusively for peaceful purposes and be covered by IAEA safeguards. Each NCA also requires that appropriate nuclear security measures are applied to AONM exported overseas, in addition to a number of supplementary conditions.

On 1 January 2021, the new Australia – United Kingdom NCA entered into force, and ASNO has subsequently conducted bilateral transfer reporting with its UK counterpart agency, the Office for Nuclear Regulation. In February 2021, the last export of UOC from ERA's Ranger uranium mine in the Northern Territory was shipped from Australia; and in April 2021, ASNO facilitated the first transfer of AONM, within fuel elements manufactured in Sweden, to Ukraine.

# Chemical Weapons Convention Developments

## Domestic Developments

During the reporting year ASNO submitted timely annual declarations to the OPCW in accordance with the requirements of the CWC. The declarations included details of Australia's CWC-related chemical trade and other relevant chemical activities within industry and laboratories, as well as national programs for assistance and protection against chemical weapons.

ASNO facilitated routine OPCW inspections at Australia's declared Schedule 1 facility for protective purposes in Victoria and at one 'Other Chemical Production Facility' in Queensland. ASNO worked closely with the OPCW Technical Secretariat to facilitate the requirement for the inspectors to quarantine on arrival in Australia. These inspections bring the total number of inspections in Australia to 62 since CWC entry-into-force in 1997. The OPCW

4 https://www.nti.org/analysis/reports/2020-nti-nuclear-security-index/

inspection team confirmed the veracity of Australia's declared information, including amendments made to past declarations. The OPCW inspection team also verified the absence of any undeclared CWC-Schedule 1 chemical production.

ASNO's 2019–20 Annual Report noted the commencement of a software development project to create a new database and portal to support Australia's CWC reporting obligations. Work to replace the current system during the reporting period were unsuccessful; the requirement to develop the system on a different platform was recognised. ASNO will continue to work with DFAT's Information Management and Technology Division to develop a new database system with an industry accessible online portal to improve both the end-user stakeholder experience and the efficiency of ASNO's regulatory function.

ASNO continued to help inform Australia's policy positions through the provision of technical advice on CWC and verification-related issues. Efforts to rid the world of chemical weapons, and to stop the proliferation of weapons of mass destruction more broadly, involve many domestic and international stakeholders operating within a complex and contested strategic environment.

## International Developments

As of June 2021, the CWC has a membership of 193 States Parties, leaving only four countries yet to join: Israel (signed but not ratified), Egypt, the Democratic People's Republic of Korea (DPRK) and South Sudan. Of the member States Parties, 119 (including Australia) have enacted comprehensive implementing legislation required to reduce the threat of the use of chemical weapons including by non-State actors.

The OPCW strives to achieve the goal to eliminate chemical weapons whilst encouraging the use of chemicals for peaceful purposes. To achieve these goals, the OPCW conducts a number of activities with a focus on verification.

The OPCW oversees the destruction of chemical weapons and related sites. The OPCW Inspectorate has conducted over 3000 inspections at chemical weapon related sites including of chemical stockpiles, old chemical weapons, manufacturing facilities and destruction facilities. Since the CWC entered into force in 1997, the OPCW has overseen the destruction of 98.7 per cent of the world's declared chemical weapons stockpiles and ensured that all 97 declared chemical weapons manufacturing facilities have either been destroyed or converted for peaceful purposes.

To facilitate the use of chemicals for peaceful purposes, the OPCW conducts regular inspections of industrial facilities, ensuring that chemicals have not been diverted into the manufacture of chemical weapons. The OPCW inspectorate has conducted 4,134 inspections of industrial chemical facilities in 80 States Parties. These routine inspections ensure that the global chemical industry operates within parameters agreed to by the CWC States Parties. In addition to routine inspections, the OPCW has extended its resources by conducting investigations into allegations of chemical weapons use.

ASNO, as Australia's national authority for the implementation of the CWC, works closely with the OPCW. As the OPCW continues the core work of overseeing the implementation of the CWC worldwide, it has also been challenged by recent uses of chemical weapons: the use of VX in Malaysia in 2017; the use of a Novichok nerve agent in the United Kingdom in 2018; and attributed use of chemical weapons in Syria. Most recently, in August 2020, Russian opposition figure Alexei Navalny was poisoned by a nerve-agent of the Novichok group, a finding that was confirmed by an OPCW Technical Assistance Visit and three independent laboratories. Throughout the 2021–22 reporting period, the OPCW has worked to address these issues whilst continuing to support States Parties through essential training, capacity building and technical assistance.

During the reporting period, the Defence Science and Technology Group (DSTG) Chemical Agents Analysis Facility was accredited by the OPCW as a Designated Laboratory for Environmental Samples,

one of 23 within the OPCW's network of laboratories. DSTG's laboratory has been accredited as an OPCW Designated Laboratory for Biomedical Samples since 2016. The DSTG laboratory is one of 13 within the OPCW network with both accreditations, making it eligible to receive biomedical and environmental samples for analysis following routine or challenge inspections, or to verify incidents of alleged use of chemical warfare agents.

Against the backdrop of the COVID–19 pandemic, technical and logistical challenges have been overcome in convening key meetings such as the Conference of the States Parties (CSP) to the CWC. The 25th CSP was split into two parts in November 2020 and April 2021. The OPCW and States Parties have been able to adapt to the challenges of COVID–19 and continue to progress important CWC issues.

During 2020 and 2021, the OPCW's Fact Finding Mission (FFM) issued two reports on its investigation regarding separate incidents of alleged use of toxic chemicals as a weapon on 1 August 2016 and 24 November 2018. The reports indicated that the available information did not allow the FFM to determine if chemicals were used as weapons or not, on either occasion.

On 12 April 2021 the OPCW Investigation and Identification Team (IIT), which has the mandate to determine responsibility for chemical weapons attacks, released its second report which focused on an incident in Saraqib on 4 February 2018. The IIT based its assessment on interviews with witnesses, review of medical reports, analysis of samples collected from the sites of the incidents, examination of imagery including satellite imagery, and consultation with experts. The IIT concluded that there are reasonable grounds to believe that the Syrian Arab Air Force, under the control of the Tiger Forces, was responsible for dropping the cylinder.

At the 25th Session of the Conference of the States Parties to the CWC, the Conference adopted a Decision to suspend certain rights and privileges of the Syrian Arab Republic pursuant to paragraph 2 of Article XII of the Convention. The Decision was co-sponsored by 46 Member States. Australia supported this decision to urge Syria to come into compliance with its Convention obligations.

Australia has long advocated for State Party consideration of Central Nervous System Acting Chemicals (CNSACS). In March 2021, the Executive Council adopted the decision entitled "Understanding Regarding the Aerosolised Use of Central Nervous System Acting Chemicals for Law Enforcement Purposes". The decision will be considered at the 26th Conference of the States Parties, due to be held in November 2021. The years of consultation with States Parties has resulted in a strong and balanced Executive Council decision which will contribute to a safer world.

In 2017, it was recognised that the OPCW Laboratory and Equipment Store required replacement if it was to continue to support OPCW core capabilities in the evolving chemical weapons threat environment. The OPCW Laboratory and Equipment Store was designed to support OPCW missions and other verification activities, and to support international cooperation and assistance activities. More recently, there has been an increased demand to respond to the emergence of new chemical threats, which requires the development of new and improved verification tools and expanded capabilities to conduct non-routine missions. A plan to replace the current facility with a purpose-built facility was announced in 2017. The new facility, to be known as the ChemTech Centre[5], has an estimated cost of AUD55 million. This cost has already been met by donations from States Parties, including Australia's donation of AUD200,000 in 2020. The main construction contract was signed in April 2021, with construction activities starting in June and operation due to commence at the end of 2022.



5 https://www.opcw.org/media-centre/featured-topics/chemtech-centre, OPCW.

## Comprehensive Nuclear-Test-Ban Treaty

Although the CTBT is not yet in force, it is a uniquely valuable element of the international non-proliferation and disarmament architecture and has strong support in the great majority of countries. More than 90 per cent of International Monitoring System (IMS) facilities are operating, including all those that Australia has committed to host (see Output 1.6). The IMS and the International Data Centre, which provides IMS data and products to Member States, have continued to function well in the face of disruptions caused by COVID–19.

While international travel remained restricted, new ways were found for Member States and their technical experts to meet to advance the work of the CTBTO. Australian experts have continued to engage with the CTBTO using online tools.

A number of important activities have had to be deferred. Every few years the CTBTO conducts field exercises to help test equipment and procedures for conducting an on-site inspection, thereby increasing preparedness for entry into force of the CTBT. These were scheduled to take place in 2020 but may be delayed by up to several years.

## Other Non-Proliferation and Disarmament Activities

### International Partnership for Nuclear Disarmament Verification

The International Partnership for Nuclear Disarmament Verification (IPNDV) was formed in 2015 to bring together both nuclear and non-nuclear weapon states under a cooperative framework to further understand and find solutions to the complex challenges involved in the verification of future nuclear disarmament. IPNDV engages a wide range of states in its work, including three of the five NPT Nuclear Weapons States.

Although physical meetings of IPNDV partners have been disrupted by COVID–19, the commitment and enthusiasm of partner countries to advance this area of work remained strong. During the reporting period, two virtual exercises were conducted to test and refine inspection concepts around a detailed fictional scenario. In that scenario, a state commits to verifiably dismantle a significant proportion of its nuclear warheads. Ongoing work is carried out by two task groups and a ‘technology stream’. During the year, ASNO’s Malcolm Coxhead replaced Dr Floyd as a co-chair of one of the task groups.

### Fissile Material Cut-Off Treaty (FMCT)

A verifiable ban on production of fissile material for use in nuclear weapons is widely seen as one of the practical steps that could be taken toward nuclear disarmament. However, an impasse in the Conference on Disarmament (CD) has prevented negotiations on a fissile material cut-off treaty (FMCT). Australia has actively supported initiatives to advance international discussions on an FMCT, both to promote the commencement of negotiations, and to develop proposals that could assist negotiators. ASNO continues to support efforts by DFAT to advance these objectives.

# The Year Ahead

Australia regards the CTBT as a critical element of the multilateral non-proliferation and disarmament architecture and continues to provide significant political and practical support to promote entry into force of the treaty and to advance the work of the CTBTO. ASNO looks forward to working with Dr Floyd as CTBTO Executive Secretary.

International engagement to advance non-proliferation and disarmament has faced significant challenges since the global spread of COVID–19. ASNO continues to contribute to online activities in support of the CTBTO and IPNDV and to prepare for new activities that will help recovery following COVID-enforced delays.

Australia was nominated during the reporting period to participate in a UN-mandated Group of Government Experts on Nuclear Disarmament Verification. Although the dates of meetings for the Group are not clear at time of publication, ASNO expects to make a significant contribution to that work.

ASNO will continue to implement Australia's bilateral nuclear cooperation agreements (NCAs) and liaise with partners to streamline relevant accounting procedures and processes where possible. Administrative Arrangements (implementation documents pursuant to NCAs) will be updated as needed to ensure they reflect current working practices.

ASNO will continue to modernise security practices to facilitate the efficient and secure exchange of information with counterparts. While COVID–19 may prohibit face-to-face engagements and meetings with counterparts, we will seek to cooperate with overseas counterparts using alternative meeting methods.

ASNO will continue the development of the Nuclear Material Balance and Tracking (NUMBAT) database to improve the efficiency of its regulatory activities.

2022 will be the 25th anniversary of the CWC. Australia will continue to work closely with the OPCW, including in the capacity of Executive Council member until May 2022.

A key challenge for ASNO over the coming year will be assisting with the development and implementation of a new chemical database to support Australia's reporting obligations under the CWC. ASNO will continue to work to develop a new chemical database system with an industry access online portal.

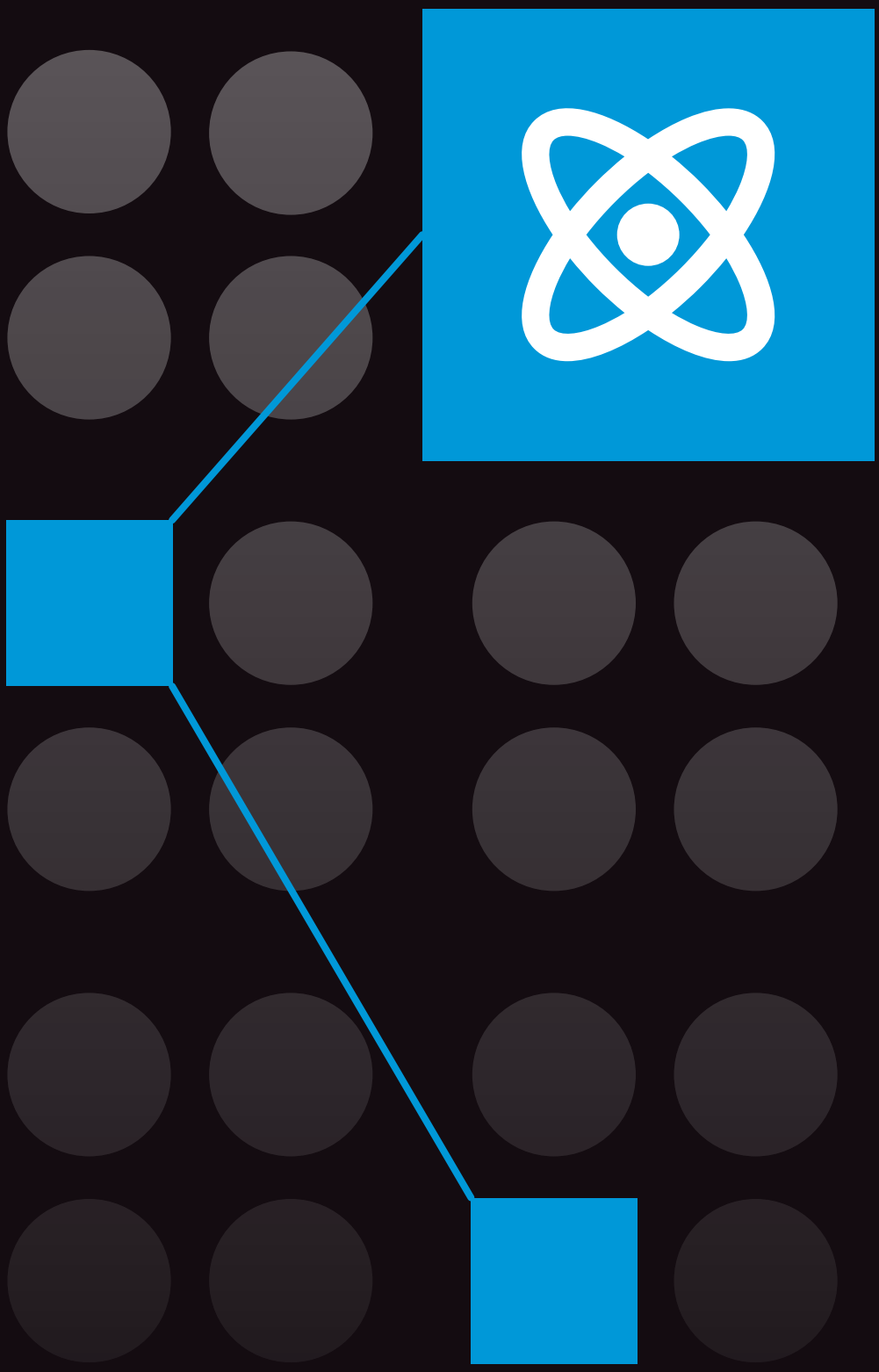
ASNO will continue its efforts to promote effective safeguards implementation internationally, through its leadership role in the Asia-Pacific Safeguards Network (APSN).

ASNO will work with the IAEA and key nuclear stakeholders to facilitate international inspections while navigating the ever-changing dynamics of the COVID–19 pandemic.

Regarding domestic nuclear security, ASNO will focus on the review of the Periodic Safety and Security Review of the OPAL reactor and support the major review of the ANSTO permit to possess nuclear material. We will continue oversight of associated technology and uranium ore concentrate storage and transport.

Internationally, ASNO continues to support preparations for the 2022 Review Conference of the Amended Convention on the Physical Protection of Nuclear Material. We will continue to engage in the Nuclear Security Contact Group and the Nuclear Security Guidance Committee.


Australia's Permanent Representative, Ambassador Matthew Neuhaus, at the OPCW's 97th Executive Council Meeting, 6-9 July 2021. (Photo courtesy OPCW Flickr)



SECTION 2

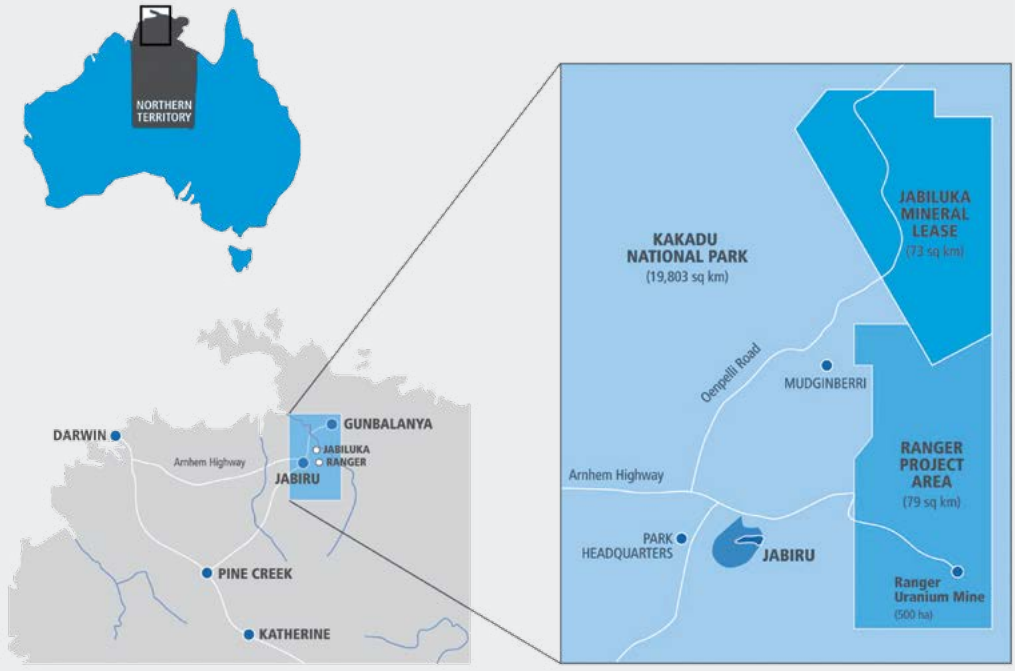
# CURRENT TOPICS

# Ranger Uranium Mine – The End of an Era

Australia has approximately one third of the world's uranium resources and in 2020 was the world's second ranking producer. Until 8 January 2021, there were three operational uranium mines in Australia: Ranger in the Northern Territory (NT), and Olympic Dam and Beverley Four Mile in South Australia. That number has now been reduced with the cessation of mining and processing activities at Ranger Mine in January 2021.

Ranger Mine was Australia's longest continually operating uranium mine, which provided international customers in the global energy market with a safe and reliable supply of uranium ore concentrate ($U_3O_8$, or UOC) for the four decades since production began. Ranger Mine produced in excess of 132,000 tonnes of UOC, making it one of three mines in the world to produce more than 120,000 tonnes. Approximately half of all the UOC exported by Australia was produced by the Ranger Mine. Ranger has also been a major local employer, catalyst for the establishment of the town of Jabiru and significantly underpinned the local economy.

**Figure 1: Location of the ERA Ranger Mine in the Northern Territory.**




Courtesy: ERA Annual Report 2019, https://www.energyres.com.au/uploads/docs/2019_Annual_Report.pdf

Ranger Mine played a key role in Australia's uranium industry over the past 50 years. The Ranger ore bodies were discovered in 1969 by the Electrolytic Zinc Company of Australasia and Peko-Wallsend Operations Limited. In 1980, Energy Resources of Australia (ERA) was established and floated on the Australian Stock Exchange in what was at the time the largest public float in Australian history.

Mine operations commenced in 1981 and the first drum of uranium oxide was produced in the same year, using ore from the open cut mine, Pit 1. Mining of Pit 1 finished in December 1994, having yielded 19.78 million tonnes of ore. Mining from Pit 3 commenced in July 1997 and concluded in November 2012.

Ranger Mine processing facilities: An aerial view of the Ranger Mine during operation showing the processing facilities in the foreground and the stockpiles in the background. (Courtesy ERA, https://www.energyres.com.au/media/gallery/)

The Ranger Mine operational infrastructure lies within the 79 square kilometre Ranger Project Area, which is located eight kilometres east of Jabiru and 260 kilometres east of Darwin, NT. The Ranger mine is on Aboriginal land, with the Mirarr people the traditional owners. ERA has access to the Ranger Project Area under a suite of agreements with and between the Commonwealth Government and the Northern Land Council. The Ranger Project Area is located in the Alligator Rivers Region and is surrounded by the World Heritage-listed Kakadu National Park. ERA's Mine Closure Plan details the rehabilitation activities it will conduct by January 2026, before transitioning into a post-works monitoring program.

## Regulatory Activities

The Australian Safeguards and Non-Proliferation Office (ASNO) oversees the protection of Australia's nuclear facilities, nuclear material and associated items against unauthorised access and sabotage, including Australia's uranium destined to be sent overseas. Throughout the years of Ranger Mine operation, ASNO has undertaken a suite of regulatory activities, with the co-operation of the mine, to ensure that national and international requirements are met.

ASNO operates Australia's state system of accounting for and control of nuclear material in accordance with Australia's Comprehensive Safeguards Agreement and Additional Protocol with the International Atomic Energy Agency (IAEA) and specific enabling national legislation.

The IAEA conducted inspections at Ranger Mine four times, in 1999, 2009, 2012 and 2017, in accordance with standard arrangements under Australia's Comprehensive Safeguards Agreement and the Additional Protocol. In March 2017 for example, an inspection was conducted at the Ranger uranium mine and ASNO officers facilitated access for the IAEA inspectors in accordance with conditions specified in ERA's permits issued under the *Nuclear Non-Proliferation (Safeguards) Act* 1987. ASNO staff accompanied the IAEA inspectors during all activities.

ASNO and IAEA inspectors at Ranger Uranium Mine during the March 2017 inspection.

ASNO also periodically conducted routine inspections of the Ranger uranium mine security and accountancy arrangements as required by the permit issued under the *Safeguards Act*, for example in 2017 and 2019. Such inspections included a review of security roles, responsibilities and plans, transport procedures, risk management, access and accountancy of uranium ore concentrate.

The Ranger uranium mine exported its last shipment of uranium ore concentrate in 2021 and the mine is currently in decommissioning. ASNO is continuing in its regulatory role during this process including granting of a permit to decommission a facility. ASNO's focus during decommissioning is to ensure the removal of nuclear safeguarded material and that the plant is unable to produce more UOC following the removal of equipment and reagents. ASNO inspected the mine in June 2021 to confirm that the decommissioning process was well underway and that safeguarded material was being appropriately handled.


Ranger Mine decommissioning underway during June 2021 inspection.
*Top left*: Counter-current decanters empty and clean. *Top right*: product pad empty. *Bottom left*: milling area decommissioned and flushed. *Bottom* right: decommissioned areas clearly indicated.

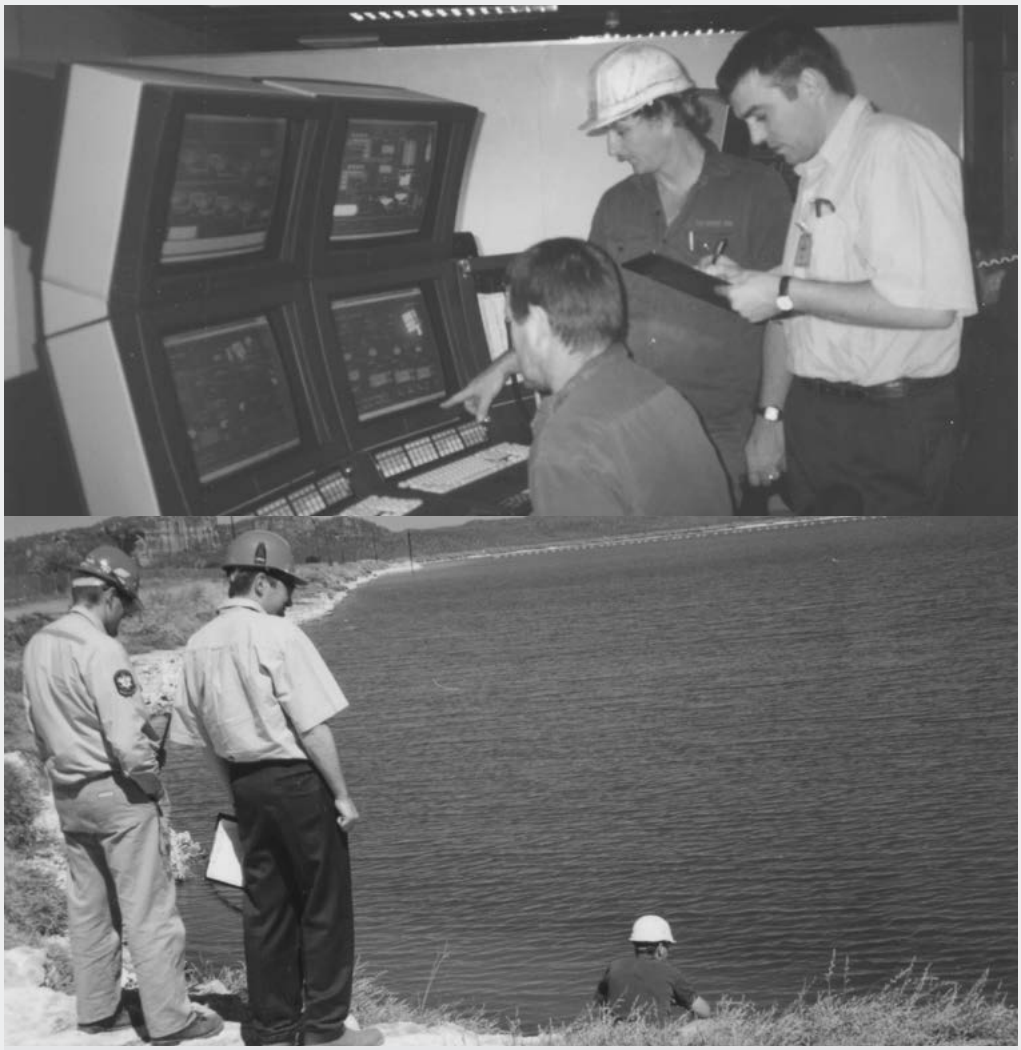
ASNO inspectors at Ranger Uranium Mine, June 2021 for inspection of decommissioning activities.

Australia's uranium export policy (see Uranium Exports and Production) was announced in 1977, prior to the opening of the Ranger Mine in 1981. A key element of that policy is that uranium can only be exported to countries that have a bilateral nuclear cooperation agreement (NCA) with Australia; all uranium exported from the Ranger Mine has been subject to these agreements. Australian uranium and nuclear material generated through the use of that uranium is designated as Australian Obligated Nuclear Material (AONM) and subject to obligations pursuant to Australia's bilateral NCAs. Energy Resources of Australia had a sales and marketing agreement with Rio Tinto Uranium pursuant to which ERA's product was sold to international power utilities under strict international and Australian Government safeguards thereby ensuring that Australian uranium is only used for peaceful purposes.

Throughout the operation of the Ranger Mine, ERA contributed to the development of safeguards and non-proliferation expertise both domestically and internationally. ERA has supported Australia's nuclear safeguards and non-proliferation objectives by hosting site visits and delegations from bilateral partners. Ranger Mine has also provided both data and samples to safeguards and security focused research projects, including projects managed through the Australian Safeguards Support Program (one of 21 programs established by IAEA Member States to assist the IAEA in safeguards research and development). These contributions influenced the development of international approaches to safeguarding uranium mines and promoted, globally, Australia's best practice regulation of nuclear safeguards and nuclear security for the uranium industry.

The IAEA's visit to Ranger in 1999 was the first ever complementary access inspection under the new Additional Protocol arrangements, which Australia was the first country to sign in December 1997. Given the short notice, only circuitous flights from Sydney to Darwin via Brisbane and Cairns could be organised. The drive to the accommodation selected by the inspectors took a further two hours but was still 50 km from the Ranger mine at Jabiru. Later, the inspectors explained that the motel had looked much closer to Jabiru on the maps obtained from the Internet which they had used for planning purposes back in Vienna.[1]

Over its 41-year operating history, ERA exported more than 133,000 tonnes of UOC, in a total of 829 shipments to 12 different converters in nine countries. These exports would have produced electricity equivalent to half of Australia's generation over that time.



IAEA inspector taking notes from the Ranger Mine control board and collecting samples from the tailings dam during a complementary access inspection under the Additional Protocol on 28 June 1999. (Photos courtesy of ERA).

1 https://www.dfat.gov.au/about-us/publications/international-relations/asno-annual-report-1998-1999/index.html/asno-annual-report-1998-99/ct_iaea.html

# The Australian Safeguards Support Program: Supporting the IAEA since 1980

For over 40 years, the Australian Safeguards Support Program (ASSP) has made niche contributions to the IAEA's safeguards mission in areas such as developing safeguards technology and approaches, delivering safeguards training, and providing technical services. Under the coordination of ASNO, the ASSP helps the IAEA keep pace with evolving challenges in verification, as well as opportunities from emerging technologies and analytical techniques.

Today, the ASSP is one of 21 programs established by IAEA Member States and the European Commission to assist the Agency to continuously strengthen the effectiveness and improve the efficiency of safeguards. Since the IAEA has limited capacity and facilities for research and development on new safeguards tools, provision of safeguards training, and analysis of samples collected during inspection, the Agency relies heavily on these Member State Support Programs.

The ASSP does not currently have a dedicated budget, instead relying on the dedication of Australian government agencies, ANSTO, CSIRO, other research institutes and universities with specialised expertise. These organisations have forged long-standing and mutually beneficial partnerships with the IAEA.

In 1980, Australia formally announced the establishment of the ASSP (then referred to as the Bilateral Australian Assistance Program) to the IAEA Board of Governors. At the time, Australia contributed to the development of approaches to safeguards inspections for gaseous centrifuge enrichment plants through the Hexapartite Safeguards Project with the IAEA, EURATOM and 5 other IAEA Member States. During the early years of the Program, the Australian Atomic Energy Commission also provided advice to the IAEA on implementation of new technology, including the IAEA's Computerised Safeguards Information System.

Throughout the 1980s, the ASSP peer reviewed papers on the development of criteria for attainment of IAEA inspection goals at nuclear facilities. This enabled the IAEA to plan inspections in a manner that ensures a high probability of detecting diversion of nuclear material while minimising costs and burdens on states, even as the quantity of nuclear material and the number of nuclear facilities under IAEA safeguards increases.

Following the revelations regarding the nuclear programs of Iraq and the DPRK in the early 1990s, the IAEA began working with Member States on strengthening safeguards. The ASSP supported the strengthening of safeguards, particularly through Australia's hosting of trials of new safeguards techniques, such as environmental sampling, which is in wide use by IAEA safeguards inspectors today.

As part of the ASSP, Australia has provided expert input to the drafting of the IAEA's Physical Model, a series of volumes first developed in the 1990s to describe the components of the nuclear fuel cycle.

The Physical Model acts as a tool for identifying indicators of the existence or development of nuclear activities and for assessing the proliferation significance of questions or inconsistencies arising in safeguards implementation. Experts from ANSTO, ASNO, other government agencies, and private companies have contributed to the development and review of the Physical Model, particularly Volume 1 on uranium mining/milling and Volume 3 on uranium enrichment.

In recent years, the IAEA has also worked with Member States to conduct broad searches of emerging technologies developing outside the traditional safeguards community that could be applied to safeguards practices. In 2013, ASNO invited CSIRO to participate in the IAEA Workshop "Scanning the Horizon: Novel Techniques and Methods for Safeguards" in Vienna. During the workshop the IAEA was particularly interested in CSIRO's recent invention of the Zebedee hand-held 3D laser mapping device. After a period of field testing, the IAEA began using the Zebedee in safeguards inspections in 2016 and it has proven particularly useful for verifying the design of nuclear facilities and calculating volumes of large objects or stockpiles of material.


*Top left:* The "Zebedee" – a hand-held 3D laser mapping device developed by CSIRO, which the IAEA uses in nuclear safeguards inspections. *Top right:* A "Zebedee" map of the Opéra-Théâtre de Clermont-Ferrand, used to demonstrate the potential applications of the device. *Bottom:* In 2017 ASNO brought the IAEA and CSIRO together to conduct the Robotic Challenge, where teams tested their robots' abilities to assist IAEA inspectors in performing safeguards tasks.

CSIRO went on to host the IAEA's crowdsourcing Robotics Challenge in 2017, which saw robotics experts from around the world build their own robots to assist IAEA inspectors by automating lengthy or repetitive verification tasks. CSIRO is now working with the IAEA and the winners of the Robotics Challenges on a control module for a robot designed to verify spent fuel from nuclear reactors (see Output 1.4).

Australia's universities are also playing an important role by conducting research on potential safeguards applications of new technologies, such as blockchain and machine learning. In 2018, a team of researchers at the Faculty of Engineering, University of New South Wales (UNSW) developed a blockchain (shared ledger) platform for recording nuclear material accounting data based on ASNO's existing centralised NUclear Material Balance and Tracking (NUMBAT) database. Their platform 'Shared-Ledger nUclear Material Balance and Tracking' (SLUMBAT) allowed testers to perform the roles of hypothetical nuclear operators, transporters and regulatory authorities and enter transactions involving hypothetical nuclear material into an encrypted blockchain. It demonstrated potential advantages of blockchain platforms in terms of data integrity, traceability and efficiency in tracking complex chains of transactions for data held among nuclear operators and regulators. Research on the potential applications of blockchain technology for nuclear safeguards information management, nuclear security and export controls is continuing as a partnership between the Finnish Radiation and Nuclear Safety Authority (STUK), the Stimson Center in the US and UNSW.

Through the ASSP, ANSTO and the University of Western Australia have made long-standing contributions by analysing environmental samples from IAEA inspections, as part of the IAEA's Network of Analytical Laboratories. Australian government agencies, including ASNO, also work with the IAEA regularly on provision of safeguards training (both to the Agency and to other Member States) and on development of safeguards concepts and guidance, particularly within the framework of State-level approaches to safeguards implementation. These and other ongoing ASSP projects are summarised in Output 1.4.

The cooperation between the IAEA, the ASSP and other Member State Support Programs also helps Australia cultivate a core of professionals with expertise in safeguards, as well as related fields such as nuclear forensics. The ASSP has also provided a mechanism for Australia to help shape developments in safeguards, particularly where they may impact Australian industries.

# Uranium Exports and Production

**Table 1: UOC ($U_3O_8$) export and nuclear electricity statistics**

| Item | Data |
|---|---|
| Total Australian UOC exports 2020–21 | 6,166 tonnes |
| Value Australian UOC exports | $606 million |
| Australian exports as percentage of world uranium requirements[2] | 7.6% |
| Number of reactors (GWe) these exports could power[3] | 30.9 |
| Power generated by these exports | 196 TWh |
| Expressed as percentage of total Australian electricity production[4] | 73.5% |

Australia has around one third of the world's uranium resources. Due to COVID–19 related closures in other uranium producing countries, Australia became the world's second ranking producer of uranium ore concentrate (UOC) in the 2020 calendar year, behind only Kazakhstan.[5] As at 30 June 2021, there are two operating Australian uranium mines – Olympic Dam and Beverley/Four Mile in South Australia. Mining operations at the Ranger uranium mine in the Northern Territory closed on 7 January 2021.[6] The Honeymoon uranium mine has remained in care and maintenance throughout the reporting period.

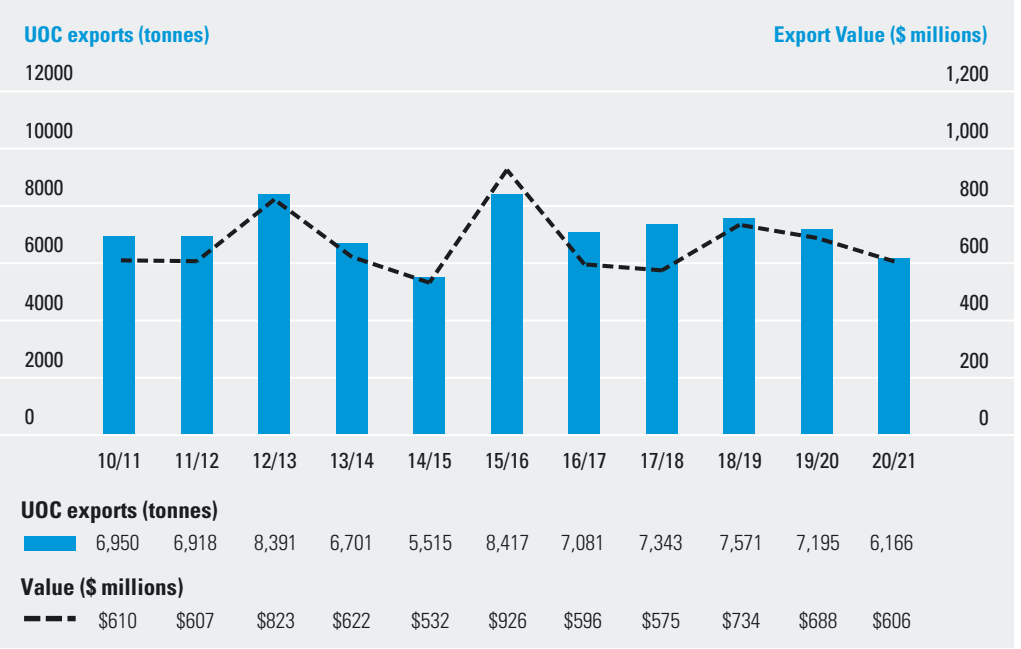
Like most major global commodities, the uranium industry has been impacted by the COVID–19 pandemic. Global production of uranium decreased in 2020 and this is likely to continue throughout 2021.

Since April 2020, Canada's Cigar Lake uranium mine in Saskatchewan has experienced two extended shutdown periods[7] and Kazakhstan's Kazatomprom announced a reduction of 15 per cent on 2019 production figures, as they both prioritised the safety of employees during the pandemic.[8]

2 Based on July 2021 world requirements of 68,269 tonnes U, from the World Nuclear Association's World Nuclear Power Reactors & Uranium Requirements.
3 Based on a comparison of GWe of nuclear electricity capacity and uranium required, for countries eligible to use AONM, from the World Nuclear Association's World Nuclear Power Reactors & Uranium Requirements, July 2021.
4 Based on Australia's electricity generation in calendar year of 2020 of 265.232 TWh from the Department of Industry, Science, Energy and Resources, 2020 Australian Energy Statistics, September 2020.
5 In 2020, Namibia produced 5,413 tU and Canada less than 2,000 tU (5 million pounds $U_3O_8$), where Australia produced 6,202 tU https://world-nuclear.org/information-library/country-profiles/countries-g-n/namibia.aspx
6 While Ranger ceased production on 7 January 2021, ERA continued to export UOC already produced until February 2021.
7 https://www.world-nuclear-news.org/Articles/Cameco-increases-uranium-purchases-to-meet-contrac
8 https://www.world-nuclear-news.org/Articles/Kazatomprom-put-health-before-profit-during-pandem

While Australian mines fared better than many of their international counterparts, Australian uranium producers were still impacted. In 2020–21, Australian uranium exports dropped 14 per cent, primarily due to reduced production and delays caused by international shipping and downstream facility closures. The impact of the closure of the Ranger mine will not be fully felt until the 2021–22 reporting period, as ERA compressed its production and export schedule to meet the closure deadline.

### Figure 2: Quantity and value of Australian UOC ($U_3O_8$) exports from 2010–11 to 2020–21



## Australia's Nuclear Safeguards Policy

The Australian Government's uranium policy limits the export of Australian uranium to countries that: are a party to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT);[9] have a Safeguards Agreement and Additional Protocol with the IAEA in force; and are within Australia's network of bilateral nuclear cooperation agreements. These nuclear cooperation agreements are designed to ensure IAEA safeguards and appropriate nuclear security measures are applied to AONM (Australian Obligated Nuclear Material) exported overseas, in addition to several supplementary conditions. Nuclear material subject to the provisions of an Australian nuclear cooperation agreement is known as AONM. The obligations of Australia's agreements apply to uranium as it moves through the different stages of the nuclear fuel cycle, and to nuclear material generated using that uranium.

All Australia's nuclear cooperation agreements contain treaty-level assurances that AONM will be used exclusively for peaceful purposes and will be covered by safeguards arrangements under each country's safeguards agreement with the IAEA. In the case of non-nuclear-weapon states, it is a minimum requirement that IAEA safeguards apply to all existing and future nuclear material and activities in that country. In the case of nuclear-weapon states, AONM must be covered by safeguards arrangements under that country's safeguards agreement with the IAEA, and is limited to use for civil (i.e. non-military) purposes.

The principal conditions for the use of AONM set out in Australia's nuclear cooperation agreements are:

- AONM will be used only for peaceful purposes and will not be diverted to military or explosive purposes (here 'military purpose' includes: nuclear weapons; any nuclear explosive device; military nuclear reactors; military propulsion; depleted uranium munitions; and tritium production for nuclear weapons)
- IAEA safeguards will apply
- Australia's prior consent will be sought for transfers of AONM to third parties, enrichment to 20 per cent or more in the isotope $^{235}U$, and reprocessing[10]
- Fall-back safeguards or contingency arrangements will apply if for any reason NPT or IAEA safeguards cease to apply in the country concerned
- internationally agreed standards of physical security will be applied to AONM in the country concerned
- detailed administrative arrangements will apply between ASNO and its counterpart organisation, setting out the procedures to apply in accounting for AONM
- regular consultations on the operation of the agreement will be undertaken and
- provision will be made for the removal of AONM in the event of a breach of the agreement.

Australia currently has 25 bilateral nuclear cooperation agreements in force, covering 43 countries plus Taiwan.[11]

9 On October 2012, the Australian Government announced that it would exempt India from its policy allowing supply of Australian uranium only to those States that are Parties to the NPT.

10 Australia has given reprocessing consent on a programmatic basis to EURATOM and Japan. Separated Australian-obligated plutonium is intended for blending with uranium into mixed oxide fuel (MOX) for further use for nuclear power generation.

11 Euratom is the European Atomic Energy Community. The Australia-Euratom NCA covers all 27 Member States of the European Union, and included the United Kingdom until 1 January 2021 when the bilateral Australia-UK agreement entered into force.

## Accounting for Australian Uranium

Australia's bilateral partners holding AONM are required to maintain detailed records of transactions involving AONM. In addition, counterpart organisations in bilateral partner countries are required to submit regular reports, consent requests, and transfer and receipt documentation to ASNO.

ASNO accounts for AONM on the basis of information and knowledge including:

- reports from each bilateral partner
- shipping and transfer documentation
- calculations of process losses, nuclear consumption, and nuclear production
- knowledge of the fuel cycle in each country
- regular liaison with, and reconciliation and bilateral visits to counterpart organisations
- regular liaison with industry and
- IAEA safeguards activities and IAEA conclusions on each country.

## Australia's Uranium Transhipment Security Policy

For States with which Australia does not have a bilateral nuclear cooperation agreement in force, but through which Australian uranium ore concentrates (UOC) are transhipped, there must be arrangements in place with those States to ensure the security of UOC during transhipment. If the State:

- is a party to the Convention on the Physical Protection of Nuclear Material (CPPNM)
- has a safeguards agreement and adopted the IAEA's Additional Protocol on strengthened safeguards and
- acts in accordance with these agreements;

then arrangements on appropriate security can be set out in an instrument with less than treaty status.[12] Any arrangements of this kind are subject to risk assessments of port security. For States that do not meet the above requirements, treaty-level arrangements on appropriate security may be required.

A characteristic of the nuclear fuel cycle is the international interdependence of facility operators and power utilities. It is unusual for a country to be entirely self-contained in the processing of uranium for civil use. Even in nuclear-weapon states, power utilities will often go to other countries seeking the most favourable terms for uranium processing and enrichment. It would not be unusual, for example, for a Japanese utility buying Australian uranium to have the uranium converted to uranium hexafluoride in Canada, enriched in France, fabricated into fuel in Japan and reprocessed in the United Kingdom.

The international flow of nuclear material means that nuclear materials are routinely mixed during processes such as conversion and enrichment, and as such cannot be separated by origin thereafter. Therefore, tracking of individual uranium atoms is impossible. Since nuclear material is fungible—that is, any given atom is the same as any other—a uranium exporter can ensure its exports do not contribute to military applications by applying safeguards obligations to the overall quantity of material it exports.

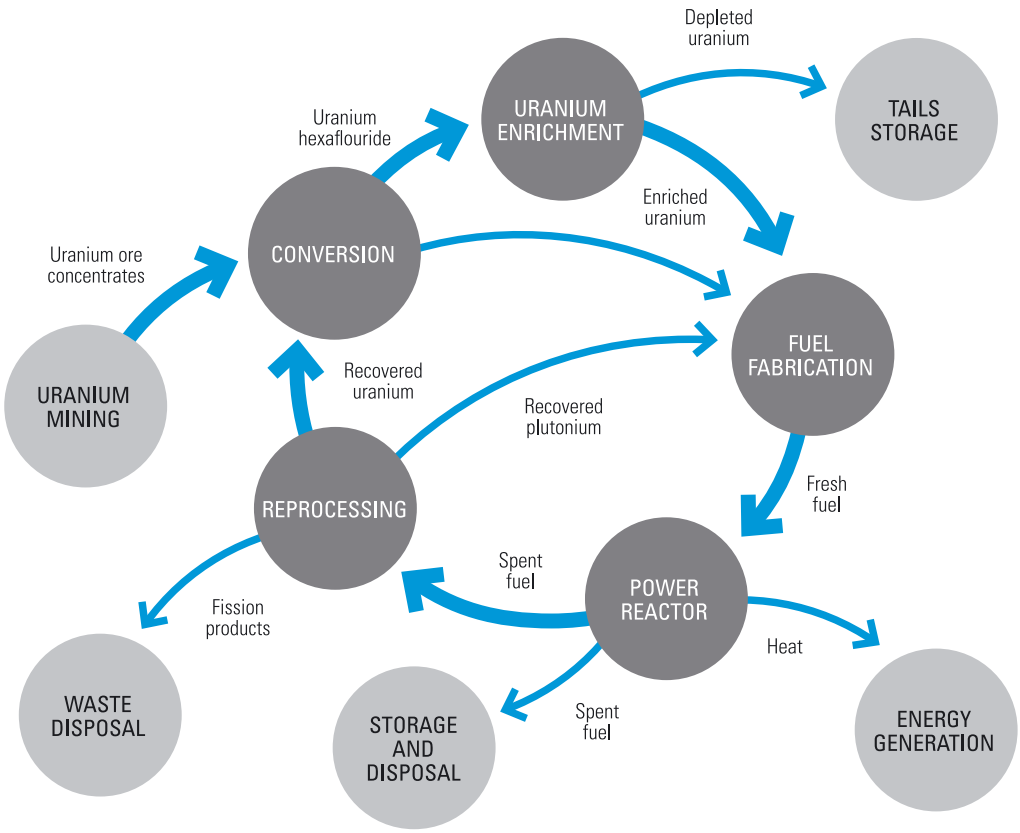


12 See page 26 of ASNO's 2008–09 Annual Report for more details on the establishment of this policy.

This practice of tracking quantities rather than atoms has led to the establishment of universal conventions for the industry, known as the principles of equivalence and proportionality. The equivalence principle provides that, where AONM loses its separate identity because of process characteristics (e.g. mixing), an equivalent quantity of that material is designated as AONM. These equivalent quantities may be derived by calculation, measurement or from operating plant parameters. The equivalence principle does not permit substitution by a lower quality material.

The proportionality principle provides that where AONM is mixed with other nuclear material and is then processed or irradiated, a corresponding proportion of the resulting material will be regarded as AONM.

**Figure 3: Civil Nuclear Fuel Cycle**



SECTION 3

# OVERVIEW OF ASNO

# Goal

The goal of ASNO is to enhance Australian and international security through activities which contribute to effective regimes against the proliferation of nuclear and chemical weapons.

# Functions

The principal focus of ASNO's work is on international and domestic activities to prevent the proliferation of nuclear and chemical weapons. Thus, ASNO's work relates directly to international and national security. ASNO performs domestic regulatory functions to ensure that Australia complies with its treaty commitments and that the public is protected through the application of high standards of safeguards and physical protection to nuclear materials and facilities. ASNO also works to strengthen the effectiveness of relevant treaty regimes through the application of specialist knowledge to complex policy problems in technical areas, including treaty verification and compliance.

The *Non-Proliferation Legislation Amendment Act 2003* enabled the offices of the national authority for safeguards, the national authority for the Chemical Weapons Convention (CWC) and the national authority for the Comprehensive Nuclear-Test-Ban Treaty (CTBT) to be formally consolidated under a common title, named the Australian Safeguards and Non-Proliferation Office (ASNO). The legislation also enabled the titles of each of the directors of the three national authorities to be combined as the Director General ASNO.

## Nuclear Safeguards Functions

Entering into force in March 1970, the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) is the cornerstone of the international nuclear non-proliferation regime and considered to be one of the United Nations' most successful multilateral treaties. The NPT has become almost universal, with 191 Parties. India, Israel, Pakistan and South Sudan have never joined the NPT. The Democratic People's Republic of Korea (DPRK) was purported to withdraw from the NPT in 2003.

Under the NPT, non-nuclear-weapon states (NNWS) agree not to receive, manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices. The five nuclear-weapons states (NWS) agree not to transfer nuclear weapons or other nuclear explosive devices, and not in any way to assist, encourage or induce an NNWS to manufacture or otherwise acquire nuclear weapons.

### The *Nuclear Non-Proliferation (Safeguards) Act 1987*

The *Nuclear Non-Proliferation (Safeguards) Act 1987* (Safeguards Act), which took effect on 31 March 1987, forms the legislative basis for ASNO's nuclear safeguards and security activities across Australia.

The Safeguards Act gives effect to Australia's obligations under:

- the NPT
- Australia's Comprehensive Safeguards Agreement and Additional Protocol with the IAEA
- agreements between Australia and various countries (and Euratom) concerning transfers of nuclear items and cooperation in peaceful uses of nuclear energy
- the Amended Convention on the Physical Protection of Nuclear Material (A/CPPNM) and
- the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT).

The Safeguards Act also establishes a system for control over nuclear material and associated items in Australia through requirements for permits for their possession and transport. Communication of information contained in sensitive nuclear technology is also controlled through the grant of authorities.

The functions of ASNO and the Director General ASNO are set out in Part IV of the Safeguards Act and include:

- ensuring the effective operation of the Australian safeguards system
- ensuring the physical protection and security of nuclear material and items in Australia
- carrying out Australia's obligations under Australia's safeguards agreement and Additional Protocol with the IAEA
- carrying out Australia's obligations under Australia's nuclear cooperation agreements with other countries and Euratom
- operating Australia's bilateral nuclear cooperation agreements and monitoring compliance with the provisions of these agreements
- undertaking, coordinating and facilitating research and development in relation to safeguards and
- advising the Minister for Foreign Affairs on matters relating to the international nuclear non-proliferation regime and the international safeguards system.

## Comprehensive Nuclear-Test-Ban Treaty Functions

Article IV of the Comprehensive Nuclear-Test-Ban Treaty (CTBT) provides that its verification regime shall be capable of meeting the requirements of the Treaty when it enters into force. This has required a substantial program of preparation in advance of the Treaty's entry into force.

To make the necessary preparations, a Preparatory Commission for the CTBT Organization (CTBTO) was established in 1997, made up of CTBT States Signatories and supported by a Provisional Technical Secretariat. The tasks of the CTBTO include the establishment and provisional operation of an International Monitoring System (IMS) comprising 337 facilities around the world and an International Data Centre in Vienna. The CTBTO must also establish a capability to conduct an on-site inspection if concerns are raised about a possible nuclear explosion.

ASNO is Australia's designated national authority for the CTBT. This role is one of liaison and facilitation to ensure that the IMS is established efficiently and relevant domestic arrangements are in place.

ASNO makes a strong contribution on behalf of Australia to the overall work of

the CTBTO to develop the CTBT verification regime. ASNO also assists DFAT with efforts to encourage ratification of the CTBT by countries that have not yet done so.

ASNO's key CTBT functions include:

- national point of contact for liaison on CTBT implementation
- establishing and maintaining legal, administrative and financial mechanisms to give effect to the CTBT in Australia
- coordinating the operation of IMS facilities in Australia, and of measures to enable Australia to effectively monitor and analyse IMS and other CTBT verification data
- contributing to the development of Treaty verification, through the CTBTO and its working groups and
- participating in development and implementation of Australian policy relevant to the CTBT.

## *Comprehensive Nuclear-Test-Ban Treaty Act 1998*

The *Comprehensive Nuclear-Test-Ban Treaty Act 1998* (CTBT Act) gives effect to Australia's obligations as a Party to the CTBT. It prohibits the causing of any nuclear explosion at any place within Australian jurisdiction or control and establishes a penalty of life imprisonment for an offence against this prohibition. The CTBT Act also prohibits Australian nationals from causing a nuclear explosion in any other place.

The CTBT Act requires the Australian Government to facilitate verification of compliance with CTBT provisions, including the obligation to arrange for the establishment and operation of Australian IMS stations and the provision of data from these. It provides the Government with the authority to establish IMS stations and to make provision for access to them for CTBT monitoring purposes. The CTBT Act makes provision for the Minister for Foreign Affairs to enter into arrangements with the CTBT Organization to facilitate cooperation in relation to monitoring stations under Australian control.

Article IV of the Treaty obliges States Parties to allow CTBT inspectors to inspect any place within their jurisdiction or control in an on-site inspection. The CTBT Act provides comprehensive powers for inspection arrangements, including the right for inspectors to gather information, to collect and remove samples, and to apply a range of monitoring and sensing techniques over a designated area. Access to locations by inspectors is by consent of the occupier of any premises, or by warrant issued by a magistrate.

The CTBT Act was assented to on 2 July 1998. On 11 June 2004, sections 3 to 9, 48 to 50, 62 to 65, 68 to 72, 74, 75 and 78; and Schedule 1 to the CTBT Act came into effect following proclamation by the Governor-General. Other provisions will come into effect with the entry into force of the CTBT. The proclaimed provisions were to:

- create the offence of causing a nuclear weapons test explosion, or any other nuclear explosion
- provide a framework for the establishment and operation of IMS facilities in Australia and
- a legal basis for the functioning of Australia's CTBT national authority.

# Chemical Weapons Convention Functions

The Convention on the Development, Production, Stockpiling and Use of Chemical Weapons and their Destruction (or CWC) prohibits the development, production, acquisition, stockpiling, retention, transfer and use of chemical weapons. Its verification regime is based on declarations by States Parties of facilities and activities dealing with particular chemicals, and on confirmation of compliance through on-site inspections.

ASNO acts as the primary liaison between domestic CWC stakeholders (such as declared chemical facilities), the Organisation for the Prohibition of Chemical Weapons (OPCW), and the national authorities of other States Parties.

Through a system of permits and notifications under the *Chemical Weapons (Prohibition) Act 1994* and the *Customs (Prohibited Imports) Regulations 1956*, ASNO gathers information from the chemical industry, traders, universities and research institutions to compile declarations that Australia must submit to the OPCW. ASNO has the right to conduct compliance inspections of relevant facilities in Australia. ASNO conducts outreach activities, including site visits, to promote compliance and to check the accuracy of information provided by industry.

The OPCW conducts routine inspections of facilities listed in Australia's CWC declarations. ASNO facilitates these inspections to ensure Australia's obligations are met, and to protect the rights of facility operators.

ASNO promotes effective international implementation of the CWC, particularly in Australia's region. It works with the OPCW and other States Parties to formulate policy and provide practical implementation assistance.

ASNO's key CWC functions are:

- Australia's point of contact for liaison on CWC implementation
- identifying and gathering information on industrial chemical facilities and other activities required to be declared to the OPCW
- preparing for and facilitating OPCW inspections in Australia
- promoting awareness and effective implementation of the CWC, both domestically and internationally
- providing technical and policy advice to Government and
- administering and developing related regulatory and administrative mechanisms.

## *Chemical Weapons (Prohibition) Act 1994*

The *Chemical Weapons (Prohibition) Act 1994* (CWP Act) was enacted on 25 February 1994. Division 1 of Part 7 of the CWP Act (establishing Australia's national authority for the CWC, and the position of its Director), and sections 95, 96, 97, 99, 102, 103 and 104 were proclaimed on 15 February 1995. Other provisions of the CWP Act which expressly relied on the CWC came into effect on 29 April 1997 when the CWC entered into force. The final parts of the CWP Act, dealing with routine compliance inspections of Other Chemical Production Facilities, came into effect on 17 August 2000.

The CWP Act gives effect to Australia's obligations, responsibilities and rights as a State Party to the CWC. In particular, the CWP Act:

- prohibits activities connected to the development, production or use of chemical weapons, including assisting anyone engaged in these activities, whether intentionally or recklessly – such offences are punishable by life imprisonment
- establishes permit and notification systems to provide a legal framework for the mandatory provision of data to ASNO by facilities which produce or use chemicals as specified by the CWC, so that ASNO can lodge declarations with the OPCW

- provides for routine inspections of declared facilities and challenge inspections of any facility or other place in Australia by OPCW inspectors to verify compliance with the CWC, and for inspections by ASNO to verify compliance with the CWP Act and
- provides for procedures should another State Party seek clarification concerning compliance with the CWC at any facility or other place or by any person in Australia.

Regulations under the CWP Act prescribe procedures and details of other arrangements under the CWP Act. In particular, the Regulations define conditions that are to be met by holders of permits issued under the CWP Act, and for granting privileges and immunities to OPCW inspectors when carrying out inspections in Australia.

The text of the CWC is reproduced in the Schedule to the CWP Act. The manner in which any powers are exercised under the CWP Act must be consistent with, and have regard to, Australia's obligations under the CWC.

## Other Functions

### South Pacific Nuclear Free Zone Treaty

The South Pacific Nuclear Free Zone (SPNFZ) Treaty (also known as the Treaty of Rarotonga) prohibits the manufacture, possession, stationing and testing of nuclear explosive devices, as well as research and development relating to manufacture or production of nuclear explosive devices, in any area for which the Signatory Parties are responsible. The SPNFZ Treaty also bans the dumping of radioactive waste at sea. Australia ratified the Treaty on 11 December 1986, which enabled its entry into force. The Treaty has 13 parties: Australia, Cook Islands, Fiji, Kiribati, Nauru, New Zealand, Niue, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu.

The SPNFZ Treaty has three protocols. Under Protocol 1, the US, UK and France are required to apply the basic provisions of the Treaty to their respective territories in the zone established by the Treaty. Under Protocol 2, the US, France, UK, Russia and China agree not to use or threaten to use nuclear explosive devices against any party to the Treaty or to each other's territories located within the zone. Under Protocol 3, the US, France, UK, Russia and China agree not to test nuclear explosive devices within the zone established by the Treaty. France and the UK have ratified all three protocols. Russia and China have ratified the protocols relevant to them, Protocols 2 and 3. The US is yet to ratify the SPNFZ Treaty protocols.

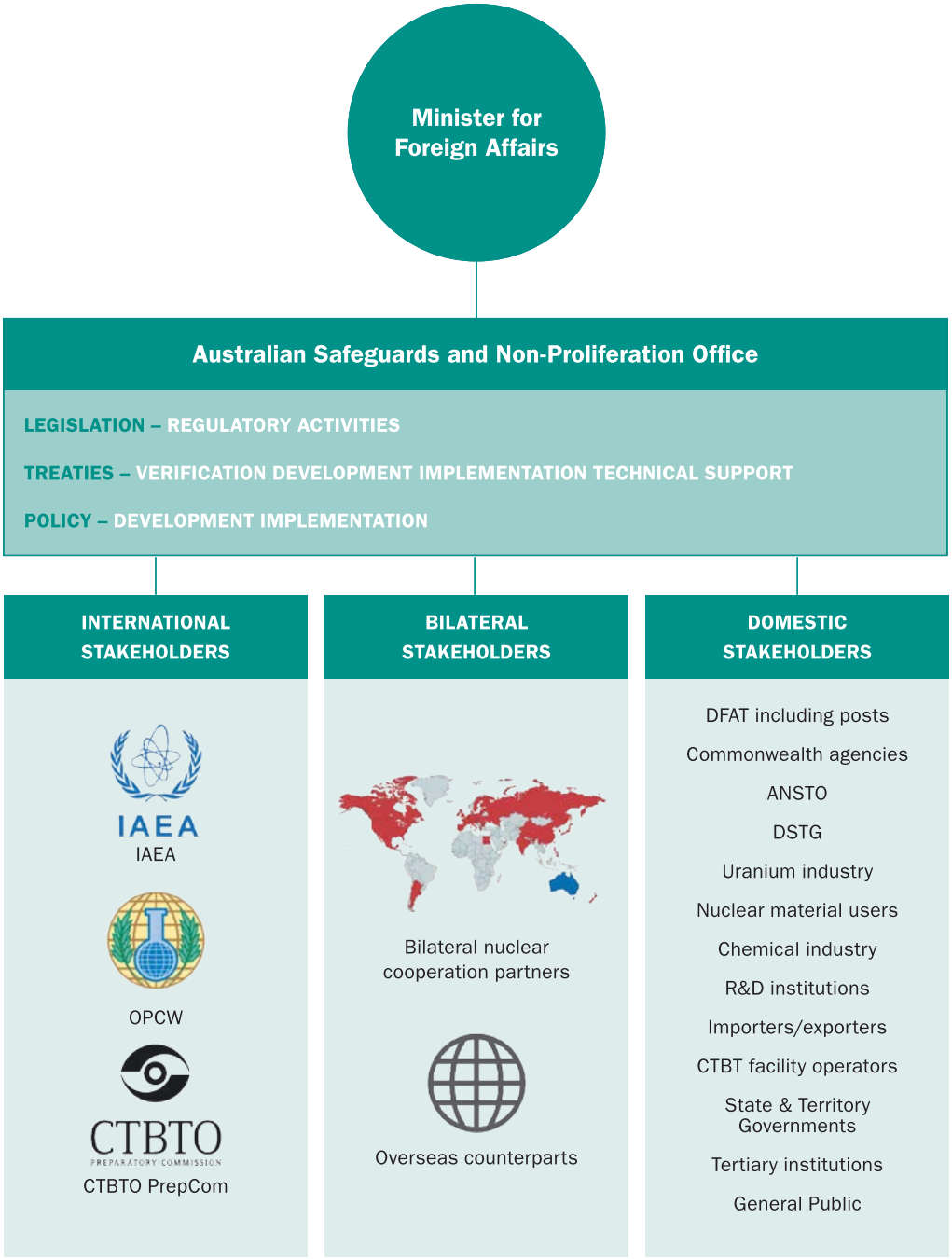
### *South Pacific Nuclear Free Zone Treaty Act 1986*

The *South Pacific Nuclear Free Zone Treaty Act 1986* (SPNFZ Act) came into force in Australia on 11 December 1986 and gives effect to Australia's obligations, responsibilities and rights under the SPNFZ Treaty. The SPNFZ Act also establishes the framework for SPNFZ Treaty inspections.

Inspectors appointed under the Safeguards Act are also inspectors for the purposes of the SPNFZ Act. These inspectors are to assist SPNFZ Treaty inspectors and authorised officers in carrying out SPNFZ Treaty inspections and to investigate possible breaches of the SPNFZ Act.

# Operating Environment

**Figure 4: Australian Safeguards and Non-Proliferation Office's Operating Environment**



## Outcomes and Outputs Structure

### Table 2: ASNO's Outcomes and Outputs Structure

| | | |
|---|---|---|
| **Outcome 1** | Australian and international security protected and advanced through activities which contribute to effective regimes against the proliferation of nuclear and chemical weapons | |
| | Output 1.1 | Operation of Australia's national system of accounting for, and control of, nuclear material, items and facilities |
| | Output 1.2 | Protection of Australia's nuclear facilities, nuclear material and nuclear items against unauthorised access and sabotage, including Australia's uranium supplied overseas |
| | Output 1.3 | Nuclear material and associated items exported from Australia under bilateral agreements remain in exclusively peaceful use and obligations under nuclear cooperation agreements are effectively implemented |
| | Output 1.4 | Contribution to the development and effective implementation of international safeguards and the nuclear non-proliferation regime |
| | Output 1.5 | Regulation and reporting of Australian chemical activities in accordance with the Chemical Weapons Convention, and strengthening international implementation of the Convention |
| | Output 1.6 | Development of verification systems and arrangements in support of Australia's commitments related to the Comprehensive Nuclear-Test-Ban Treaty |
| | Output 1.7 | Contribution to the development and strengthening of other weapons of mass destruction non-proliferation regimes |
| | Output 1.8 | Provision of high-quality, timely, relevant and professional advice to Government |
| **Outcome 2** | Knowledge about Australian's efforts to prevent the proliferation of weapons of mass destruction enhanced through public advocacy | |
| | Output 2.1 | Provision of public information on the development, implementation and regulation of weapons of mass destruction, non-proliferation regimes, and Australia's role in these activities |


ASNO officers participating at a virtual meeting: Building Resilience in Safeguards Implementation: Experiences, Lessons and Good Practices in Preparing for Unforeseen Events, 2-4 March 2021 hosted by the US DOE and APSN. (Image courtesy of DOE/NNSA INSEP.)

SECTION 4

# PERFORMANCE

# Output 1.1: National Safeguards Systems

Operation of Australia's national system of accounting for, and control of, nuclear material, items and facilities.

## Performance Measures

- Australia continues to receive the broader conclusion that 'all nuclear material remained in peaceful activities' from the IAEA.
- Australia's obligations are met under Australia's Comprehensive Safeguards Agreement and Additional Protocol with the IAEA.
- Australia's system of safeguards permits and authorities is administered in a timely and effective manner.
- The quantities, categories, locations and intended end-uses of nuclear material and associated items within Australia are accounted for.

## Performance Assessment

### International Obligations

**Reporting Obligations under the Australia – IAEA Comprehensive Safeguards Agreement**

During the reporting period, ASNO submitted all reports, declarations and notifications to the IAEA on nuclear materials, facilities and activities, ensuring that Australia met its obligations under its safeguards agreements with the IAEA.

### Table 3: Material Balance Areas (MBAs) in Australia for IAEA safeguards purposes

| Location | Material balance area (MBA) | Name of facility or location outside facility (as designated in Australia's subsidiary arrangements with the IAEA) |
|---|---|---|
| Lucas Heights | AS-A | HIFAR (Note: de-fuelled in 2007) |
| Lucas Heights | AS-C | Research and development laboratories |
| Lucas Heights | AS-D | Vault storage |
| Elsewhere | AS-E | Other locations in Australia (e.g. universities, industrial radiography companies, hospitals) |
| Elsewhere | ASE1 | Other locations in Australia (e.g. universities, industrial radiography companies, hospitals) |
| Lucas Heights | AS-F | OPAL reactor |
| Lucas Heights | AS-H | Synroc waste immobilisation (SyMo) plant |
| CSIRO (various sites) | AS-I | CSIRO |

### Table 4: Number of line entries in inventory and inventory change reports submitted by ASNO to the IAEA for each MBA

| Location/facility | MBA | 2018–19 | 2019–20 | 2020–21 |
|---|---|---|---|---|
| HIFAR (de-fuelled 2007) | AS-A | 0 | 0 | 0 |
| ANSTO research laboratories | AS-C | 997 | 494 | 681 |
| ANSTO vault storage | AS-D | 336 | 280 | 297 |
| Other locations | AS-E<br>ASE1<br>AS-I | 2,405 | 2,315 | 2,359 |
| OPAL reactor | AS-F | 343 | 122 | 179 |
| **Total** | | **4,081** | **3,211** | **3,516** |

### Table 5: Number of line entries (by report type) submitted by ASNO to the IAEA across all MBAs

| Type of data | 2018–19 | 2019–20 | 2020–21 |
|---|---|---|---|
| Inventory Change Report (monthly) | 1,449 | 605 | 862 |
| Physical Inventory Listing (annual) | 2,422 | 2,447 | 2,470 |
| Material Balance Report (annual) | 210 | 159 | 184 |

For each material balance area (summarised in Table 3), ASNO provided reports to the IAEA as required by the Comprehensive Safeguards Agreement. Report statistics are summarised in Tables 4 and 5. The high number of reports in Table 4 attributed to 'other locations' primarily relates to small holdings of uranium and thorium compounds at universities and research institutions.

Table 6 is a summary of total quantities of nuclear material by category in Australia. A small quantity (2.7 kg) of $^{235}U$ in high enriched uranium is retained in Australia and used for a variety of purposes primarily due to the utility of the particular chemical, physical and isotopic characteristics. Typical uses of this material include: research and development related to nuclear non-proliferation activities; validating the commercial application of ANSTO's Synroc waste immobilisation technology; nuclear forensics for identifying illicit nuclear materials; development of detection technologies and chemistry work. The quantity comprises several items in various locations around Australia such as ANSTO and some universities.

### Table 6: Nuclear Material in Australia at 30 June 2021

| Category | Quantity | Intended end-use |
|---|---|---|
| **Source Material** | | |
| Uranium Ore Concentrates (UOC) | 1,165 tonnes | Export for energy use pursuant to bilateral agreements |
| | 3.5 tonnes | Storage |
| Natural Uranium (other than UOC) | 4,485 kg | Research, storage |
| Depleted Uranium | 28,276 kg | Research, shielding |
| Thorium Ore Residues | 59 tonnes | Storage/disposal |
| Thorium (other than Thorium Ore Residues) | 1,935 kg | Research, industry |
| **Special Fissionable Material** | | |
| $^{235}U$ – low enriched | 194,666 grams[1] | Research, radioisotope production, storage |
| $^{235}U$ – high enriched | 2,747 grams | Research, storage |
| $^{233}U$ | 3.8 grams | Research |
| Plutonium (other than $^{238}Pu$) | 1,203 grams | Research, neutron sources |

As well as requiring reporting on nuclear material inventory and transactions, the Comprehensive Safeguards Agreement also requires reporting on design and operational attributes (relevant to safeguards) of nuclear facilities. This information is provided to the IAEA in Design Information Questionnaires (DIQs) for each facility MBA, and in the case of MBAs for locations outside facilities (LOFs), in LOF information questionnaires. No DIQs were updated during the reporting period.

1 The quantity of $^{235}U$ in low enriched uranium in Australia increased between 30 June 2020 and 30 June 2021 primarily due to the import of fresh fuel assemblies for the OPAL reactor.

The Safeguards Act requires permits for possession of nuclear material, as well as associated material, associated equipment and associated technology (collectively termed associated items). Permits for associated items ensure Australia can maintain regulatory controls on technology, equipment and material with potential proliferation risks, can report on design attributes for DIQs, and meet other reporting obligations under various nuclear cooperation agreements. Table 7 lists the inventory of associated items in Australia.

### Table 7: Associated Items[2] in Australia at 30 June 2021

| Category | Quantity | Intended end-use |
|---|---|---|
| **Associated Material** | | |
| Deuterium and heavy water | 20.9 tonnes | Research, reactors |
| Nuclear grade graphite | 83.4 tonnes | Research and storage |
| **Associated Equipment** | | |
| HIFAR[3] | 1 | Reactor |
| HIFAR coarse control arms (unused) | 5 | Reactor components |
| HIFAR coarse control arms (used) | 14 | Reactor components |
| HIFAR safety rods | 3 | Reactor components |
| HIFAR fuel charging and discharging machines | 2 | Reactor components |
| OPAL reactor[4] | 1 | Reactor |
| OPAL control rods | 14 | Reactor components |
| OPAL control rod drives | 6 | Reactor components |
| Nuclear-grade zirconium tubes | <50 kgs | R&D and storage |

### Reporting Obligations under the Australia– IAEA Additional Protocol

The Additional Protocol gives the IAEA greater access to information and locations related to nuclear fuel cycle activities, thereby allowing the IAEA to provide greater assurances not only that all declared nuclear material is accounted for, but also that states do not have any undeclared nuclear material or activities. Australia was the first country to sign and ratify an Additional Protocol with the IAEA, which came into force for Australia on 12 December 1997.

ASNO prepares and provides annual declarations under a range of Additional Protocol categories, as well as quarterly declarations on relevant exports. Table 8 lists the number of entries made under each category. An important aspect of the Additional Protocol is reporting to the IAEA on nuclear fuel cycle related research and development activities. ASNO ensured that all IAEA requirements were met during the reporting period with respect to nuclear research and development.

2 Not including items categorised as associated technology.
3 The ANSTO Board decided to cease operation of HIFAR in January 2007. The reactor was de-fuelled in May 2007. It is awaiting decommissioning.
4 Includes, *inter alia*, the reactor reflector vessel and core grid.

### Table 8: Number of entries made under the Additional Protocol

| Type of Declaration under Article 2.a and 2.b of the Additional Protocol | | 2016 –17 | 2017 –18 | 2018 –19 | 2019 –20 | 2020 –21 |
|---|---|---|---|---|---|---|
| 2.a.i | Government funded, authorised or controlled nuclear fuel cycle-related research and development activities not involving nuclear material | 8 | 10 | 13 | 16 | 15 |
| 2.a.ii | OPAL operational schedules | 2 | 1 | 1 | 1 | 1 |
| 2.a.iii | General description of each building on each site, e.g. ANSTO, universities | 289 | 274 | 273 | 267 | 259 |
| 2.a.iv | Manufacturing or construction of specified nuclear related equipment | 2 | 2 | 0 | 1 | 1 |
| 2.a.v | Location, operational status and production capacity of uranium or thorium mines or concentration plants | 4 | 6[5] | 6 | 6 | 6 |
| 2.a.vi | Information on source material that is not of a composition or purity that requires full IAEA safeguards requirements | 7 | 7 | 7 | 7 | 7 |
| 2.a.vii | Information on nuclear material exempted from Safeguards | 4 | 4 | 4 | 4 | 4 |
| 2.a.viii | Information related to the further processing of intermediate or high-level waste containing plutonium | 2 | 2 | 2 | 2 | 2 |
| 2.a.ix | Exports or imports of nuclear-related equipment listed in Annex II of the Additional Protocol | - | - | - | - | - |
| 2.a.x | General 10-year plans related to nuclear fuel cycle activities | 4 | 4 | 5[6] | 5 | 5 |
| 2.b.i | Nuclear fuel cycle-related research and development activities not involving nuclear material and not funded, authorised or controlled by the Government | - | - | - | - | - |

5 This value includes one entry for each of Australia's four uranium mines, one entry for the production of all mines, and one entry with the total production of all concentration plants at all mines.
6 The additional entry for 10-year plans relates to the Australian Government project to site, design and build a national radioactive waste management facility.

## Safeguards Developments in Australia

The IAEA implements safeguards in Australia in accordance with the provisions in a range of legal instruments: the Comprehensive Safeguards Agreement; Additional Protocol; Subsidiary Arrangements; facility attachments and LOF attachments for each material balance area (MBA). Australia's MBAs are described in Table 3. The overarching framework the IAEA uses to prioritise and optimise various in-field verification and headquarters (i.e. at the IAEA) analysis activities under these instruments is the State-level approach (SLA) for Australia, which the IAEA updated in 2016 and is currently reviewing under the IAEA's SLA Improvement Project.

In Australia, the IAEA and ASNO apply most of their respective safeguards efforts to the Australian Nuclear Science and Technology Organisation (ANSTO), particularly safeguards aspects of the ANSTO Nuclear Medicine (ANM) project. At full operation, ANM has the capacity to supply a significant proportion (up to 25 per cent) of the world's requirements for molybdenum–99 (Mo–99), the parent product of the world's most widely used nuclear medicine, technetium–99m. ANSTO's permit issued under the Safeguards Act to establish its SyMo facility (Synroc Waste Immobilisation Facility) was extended by the Minister for Foreign Affairs, Senator Marise Payne, to cover construction delays.

All entities holding a permit to possess nuclear material are required to conduct an annual physical inventory taking (a stocktake of nuclear material held). As first done in 2020, ASNO adjusted procedures for the physical inventory taking at small permit holders (primarily comprising radiographers, universities, laboratories and state regulators) in 2021 to allow flexibility for COVID-impacted industries that could not readily conduct inventory-taking during June/July 2021. However, the multiple COVID-related lockdowns, especially in Sydney and Melbourne, resulted in two permit holders being unable to complete their physical inventory taking and associated reporting in time for ASNO to meet its reporting deadline to the IAEA (30 July). ASNO worked with these permit holders to obtain a "book inventory" based on the best information available to them. Formal physical inventory taking will be pursued once the lockdown periods end.

ASNO continues to engage with the Australian Radioactive Waste Agency (ARWA) in its mandate to establish a facility for Australia's radioactive waste. During the reporting period, ASNO assisted ARWA in its project of establishing a Common National Inventory for Radioactive Waste.

## Permits and Authorities System

ASNO continued to operate Australia's state system of accounting for and control of nuclear material (SSAC) in accordance with Australia's Comprehensive Safeguards Agreement with the IAEA and national legislation. Australia's SSAC is implemented through permits issued under the Safeguards Act. Notices of all permit changes were published in the Australia Government Gazette as required by subsection 20(1) of the Safeguards Act. A summary of all permits granted, varied, revoked and expired in the reporting period is in Table 9.

### Table 9: Status of Permits and Authorities under the Safeguards Act at 30 June 2021 and Changes in the Reporting Period

| Permit or authority | Current total | Granted | Varied | Revoked | Expired |
|---|---|---|---|---|---|
| Possess nuclear material | 110 | 6 | 92 | 3 | 4 |
| Possess associated items | 10 | 0 | 2 | 0 | 0 |
| Transport nuclear material | 21 | 2 | 0 | 0 | 0 |
| Transport associated items | 0 | 0 | 0 | 0 | 0 |
| Establish a facility | 1 | 0 | 1 | 0 | 0 |
| Decommission a facility | 2 | 1 | 0 | 0 | 0 |
| Communicate information contained in associated technology | 7 | 0 | 1 | 0 | 0 |
| **Total** | **151** | **9** | **96** | **3** | **4** |

The conditions and restrictions set in ASNO's permits and authorities are customised to the activities relevant to the possession and transport of nuclear material and associated items and also to the relevant industry involved (e.g. research, radiography, mining, patent services). A summary of these permit classes is listed in Table 10. A high-level plan for the revision of all permits and authorities was established in August 2020. In 2020–21, 96 permits and authorities (including nearly all Class L, R and U6 permits) were revised under this plan. In 2021–22 all Class U2, U3, T1 & T2 permits and ANSTO's S1 permit are scheduled for revision.

Essential for the operation of the permit system is a fit-for-purpose database for managing permits and preparing routine reports on nuclear material inventory and transactions to the IAEA. ASNO continued to work with the database development team (under DFAT's Information Management Division) on the continuing development of ASNO's NUMBAT database.

### Table 10: Main classes of Permits and Authorities

| Class Code | Class Description | Number of Instruments Issued |
|---|---|---|
| R1 | Radiographers holding less than 500 kg of depleted uranium shielding | 37 |
| R2 | Radiographers holding between 500–5000 kg of depleted uranium shielding | 7 |
| L1 | Using and storing less than 10 kg source material and less than 1 g special fissionable material | 32 |
| L2 | Using and storing less than 500 kg source material and less than 5 g special fissionable material | 17 |
| L3 | Using and storing less than 5000 kg source material and less than 10 g special fissionable material | 3 |
| U1 | Production of UOC at concentration plants | 4 |
| U2 | Transport UOC from mine to Australian port | 10 |
| U3 | Transport UOC from Australian port to overseas destination | 7 |
| U4 | Handling of UOC at ports and by stevedores | 3 |
| U5 | Transport and export of UOC from mine gate to overseas destination | 0 |
| U6 | Analysis of UOC samples | 4 |
| U7 | Establish a UOC concentration plant | 0 |
| U8 | Decommission a UOC concentration plant | 1 |
| T1 | Transport of nuclear material by road, sea or air | 3 |
| T2 | Transport of nuclear material by air | 1 |
| P1 | Patent attorney services for patents potentially containing associated technology | 5 |
| P2 | Storage and archiving of associated technology | 1 |
| S | Special series covering larger holders of nuclear material and associated items | 4 |

## IAEA Inspections

During the reporting period, the IAEA conducted inspections in accordance with standard arrangements under Australia's Comprehensive Safeguards Agreement and the Additional Protocol. In the reporting period, the IAEA made three separate visits to Australia. On each occasion, the IAEA inspectors spent two weeks in quarantine before conducting their inspections. Details on all inspections are provided in Table 11, and the IAEA's findings from these inspections (where available at the time of publishing this Annual Report) are listed in Appendix B.

ASNO officers facilitated access for the IAEA inspectors in accordance with conditions under respective permits issued under the Safeguards Act and accompanied the inspectors during all of their activities.

In August 2020, the IAEA conducted verification of the uranium content in solid waste from molybdenum–99 (Mo–99) radiopharmaceutical production using an active well coincidence counter (AWCC). This first formal use of the AWCC in Australia followed successful hot commissioning of the detector in 2019. This inspection addressed the issue previously identified by the IAEA of the build-up of otherwise unverified nuclear material (see findings of material balance area AS-C page 96 of the 2019–20 ASNO Annual Report). Following verification with the AWCC, the IAEA applied dual containment seals to verified waste in storage.

The IAEA conducted a short notice random inspection in April 2021 and its annual, scheduled Physical Inventory Verification (PIV) inspections in June 2021. The IAEA also conducted a Complementary Access at the Honeymoon uranium mine (currently under care and maintenance) in June 2021.

Overall, the IAEA has maintained the "broader conclusion" for Australia that "all nuclear material remained in peaceful activities" (see Appendix B).

The active well coincidence counter (AWCC) used during the interim inventory verification inspection at ANSTO in August 2020.

IAEA seals and sealing tools used for dual containment and surveillance during the inspection with the AWCC, August 2020.

### Table 11: IAEA Safeguards Inspections 2020–21

| Date | Facility | Material balance area[7] | Type[8] |
|---|---|---|---|
| 24–27 August 2020 | ANSTO | AS-C | Interim Inventory Verification |
| 28 August 2020 | CSIRO | AS-I | Complementary Access (4.a.i) |
| 28 April 2021 | ANSTO | AS-F | Short Notice Random Inspection |
| | ANSTO | AS-C and AS-F | Complementary Access (4.a.i) |
| 29 April 2021 | ANSTO | AS-C | Complementary Access (4.a.i) |
| 30 April 2021 | ANSTO | AS-A | Design Information Verification |
| 30 April 2021 | ANSTO | AS-C | Design Information Verification |
| 3–10 June 2021 | ANSTO | AS-C | Design Information Verification & Physical Inventory Verification |
| | | AS-F | Design Information Verification & Physical Inventory Verification |
| | | AS-D | Design Information Verification & Physical Inventory Verification |
| | | AS-C | Technical visit |
| 11 June 2021 | CSIRO | AS-I | Complementary Access (4.a.i) |
| 15 June 2021 | Honeymoon uranium mine | AS-E | Complementary Access (4.a.i) |

7 See explanation of each material balance area in Table 3.
8 Details on different types of inspections are outlined in Appendix B.

ASNO inspector performing a measurement with an HM–5 handheld spectrometer during IAEA Complementary Access at CSIRO, 28 August 2020.

Equipment used by IAEA inspectors during the short-notice inspection at the OPAL reactor and Complementary Access at ANSTO in April 2021.

IAEA inspectors and ASNO inspectors during Design Information Verification at the HIFAR reactor in April 2021.

## ASNO Inspections

During 2020–21, ASNO accompanied the IAEA on all the inspections listed above to ensure Australia's obligations were met in a timely and efficient manner and to ensure the inspections were conducted effectively.

The IAEA holds inspections to help it draw its conclusions on the correctness and completeness of Australia's nuclear accounting reports and safeguards declarations. ASNO inspectors are able also to use these opportunities to observe the inspected organisation's performance against their domestic permit conditions. This proves an efficient mechanism for ASNO's stakeholder outreach on regulatory requirements.

In addition to the IAEA inspections, ASNO continued to assist CSIRO and other permit holders with characterising legacy items of nuclear material and adding them to the inventory records. ASNO visited the NSW Environment Protection Authority (NSW EPA) radioactive store for which re-characterisation of its inventory had been partially completed. ASNO provided advice and recommendations on required actions for NSW EPA to satisfactorily establish and maintain the nuclear material inventory for the store.

## Inventory balances

ASNO performed the annual material balance evaluation of the nuclear inventory accounts for each MBA with minor differences between book and physical inventory. These inventory differences were reported to the IAEA in conjunction with inventory change reports and physical inventory listings. Details are provided in Table 12. Differences were due to re-measurement of small batches of nuclear material at universities and research institutes and approximately 0.2 kilograms of mis-located items of depleted uranium and thorium for which investigations were pending the cessation of COVID-related lockdowns.

**Table 12: Inventory Differences Recorded during 2020–21**

| Material Balance Area | Difference between book and physical inventory | Comment |
|---|---|---|
| ANSTO research and development laboratories (AS-C) | –0.04 kg depleted uranium | Re-measurement of batch weights |
| | –0.28 kg natural uranium | |
| Other locations (MBA AS-E & ASE1) | +1.75 kg depleted uranium | Re-measurement of batch weights and three small items that were not located during physical inventory taking in 2021 but are expected to be located following the cessation of COVID-related lockdowns. |
| | +0.04 kg natural uranium | |
| | +0.79 kg thorium | |
| CSIRO (MBA AS-I) | 342.00 g element weight (2.82 g $^{235}$U) enriched uranium | As part of CSIRO's campaign to characterise legacy inventory in storage, two items previously identified as being low enriched uranium were re-measured and found to in fact be natural uranium. |
| | –0.34 kg natural uranium | |

# Output 1.2: Nuclear Security

Protection of Australia's nuclear facilities, nuclear material and nuclear items against unauthorised access removal, and sabotage, including Australia's uranium supplied overseas.

## Performance Measures

- Security of nuclear material, technology and facilities meets Australia's obligations under the Amended Convention on the Physical Protection of Nuclear Material (A/CPPNM), the International Convention for the Suppression of Acts of Nuclear Terrorism and bilateral nuclear cooperation agreements, as well as being in accordance with IAEA guidelines.
- Internationally agreed standards for the security of nuclear material are applied to all AONM.
- Proactive and professional contributions are made to the development and effective implementation of nuclear security worldwide.

## Performance Assessment

### Australian Nuclear Material Categories

Table 13 lists the permit holders for which physical protection or information security is required, categorised according to the materials or items held.

**Table 13: Distribution of Permits Holders according to security category**

| Nuclear Material Category | Type of 'Facility' | Number of Permit Holders |
|---|---|---|
| Category II[9] | Research Reactor, Storage | 1 |
| Category III | Storage, Scientific Research | 1 |
| Category IV[10] | Scientific Research | 1 |
| Uncategorised[11] | LOFs, Radiographers | 101 |
| Natural Uranium (UOC) | Uranium Mines and Concentration Plants | 4 |
| Transport of nuclear material | Transport Companies, Ports, Shipping Lines | 24 |
| **Associated Items** | | |
| Associated Equipment and Technology | Enrichment Research, Storage and Archives | 4 |
| Associated Technology | Patent Attorneys | 5 |

## International and Bilateral Obligations

ASNO's regulation of permit holders established that security arrangements at Australian nuclear facilities were in accordance with Australia's obligations under the A/CPPNM and relevant bilateral nuclear cooperation agreements. In 2014, Australia, along with 24 other states, subscribed to the IAEA's fundamental principles of nuclear security and committed to meet the intent of IAEA recommendations on nuclear security.[12] Throughout the reporting period, ASNO continued to ensure that domestic requirements for nuclear security were in accordance with IAEA recommendations. ASNO also met Australia's international shipment notification obligations under the A/CPPNM by notifying relevant parties of the transhipment of uranium ore concentrates (UOC) exported from Australia.

## Exports of Australian Uranium

The pandemic has continued to affect the timely international shipment of Australian UOC. Permit Holders have had to adapt schedules or delay deliveries to accommodate vessel delays and congestion in ports and container facilities around the globe. Good communication with relevant government agencies and overseas counterparts has minimised flow-on effects to physical security due to these delays.

Australian uranium exports are subject to security arrangements that include checking the physical condition and integrity of containers, fitted seals and locks at each port of unloading or transhipment. There were no security incidents (malicious acts) involving the transport of UOC in Australia during the reporting period.

9 Nuclear material category is based on IAEA Nuclear Security Series No. 13.
10 Category IV limits are 15g≥Pu>10g; 15g ≥($^{235}$U≥20%)>10g; 1000g ≥($^{235}$U<20%–10%)>10g; 10 000g ≥($^{235}$U<10%)>10g; 15g ≥$^{233}$U>10g; Unirradiated Source Material ≤5000kg. (%-enrichment).
11 i.e. below Category IV quantities.
12 The 2014 Joint Statement on Strengthening Nuclear Security was distributed by the IAEA as INFCIRC/869 and can be found at: https://www.iaea.org/sites/default/files/publications/documents/infcircs/infcirc869.pdf.


Uranium ore concentrate in Australia is protected to the same high standard from production to export.

ASNO received an incident report in October 2020 of a single vehicle accident hauling a UOC container. The vehicle sustained limited damage and as a precaution the unaffected shipment was transferred to a new vehicle.

In November 2020, a Permit Holder reported a shipping container packed with UOC was not locked after loading. Review of security CCTV footage showed that there had been no other access to the container, which was located within a secure compound. ASNO requested the container inventory be verified, procedures be updated and personnel retrained.

In February 2021, a shipment of UOC was loaded onto an ASNO approved vessel, but not on the vessel recorded on the shipment approval. The permit holder notified ASNO of this discrepancy after the shipment had been loaded and resubmitted shipment information. The change in vessel was a result of delayed arrival of vessels to Australian ports and short notice reallocation of cargo to a new vessel. ASNO requested that permit holders maintain accurate records when managing changes to consignments due to delays.

## Nuclear Security of UOC at Australian Mines and in Transport

Within the reporting period ASNO received applications for, and granted two new permits for the transport of UOC within Australia. On 18 May 2021, ASNO conducted an inspection of Neil Mansell Transport's proposed secure compound for the purpose of interim storage of UOC incidental to transport. During the inspection, ASNO provided presentation material for regulating the transport of UOC as guidance material.

BHP Olympic Dam also submitted draft copies of a revised UOC Transport Management Plan and Uranium Security Plan. ASNO approved the updated UOC Transport Management Plan in June 2021. At the end of the reporting period, the

new Uranium Security Plan remained under review.

On 26 May 2021, ASNO conducted a routine inspection of BHP's security and accountancy arrangements, evaluated security plans and procedures against ASNO's permit requirements and verified that recommendations arising from previous inspections had been addressed. DFAT has committed to recognising and promoting Australia's Indigenous Peoples in its core business, and ASNO actively requests mining companies include a presentation on their outreach, opportunities and inclusion of local Indigenous communities.

ASNO inspects UOC productions facilities in Australia.

Heathgate Resources, operator of the Beverley Uranium mine, also submitted a revised Transport Security Management Plans for ASNO approval in the reporting period. ASNO reviewed the plan against permit requirements and international best practice, approving the updated plan in June 2021. In keeping with ASNO permit requirements and supporting the Government's policies to reduce regulatory burden where appropriate, the contracted transport company adopted the mine's transport security plan and transported UOC consistent with the plan's requirements.

In accordance with relevant Commonwealth and Northern Territory Government legislative and regulatory requirements, Energy Resources of Australia (ERA) ceased uranium mining and processing activities at the Ranger Uranium Mine on 8 January 2021. In the period leading up to cessation of operations, ERA applied to ASNO for a Permit to Decommission a Facility[13] and prepared a decommissioning

13 A Permit to Decommission a Facility, issued pursuant to Section 16B of the Safeguards Act, is required for any nuclear facility or facility where nuclear activities have been conducted before any decommissioning work can commence. These Permits ensure that appropriate security measures are in place and relevant IAEA safeguards activities can be conducted throughout the decommissioning process.

plan in support of that permit application. The permit was granted on 8 January 2021. ASNO conducted the first post-shutdown inspection at the Ranger Uranium Mine on 16 June 2021. The purpose of the inspection was to evaluate the status of the mine and security arrangements for key plant during decommissioning. The inspection included verification of a nil nuclear material inventory and review of the decommissioning progress of the processing plant, on-site laboratory, UOC sample inventory and UOC storage yard. ASNO also discussed other decommissioning arrangements at Ranger. In addition, ERA provided ASNO a briefing on the planned rehabilitation works for the mine and on the ongoing Indigenous community engagement activities conducted by ERA.

ASNO has conducted nuclear security and safeguards inspections at Ranger since the start of operations in 1981.

## Minor Design Basis Threat Review

ASNO conducted a planned minor review of the design basis threat (DBT). ASNO adopted a periodic cycle of major and minor reviews of the DBT following a recommendation of the 2013 IAEA International Physical Protection Advisory Service (IPPAS) peer-review mission.[14] As a central concept in the internationally recognised guidance document Nuclear Security Series No. 13[15], the DBT is a statement of credible adversary intentions and capabilities and is to be considered a "worst-case credible threat". Physical protection systems at high consequence nuclear facilities are then designed and implemented to provide high assurance of protection against the DBT. ASNO maintains the DBT with the support of several other Australian government agencies. An unclassified version of the DBT is published on ASNO's website.[16]

14 A redacted copy of the 2013 IPPAS mission report can be found at: https://www.dfat.gov.au/international-relations/security/asno/Pages/iaea-ippas-mission-to-australia.
15 Also referred to as INFCIRC/225/Rev.5.
16 https://www.dfat.gov.au/international-relations/security/asno/Pages/design-basis-threat

## Nuclear Security at Lucas Heights

Throughout the pandemic, ASNO has maintained a strong regulatory relationship and effective communication with ANSTO, including with in-person visits and inspections. Where face-to-face meetings were not possible due to COVID-related restrictions, ASNO conducted virtual meetings with ANSTO to progress critical activities and maintain relationships. Despite the restrictions, key security issues were addressed or progressed, including the conduct of security exercises, enhanced search procedures, approval of new storage facilities and updates to key security documentation.

During the reporting period, ASNO conducted three routine inspections at ANSTO. The inspections reviewed ANSTO implementation of permit requirements and international best practice for nuclear security. ASNO reviewed arrangements at ANSTO facilities located at Lucas Heights for storage of both nuclear material and associated items. During the inspections ASNO reviewed the physical security, information security, personnel security and security governance arrangements for these facilities. ASNO also observed the conduct of a security exercise at ANSTO that demonstrated site capabilities to respond to an advanced threat.

Over the reporting period, ANSTO continued to review a significant number of security documents and procedures that support implementation of its permit conditions to possess nuclear material and associated items. ASNO has reviewed and approved several updated security plans for facilities at ANSTO in 2021. ANSTO continues to work on updating the OPAL security plan and submission of the revised plan is expected in the latter half of 2021.

ANSTO continued to report to ASNO on the progress of its Periodic Safety and Security Review (PSSR) of the OPAL reactor. ANSTO provided ASNO with quarterly updates on the PSSR including review and report drafting activities. The conduct of the PSSR is a requirement that is imposed by both ASNO and ARPANSA jointly. ANSTO is scheduled to provide the PSSR report to ARPANSA's CEO and ASNO's Director General by 30 November 2021.

## SILEX Enrichment Technology

Silex Systems Limited (SSL) continued to hold a Permit to Possess Associated Technology with ASNO for research and development of the Silex process towards commercialisation. ASNO continued its regulatory oversight of SSL's activities, including regular meetings and monthly reports.

In January 2021, SSL announced the completion of the restructure of SILEX technology licensee Global Laser Enrichment LLC (GLE). This followed final approval of the restructure by United States government agencies, including the US Department of the Treasury-led Committee on Foreign Investment in the United States. This resulted in SSL acquiring a 51 per cent majority interest in GLE, and Canada's Cameco Corporation increasing its interest from 24 per cent to 49 per cent.

ASNO regulates uranium enrichment research and development to ensure the security of sensitive nuclear technologies.

ASNO conducted an inspection at SSL on 21 May 2021, when it reviewed ongoing development activities, security plans and arrangements, and conducted a partial inventory verification.

SSL progressed its collaboration partnership with UNSW Sydney and Silicon Quantum Computing Pty Ltd (SQC) for the enrichment of Silicon. The project is developing a commercial process for the production of high-purity 'Zero-Spin Silicon' using a variant of the SILEX laser isotope separation technology. ASNO remained satisfied that this program does not involve associated technology as defined by the Safeguards Act.

## Ubaryon Enrichment Technology

Ubaryon Pty Ltd holds a Permit to Possess Associated Technology for research and development of an innovative uranium enrichment technique. ASNO continued to work closely in supporting the company to mature its security measures and culture. ASNO collaboratively established a classification guide which provides prudent information security for the technology and supports Ubaryon during commercial partnership, technology development and other related discussions.

## Nuclear Security Guidance Committee

The primary role of the Nuclear Security Guidance Committee (NSGC) is to manage the production of guidance documents in the IAEA Nuclear Security Series (NSS). The NSGC comprises over 50 IAEA Member States, is constituted on rolling three-year terms and meets twice per year at the IAEA in Vienna (i.e. six meetings per term). Australia (ASNO) has been a member since its inception in 2012. The former ASNO Director, Nuclear Security (Dr Stephan Bayer) was Chair of the NSGC's third term from 2018 to December 2020. The 18th meeting of the NSGC, held in November–December 2020, concentrated on the continuing discussion over the revision

of the top-tier documents of the Nuclear Security Series and the merits of a Nuclear Security Series publication on safety/security interfaces. Following the meeting, a subgroup was commissioned to provide suggestions and feedback on the process to revise the top-tier documents.

The fourth term of the NSGC commenced in 2021, and following a change of responsibility within ASNO, the new Director, Nuclear Security (Ms Charlotte East) was nominated as Australia's member on the NSGC for the fourth term. The fourth term of the NSGC commenced with the 19th meeting on 7–10 June 2021. The 19th meeting continued to focus on the topics of revision of the top-tier documents in the Nuclear Security Series, the development of a new roadmap for future publications and issues relating to the safety/security interface, including potential publications and the integration of the nuclear safety and nuclear security glossary.

## Review Conference of the Amended CPPNM

The Preparatory Committee (PrepCom) for the Conference of Parties to the Amendment to the Convention on the Physical Protection of Nuclear Material was held, virtually, from 7–11 December 2020 and again on 1 February 2021. The PrepCom was co-chaired by Dr Robert Floyd (formerly Director General ASNO) for Australia and Mr Vilmos Cserveny for Hungary. The main topics of discussion at the PrepCom were the proposed program and agenda for the Review Conference and the draft rules of procedure for the Conference. The PrepCom concluded at the end of the 1 February 2021 meeting, providing a report on preparations to the designated Co-Presidents of the Review Conference, Nigeria and Switzerland.

Throughout the PrepCom, States Parties expressed a strong desire for a robust and inclusive review conference, clearly indicating a preference for an in-person conference, if possible. With this in mind, participants agreed that a further delay to the conference was desirable. The Review Conference is scheduled for 28 March – 1 April 2022 at IAEA Headquarters in Vienna, Austria.

## Post Nuclear Security Summit Activities

Australia is a member of the post-Nuclear Security Summit Nuclear Security Contact Group (NSCG), whose Statement of Principles[17] includes advancing implementation of nuclear security commitments and building a strengthened, sustainable and comprehensive global nuclear security architecture. The NSCG has remained active during the reporting period, despite the pandemic, supporting discussions on the A/CPPNM Review Conference, collective nuclear security commitments, core messaging on nuclear security and work under the GICNT. Dr Floyd was Australia's designated NSCG participant. Australia continued leading a discussion on the preparatory process for the A/CPPNM Review Conference which is expected to take place in March 2022.

In further initiatives to promote nuclear security internationally, Dr Floyd continued to be active in track 1.5 dialogues, in particular the Nuclear Threat Initiative's Global Dialogue on Nuclear Security Priorities, which like the NSCG, has actively promoted the Nuclear Security Summits' goals and commitments and assisted in preparations for the A/CPPNM Review Conference.



17 https://www.iaea.org/sites/default/files/publications/documents/infcircs/2016/infcirc899.pdf

# Output 1.3: Bilateral Safeguards

Nuclear material and associated items exported from Australia under bilateral agreements remain in exclusively peaceful use and obligations under nuclear cooperation agreements (NCAs) are effectively implemented.

## Performance Measures

- Australian Obligated Nuclear Material (AONM) is accounted for in accordance with the procedures and standards prescribed under relevant bilateral agreements.
- Foreign Obligated Nuclear Material (FONM) is accounted for in accordance with the procedures and standards prescribed under relevant bilateral agreements.
- NCAs are effectively implemented and administrative arrangements are reviewed and revised as necessary to ensure their continuing effectiveness.

## Performance Assessment

### Australian Obligated Nuclear Material

On the basis of reports from bilateral treaty partners, other information and analysis, ASNO concluded that all AONM was satisfactorily accounted for. Details are provided in Table 14. Based on ASNO's analysis of reports and other information from counterparts on AONM located overseas, ASNO concludes that no AONM was used for non-peaceful purposes in 2020.

### Table 14: Summary of net accumulated AONM by category, quantity and location at 31 December 2020[18]

| Category | Location | tonnes[19] |
|---|---|---|
| Depleted Uranium | Canada, China, European Union[20], Japan, Republic of Korea, Russia, United States | 140,687 |
| Natural Uranium | Canada, China, European Union, India, Japan, Republic of Korea, United States | 34,273 |
| Uranium in Enrichment Plants | China, European Union, Japan, United States | 29,918 |
| Low Enriched Uranium | Canada, China, European Union, Japan, Mexico, Republic of Korea, Switzerland, Taiwan, United States | 19,918 |
| Irradiated Plutonium | Canada, China, European Union, Japan, Mexico, Republic of Korea, Switzerland, Taiwan, United States | 217 |
| Separated Plutonium | European Union, Japan | 1.5 |
| **Total** | | **225,014.5** |

### Table 15: Supply of Australian uranium by region during 2020[21]

| Region | tonnes UOC ($U_3O_8$) | Percentage of Total |
|---|---|---|
| Asia | 0 | 0 |
| Europe | 874 | 12 |
| North America | 6,141 | 88 |
| **Total** | **7,015** | **100** |

18 Figures are based on yearly reports to ASNO in accordance with Australia's bilateral agreements and other information held by ASNO.
19 All quantities are given as tonnes weight of the element uranium or plutonium. The isotope weight of $^{235}U$ is 0.711 per cent of the element weight for natural uranium and from one to five per cent for low enriched uranium.
20 Euratom is the European Atomic Energy Community. The Australia-Euratom NCA covers all 27 Member States of the European Union, as well as the United Kingdom of Great Britain and Northern Ireland to 31 December 2020.
21 Export destinations for Australian uranium are decided by commercial factors including the availability of conversion capacity and customer preferences.

**Table 16: Summary of AONM Transfers during 2020**[22]

| Fuel cycle Stage | Destination | U (tonnes) |
|---|---|---|
| Conversion | Canada | 5,680 |
| | European Union | 623 |
| | United States | 251 |
| Enrichment | European Union | 5,059 |
| Fuel fabrication | European Union | 21 |
| | Republic of Korea | 105 |
| | United States | 156 |
| Reactor | Switzerland | 9 |

The end-use for all AONM is electric power production in civil nuclear reactors and research and development for civilian applications. AONM cannot be used for any military purpose.

The shipper's weight for each UOC consignment is entered on ASNO's record of AONM. These weights, subject to amendment by measured Shipper/Receiver Differences, are the basic source data for ASNO's system of accounting for AONM in the international nuclear fuel cycle. ASNO notifies each export to the safeguards authorities in relevant countries. In every case, those safeguards authorities confirm to ASNO receipt of the shipment. ASNO also notifies the IAEA of each export to non-nuclear weapon states pursuant to Article 35(a) of Australia's Safeguards Agreement with the IAEA, and each export to nuclear-weapon states under the IAEA's Voluntary Reporting Scheme. Countries which receive these exports also report the receipts to the IAEA, to allow international transit matching of source material before it enters the initial point of safeguards.

## Foreign Obligated Nuclear Material

Just as Australia's bilateral treaty partners report on AONM in their jurisdiction, ASNO in turn maintains an inventory and reports on the movement of Foreign Obligated Nuclear Material (FONM) – nuclear material that an Australian company has imported and which a bilateral treaty partner transfers under the nuclear cooperation agreement, or has been produced using previously imported FONM. An example of this is fuel and target plates for the Opal Reactor at ANSTO. Foreign obligations are in addition to IAEA safeguards, as all nuclear material in Australia is under IAEA safeguards. Given the international, but jurisdictionally independent nature of the nuclear fuel cycle (as described on page 27), nuclear material can be obligated by more than one bilateral treaty partner. Exporting countries may also choose not to place an obligation on particular types of nuclear material they export to Australia if they feel that IAEA safeguards alone can provide sufficient assurance of peaceful use.

ASNO tracks the movement of FONM in Australia and provides an FONM report to all our bilateral treaty partners each year, as a reciprocal action to receiving their annual AONM report.

In addition to nuclear material, foreign obligations can be placed on non-nuclear material (called associated material) such as heavy water, associated equipment or technology depending on the NCA.

22 Figures are for transfers completed between jurisdictions from 1 January to 31 December 2020.

**Table 17: The total quantity of FONM in Australia (by category) from all partner countries as of 31 December 2020[23]**

| Category | Quantity |
|---|---|
| **Source Material** | **kilograms** |
| Natural Uranium (other than UOC) | 49 |
| Depleted Uranium | 2,611 |
| Thorium (other than Thorium Ore Residues) | 735 |
| **Associated or non-nuclear material** | **kilograms** |
| Heavy water and deuterium | 10,695 |
| **Special Fissionable Material** | **grams** |
| $^{235}U$ – low enriched | 175,900 |
| $^{235}U$ – high enriched | 714 |
| $^{233}U$ | 3.7 |
| Plutonium (other than $^{238}Pu$) | 1,196 |

## Bilateral Agreements

### Reporting

Reports on AONM from ASNO's counterpart organisations were received in a timely fashion enabling efficient analysis and reconciliation with ASNO's records. Figures provided in Tables 16 and 17 are based on ASNO's analysis of all available information at the time of publication.

2021 will see the commencement of bilateral annual reporting between Australia and Ukraine, following the first transfer of AONM to Ukraine in April 2021. The Australia-Ukraine nuclear cooperation agreement entered into force in June 2017.

### Implications of Brexit

A new Australia-United Kingdom NCA was signed in August 2018, which entered into force on 1 January 2021 following the UK's transition period following its decision to leave the European Union.

The Australia-United Kingdom NCA requires that Australian uranium to be used exclusively for peaceful purposes, be subject to IAEA safeguards, and be protected by internationally agreed standards of physical protection.

Cooperation between Australia and other Euratom Member States continues unaffected under the Australia-Euratom NCA, and ASNO commenced tracking transfers of AONM between Euratom member states and the United Kingdom in 2021.

### Engagement on Nuclear Cooperation Agreements

While COVID–19 prevented ASNO representatives from conducting in-person reconciliation visits with representatives of our bilateral partners, ASNO maintained regular communication through email, phone and video teleconferences.

23 FONM data is provided in a consolidated form based on permit holder reporting and to protect commercial-in-confidence concerns.

# Output 1.4: International Safeguards and Non-Proliferation

Contribution to the development and effective implementation of international safeguards and the nuclear non-proliferation regime.

## Performance Measures

- Contribute to the strengthening of international safeguards in ways that advance Australia's interests.
- Contribute to policy development and diplomatic activity by the Department of Foreign Affairs and Trade (DFAT).
- Contribute to the IAEA's Standing Advisory Group on Safeguards Implementation (SAGSI).
- Manage the Australian Safeguards Support Program (ASSP).
- Cooperate with counterparts in other countries in the strengthening of international safeguards and improvement of domestic safeguards implementation.
- Provide advice and assistance to the Australian Intelligence Community in support of national and international non-proliferation efforts.
- Manage ASNO's international outreach program.
- Assess developments in nuclear technology.

## Performance Assessment

### Strengthening International Safeguards

ASNO continues its active role in international efforts in shaping and developing the effective implementation of nuclear safeguards, through engagement in a range of fora and projects. This includes working directly with the IAEA, as well as with other international bodies, notably through ASNO's membership of the Asia-Pacific Safeguards Network (APSN).

This engagement assists with building and maintaining of specialist knowledge in ASNO on developments, emerging issues and trends in nuclear non-proliferation and how the IAEA verifies nuclear programs. This helps inform Australian Government policy on international security issues and supports ASNO's monitoring and administration of the use of Australian uranium under Australia's many bilateral nuclear cooperation agreements. Developments in a range of IAEA approaches to different verification challenges can also change the regulatory impact on nuclear industrial and research activities in Australia. Maintaining specialist knowledge therefore also helps ensure changes in safeguards regulatory approaches can be managed with minimal disruption.

On broader aspects of safeguards implementation, ASNO's engagement included the IAEA Director General's Standing Advisory Group on Safeguards Implementation (SAGSI),

technical meetings on IAEA safeguards projects, and various conferences and workshops. In September 2020, ASNO was also part of the Australian delegation to the annual IAEA General Conference, contributing to the negotiation of the Safeguards Resolution ('Strengthening the Effectiveness and Improving the Efficiency of Agency Safeguards') which was adopted by consensus.

## Australian Safeguards Support Program

The Australian Safeguards Support Program (ASSP), coordinated by ASNO, is one of 21 programs established by Member States and the European Commission to assist the IAEA in safeguards research and development. Australia has one of the longest-running programs, having been in place for over 40 years.

The ASSP contributes to projects supporting the IAEA's safeguards development and implementation needs, including by reviewing IAEA technical guidance documents, training materials and updates to the Physical Model. In February 2021, technical experts from ANSTO Minerals and Rio Tinto participated in a virtual consultancy meeting to update IAEA guidance on performing technical assessments of states' capabilities to develop and deploy undeclared uranium mining and milling technologies.

In August 2020, ASNO participated in the review of the IAEA's draft guidelines on implementation of safeguards for facilities and LOFs that are shutdown or under decommissioning. In 2021, ASNO is assisting the IAEA with development of online courses by peer reviewing the Agency's e-learning training modules on state systems of accounting for and control of nuclear material (SSAC).

ASNO is also supporting the IAEA's Comprehensive Capacity Building Initiative for SSACs and RSAs (COMPASS), the IAEA's new initiative to provide tailored safeguards assistance to Member States in areas such as training for the safeguards regulatory authority, outreach to nuclear operators, procurement of equipment, and drafting of national regulations and reference guidelines/manuals.

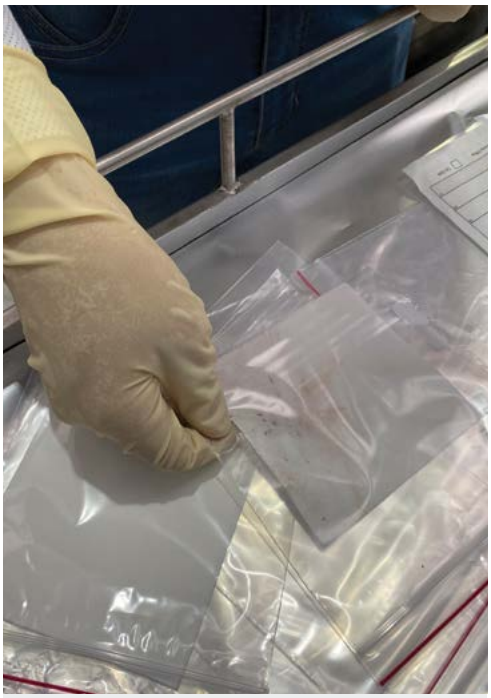
## Nuclear Inspection Robots

In November 2017, CSIRO hosted the IAEA's Robotics Challenge, an event aimed at developing robotic systems to help inspectors perform repetitive inspection tasks more efficiently and consistently, particularly in areas of nuclear facilities that may be difficult to access (see ASNO's Annual Report 2017–18). The IAEA selected a design produced by Datastart Ltd of Hungary, which autonomously propels itself across the surface of a spent fuel pond while holding a device for measuring radiation glow patterns (known as Cherenkov glow). The robot has the potential to automate time-consuming inspection tasks required to verify nuclear material in spent fuel. The IAEA is continuing discussions with Member States, nuclear facility operators (including ANSTO) and Datastart Ltd to further refine and test the design to ensure it is compliant with all applicable requirements and regulations. During 2020–21, CSIRO assisted with upgrading the robot's autonomous features, user interface and broader system architecture.

## Mass Spectrometers for the Detection of Undeclared Nuclear Activities

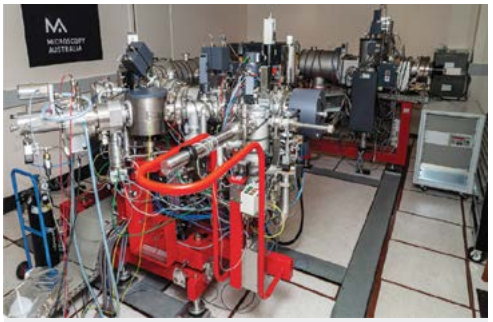
ANSTO's Centre for Accelerator Science participates in the IAEA Department of Safeguards' Network of Analytical Laboratories (NWAL), providing bulk analysis of swipe samples. During 2019, extensive testing established that ANSTO successfully resolved issues with sources of background in the Accelerator Mass Spectrometry system that had required temporary suspension of routine analyses of swipe samples. In July 2020, ANSTO issued its results to the IAEA for a batch of re-validation samples, which the IAEA accepted.

ANSTO and other NWAL members participated in an inter-laboratory comparison exercise during 2020–21 in which they analysed swipe samples from the IAEA. The results of the exercise were discussed during the Technical Meeting on Bulk Analysis of Environmental Samples for Safeguards in May 2021. ANSTO obtained satisfactory results in the exercise. ANSTO expects to resume routine analysis of samples from IAEA inspections from July 2021.



IAEA inspectors collecting environmental samples for analysis by the IAEA Department of Safeguards' Network of Analytical Laboratories (NWAL).

The University of Western Australia's Centre for Microscopy, Characterisation and Analysis continues to participate in the NWAL. The Centre uses its large-geometry secondary ion mass spectrometer (LG-SIMS) for uranium isotopic characterisation of particles in environmental samples for nuclear safeguards. The Centre has continued to analyse samples for the IAEA on a regular basis throughout the COVID–19 pandemic, including 22 IAEA samples during the financial year 2020–21 of which several were categorised by the IAEA as high priority.



Large-geometry secondary ion mass spectrometer (LG-SIMS) at University of Western Australia's Centre for Microscopy, Characterisation and Analysis. (Credit: UWA)

## Proliferation Analysis Training

Since 2009, Australia has provided annual proliferation analysis training to IAEA safeguards staff to enhance their ability to apply structured analytical techniques to complex proliferation issues. This training assists IAEA staff to analyse disparate sources of information, including state-declared and open-source information. The Office of National Intelligence (ONI) and the Australian Department of Defence planned proliferation analysis workshops for the IAEA in 2020–21 but these were postponed due to travel COVID–19 restrictions. ONI is working with the IAEA on a shorter introductory seminar on proliferation analysis. The content of the workshop is regularly updated and participant feedback from recent work shops has confirmed that the training continues to meet the needs of the IAEA Department of Safeguards.

## Information Collection and Analysis for Safeguards

The Department of Government and International Relations at the University of Sydney has provided an expert consultant to assist the IAEA Department of Safeguards' Division of Information Management to optimise the collection and analysis of open-source information for safeguards. The project involves applying network

analysis software to map safeguards-relevant transfers and relationships within strategic trade networks for states in East and Southeast Asia, using open-source trade statistics and transaction-level data. The ultimate goal is to strengthen the Agency's ability to identify trade flows of safeguards-relevant commodities.

## Cooperation with other States

ASNO has close and long-standing relationships with nuclear security and safeguards regulatory and policy agencies in several countries both within and outside the region. ASNO actively worked to maintain and strengthen relationships through projects under the Asia-Pacific Safeguards Network (APSN). The constraints on travel due to COVID–19 meant that all outreach was done virtually during the reporting period.

The 11th annual meeting of APSN was held virtually on 2 December 2020, hosted by the Government of Indonesia and organised by Indonesia's Nuclear Energy Regulatory Agency (BAPETEN). The meeting was attended by 70 participants from 16 countries (including observers from Papua New Guinea, Sri Lanka and Timor-Leste) and representatives from the IAEA and ESARDA.[24] A common theme of the shared experiences was the operational flexibility and new approaches used by the IAEA and Member States to achieve safeguards objectives under COVID-related restrictions.

APSN Chair Prof Jazi Eko Istiyanto and the BAPETEN Host at the APSN 11th Annual Meeting, 2 December 2020, virtual format. (Image courtesy of BAPETEN.)

Dr Robert Floyd, Steering Committee Members and Mr Peter Rance (from left to right) at the APSN, 11th Annual Meeting, 2 December 2020, virtual format. (Image courtesy of BAPETEN.)





24 The European Safeguards Research and Development Association

The resilience required to continue implementing safeguards was explored further in a virtual regional seminar on "Building Resilience in Safeguards Implementation: Experiences, Lessons and Good Practices in Preparing for Unforeseen Events" held on 2–4 March 2021 hosted by the United States Department of Energy and APSN. ASNO gave presentations on its experiences in facilitating IAEA safeguards inspections and working with permit holders to meet safeguards objectives. ASNO shared results from the application of the Department of Home Affairs' Organisational Resilience Health Check tool[25] to evaluate resilience indicators. The results helped to show where improvements could be made in ASNO's own business continuity plans.

## IAEA Standing Advisory Group on Safeguards Implementation

The IAEA Director General's Standing Advisory Group on Safeguards Implementation (SAGSI) provides recommendations to the IAEA Director General on vital safeguards implementation issues. The Group currently comprises 17 international experts from 17 Member States. The members serve on the group in a personal capacity (rather than as representatives of their government or organisation). Each expert is invited to serve a three-year term, with the possibility of renewal. The Secretariat of SAGSI includes the IAEA Deputy Director General for Safeguards, and the Director, Division of Concepts and Planning. Dr Robert Floyd (formerly Director General ASNO) had been the Chair of SAGSI since the 77th series of SAGSI meetings in 2013. He resigned his position in June 2021 after his appointment as Executive Secretary CTBTO. Dr Stephan Bayer, Director IAEA Safeguards Section, ASNO, will take up an appointment to SAGSI at its next meeting.

SAGSI has two series of meetings each year, with each series usually comprising a working group meeting and a plenary meeting. During the reporting period all meetings were held virtually. During each series of meetings, SAGSI examines and provides advice on a list of safeguards implementation topics set by the IAEA Director General. In 2020–21, SAGSI examined the IAEA's State-level approaches (SLA) Improvement Project, updating the IAEA safeguards glossary and progress on the COMPASS Initiative (see page 65).



25 https://www.organisationalresilience.gov.au/

# Output 1.5: CWC Implementation

Regulation and reporting of Australian chemical activities in accordance with the Chemical Weapons Convention (CWC), and strengthening international implementation of the Convention.

## Performance Measures

- Australia's obligations under the CWC are met.
- Effective regulation of CWC-related activities in Australia, involving the chemical industry, research and trade.
- Contribute to strengthening CWC verification and implementation, including through cooperation with the Organisation for the Prohibition of Chemical Weapons (OPCW) and with CWC States Parties.
- Contribute to enhancing regional CWC implementation through targeted outreach.

## Performance Assessment

### Meeting CWC Obligations

ASNO maintained Australia's strong record of performance in meeting its CWC obligations. Comprehensive and timely annual declarations, amendments and notifications were provided to the OPCW via its Secure Information Exchange portal as follows:

- Article VI declaration of imports and exports of CWC-Scheduled chemicals and of past activities at 37 facilities with CWC-relevant chemical production, processing or consumption activities during 2020 (declared in March 2021)
- Article VI declaration of anticipated activities at seven CWC-Scheduled chemical facilities for 2021 (declared in September and October 2020)
- Article X, paragraph 4, declaration of Australia's national programs for protection against chemical weapons during 2020 (declared in April 2021)
- responses to OPCW Third Person Notes including routine clarification of the operational status of declared chemical plants and
- responses to OPCW notifications and amendments/corrections to inspector details and deletions or additions to the OPCW inspectorate.

#### OPCW Inspections

Since 1997, the OPCW has conducted 62 routine inspections in Australia. The inspections have occurred at declared chemical plants and a Defence protective purposes laboratory suite in accordance with the provisions of Article VI of the CWC. In the reporting period, ASNO facilitated two routine OPCW inspections.

The first inspection was of Australia's declared Schedule 1 protective purpose facility in Victoria, from 12 to 18 May 2021. Prior to the inspection starting, the facility identified that the 2020 annual notification

of past activities was missing information for one chemical. On arrival, OPCW inspectors were briefed of this record-keeping oversight which was a consequence of Melbourne's sudden COVID–19 lockdowns. The inspection proceeded smoothly, with excellent support and cooperation from the facility. The inspectors confirmed the record keeping oversight and verified other declared information, including the absence of any undeclared CWC-Schedule 1 chemical production, in accordance with the inspection mandate. The facility amended annual declarations of past activities and the OPCW considers the inspection closed.

The second inspection was of a declared 'Other Chemical Production Facility' (OCPF) in Queensland on 20 May 2021. The inspection proceeded smoothly, with excellent support and cooperation from the site. The OPCW inspection team verified the company's declarations, including the absence of any undeclared CWC-Schedule 1 chemical production, in accordance with the inspection mandate.

### ASNO chemical database

Online reporting by regulated chemical facilities and import permit holders, in accordance with statutory obligations, enabled ASNO's preparation of Australia's declaration of past and anticipated chemical activities to the OPCW.

As mentioned in the ASNO's Annual Report 2019–2020, a key challenge for ASNO is assisting with the development and implementation of a new chemical database to support Australia's reporting obligations under the Chemical Weapons Convention. ASNO's current chemical database and online portal are no longer fit-for-purpose. Efforts to replace the database during the reporting period were unsuccessful. ASNO will continue to work with DFAT's Information Management and Technology Division to develop a new chemical database system with an industry access online portal to improve the end-user stakeholder experience and the efficiency of ASNO's regulatory function.

## Legislation and Regulation

The CWC is included as a Schedule to the *Chemical Weapons (Prohibition) Act 1994* (the CWP Act). There are three Schedules of chemicals listed in an annex to the CWC known as the 'Annex on Chemicals'. Any changes to the CWC Annex on Chemicals accepted by Australia are regulated by amending the *Chemical Weapons (Prohibition) Regulations 1997*. The Regulations were last updated in June 2020 to include four additional Schedule 1 chemicals/ chemical families.

The permit systems, under the CWP Act and Regulation 5J of the Customs (Prohibited Imports) Regulations 1956, continued to operate well.

Table 18 provides statistics for the permits issued to facilities producing, processing or consuming CWC-Scheduled chemicals during the current reporting period. Thirty-three facility permits were in effect at 30 June 2021.

During the 2020–21 period, 58 import permits and five import permit variations were issued for the import of CWC-Schedule 2 and 3 chemicals; no permits were issued for the import of CWC-Schedule 1 chemicals.

### Table 18: Permits for CWC-Scheduled Chemical Facilities

| CWC-Scheduled Chemicals | CWP Act 1994 | Permit type | Permits at 30 June 2021[26] | New permits 2020–21 | Re-issued permits 2020–21 | Permits cancelled 2020–21 |
|---|---|---|---|---|---|---|
| Schedule 1 | s19(4) | Production (Protective) | 1 | 0 | 1 | 0 |
| | s19(5) | Production (Research) | 8 | 0 | 3 | 1 |
| | s19(6) | Consumption | 12 | 1 | 4 | 0 |
| Schedule 2 | s18(1) | Processing | 7 | 0 | 1 | 0 |
| Schedule 3 | s18(1) | Production | 3 | 0 | 0 | 0 |

ASNO is a member of the Australian Government Regulatory Science Network (RSN). Established in 2011, the RSN is a network of Australian Government agencies responsible for regulating chemical, biological or radiological materials. The RSN committee meets regularly to exchange information and conducts at least one major science-focused activity each year to promote regulatory science exchange among the member agencies. Other activities include joint agency seminars, interagency workshops, symposiums and conference presentations.

RSN membership includes:

- Australian Government Department of Agriculture, Water and the Environment (DAWE)
- Australian Pesticides and Veterinary Medicines Authority (APVMA)
- Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)
- Australian Safeguards and Non-Proliferation Office (ASNO)
- Defence Export Control (DEC)
- Food Standards Australia New Zealand (FSANZ)
- National Health and Medical Research Council (NHMRC)
- Australian Industrial Chemical Introduction Scheme (AICIS)
- Office of Chemical Safety, Department of Health (OCS)
- Office of the Gene Technology Regulator (OGTR)
- Safe Work Australia (SWA) and
- Therapeutic Goods Administration (TGA).

The RSN is a forum for scientific and technical staff from member agencies to discuss regulatory scientific issues and improve interagency cooperation. The objective of the RSN is to improve the performance of Australian government regulatory agencies by strengthening evidence-based decision-making through:

- improving the quality and consistency of regulatory science
- fostering collaboration and sharing scientific knowledge and experience between agencies and
- contributing to regulatory science issues.



26 Permit numbers include new, existing and renewed permits.

## Cooperation with the OPCW and CWC States Parties

ASNO has continued to support OPCW initiatives and has worked with other States Parties to encourage effective implementation of the CWC.

ASNO provided technical advice and contributed to policy development in preparation for OPCW Executive Council meetings, industry cluster meetings and informal consultations in The Hague during the reporting period. ASNO attended the virtual Regional Meetings of CWC National Authorities in Asia on 29 July 2020 and 22–24 June 2021. ASNO also attended the virtual National Authorities for the CWC meeting from 23–25 November 2020.

## Domestic Outreach

ASNO continued its close cooperation on CWC implementation issues with Australian Government agencies including the Department of Defence, Defence Export Controls, Attorney-General's Department, Department of Home Affairs and Australian Border Force.

To assist with meeting CWC reporting obligations and ensure compliance with CWC-relevant legislation, ASNO also continued to strengthen engagement with its constituency in industry, research and trade, including with non-government agencies and associations.

Organisation for the Prohibition of Chemical Weapons inspection at an Other Chemical Production Facility, May 2021 (Photo courtesy of the site.)

# Output 1.6: CTBT Implementation

Development of verification systems and arrangements in support of Australia's commitments related to the Comprehensive Nuclear-Test-Ban Treaty.

## Performance Measures

- Australia's obligations under the Comprehensive Nuclear-Test-Ban Treaty (CTBT) are met.
- Legal and administrative mechanisms which support Australia's commitments related to the CTBT are effective.
- Contribute to the development of CTBT verification, including through the work of the CTBT Organization (CTBTO) Preparatory Commission.
- Contribute to Australia's CTBT outreach efforts.

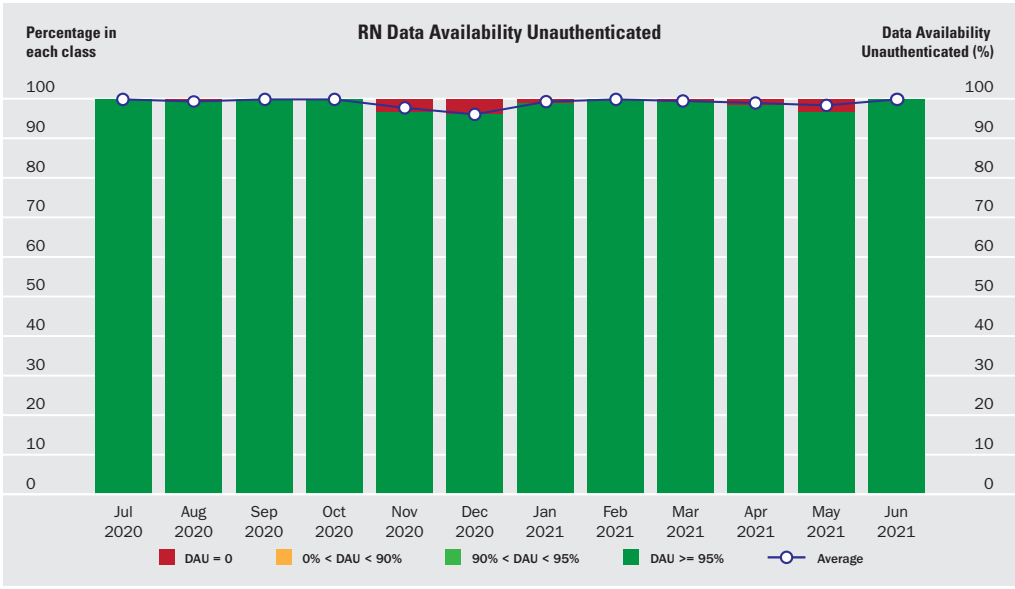
## Performance Assessment

### International Obligations

Australia hosts 20 monitoring stations and one laboratory as part of the CTBT International Monitoring System (IMS). All are certified as operating to CTBTO technical specifications. Ensuring the effective operation of Australia's IMS stations is a routine focus for ASNO.

Australian CTBT stations performed very well despite the COVID–19 shutdowns and restrictions which delayed or stopped some maintenance activities. Performance of Australian seismo-acoustic stations, operated by Geoscience Australia and the Australian National University, has been very good throughout the year with an average operational performance of 99.53 per cent across the 13 stations. Radionuclide monitoring data availability remained high across the seven stations, with an average 99.1 per cent over the 12-month reporting period.

Figure 5: Data availability for Australian IMS radionuclide monitoring stations in 2020–21. Green indicates the percentage of data that was available for each month.




To overcome the problems caused by the pandemic, there has been more reliance on remote monitoring and access to stations, as well as engaging local operators to undertake additional tasks. Repairs to one of the infrasound elements at IS06 (Shannon, WA) had to be deferred, however the station is still mission capable. For radionuclide stations, visits have been restricted during the reporting period, however all maintenance has either been completed or is planned for Q1 in 2021–22 and the Melbourne station (AUP04) has been refreshed.

During the year, ASNO continued to work with the CTBTO on plans for maintaining the cable that brings to shore data from the Cape Leeuwin hydrophone array (HA01).

ARPANSA, which operates the Australian RN stations, also supported the operation of stations in Fiji and Kiribati. Cocos Island (AUP08) radionuclide station has three new local operators with ARPANSA training being conducted in May.

ASNO is working also with ARPANSA and the Australian Antarctic Division to ensure that the redevelopment of facilities on Macquarie Island has minimal impact on the operation of the IMS radionuclide monitoring facility on the island.

## Nuclear-Test-Ban Verification

ASNO administers funding for Geoscience Australia to carry out nuclear test monitoring through its network of seismic stations in addition to those of the CTBT's International Monitoring System (IMS). This arrangement, set out in a Letter of Understanding between Geoscience Australia and ASNO, is reviewed each year. ASNO is satisfied that Geoscience Australia has met its commitments under the Letter of Understanding during the reporting period.

Although the CTBT is not yet in force, its IMS is now substantially in place, with around 90 per cent of Treaty-designated stations in operation. The system detects and reports on many thousands of events each year. Almost all of these can be clearly identified as natural in origin and in the twenty-first century only the DPRK appears to have conducted nuclear test explosions. The table below details nuclear tests conducted by the DPRK.

**Table 19: DPRK Nuclear Test Explosions**

| Date | Approximate seismic magnitude | Estimated explosive yield (kT) | Comment |
|---|---|---|---|
| 9 Oct 2006 | mb 3.9 | < 1 | Likely partial failure |
| 25 May 2009 | mb 4.56 | 1 – 5 | Seismic detection consistent with a simple fission device |
| 12 Feb 2013 | mb 4.93 | 3 – 13 | Seismic detection consistent with a simple fission device |
| 6 Jan 2016 | mb 4.83 | 2.5 – 10 | Claimed by DPRK to be test of a 'hydrogen bomb'. Seismic detection consistent with a simple fission device. |
| 9 Sep 2016 | mb 5.06 | 4.4 – 19 | Seismic detection consistent with a simple fission device |
| 3 Sep 2017 | mb 6.05 | 150–240 | Seismic detection consistent with a more advanced weapon design – potentially thermonuclear as claimed by DPRK. |

Since the 2017 declared nuclear explosion, Geoscience Australia has reported to ASNO on the detection of 47 tectonic events located in the vicinity of the DPRK test site at P'unggye-ri. Based on the signal characteristics, some of these appear to be a continuing series of aftershocks following the large September 2017 test explosion. During this reporting period, Geoscience Australia continued to monitor seismic activity in the vicinity of the DPRK test site at P'unggye-ri and reported to ASNO on the detection of eight earthquakes. The sizes of the events ranged from magnitude 2 to 3.2. Based on technical analysis of the detections, it seems unlikely that any of these events indicate new human activity at the test site.

## Australian Participation in CTBTO verification development activities

The CTBTO Preparatory Commission, including its Member States, continues to carry out work to ensure the Treaty's verification regime will be ready to meet requirements in the CTBT when the Treaty enters into force.

ASNO coordinates and contributes to Australia's specialist support for this work, which is focused on meetings of the CTBTO's Working Group B. Experts from Geoscience Australia and ARPANSA contribute mainly in relation to ongoing development of the CTBT's IMS and International Data Centre (IDC). When the CTBT enters into force, it will provide for on-site inspections (OSI) to determine whether a nuclear explosion has taken place in a particular area. ASNO's Malcolm Coxhead, as Task Leader for the elaboration of an Operational Manual on the conduct of OSI, continued to chair discussions on this subject at the CTBTO Preparatory Commission's technical working group. Travel restrictions due to COVID have limited the scope of this work during the reporting period. Some meetings continued in a virtual format although progress on advancing technical work was been impaired. In particular, field exercises to test and develop the CTBTO's ability to conduct an on-site inspection under the CTBT had to be deferred.

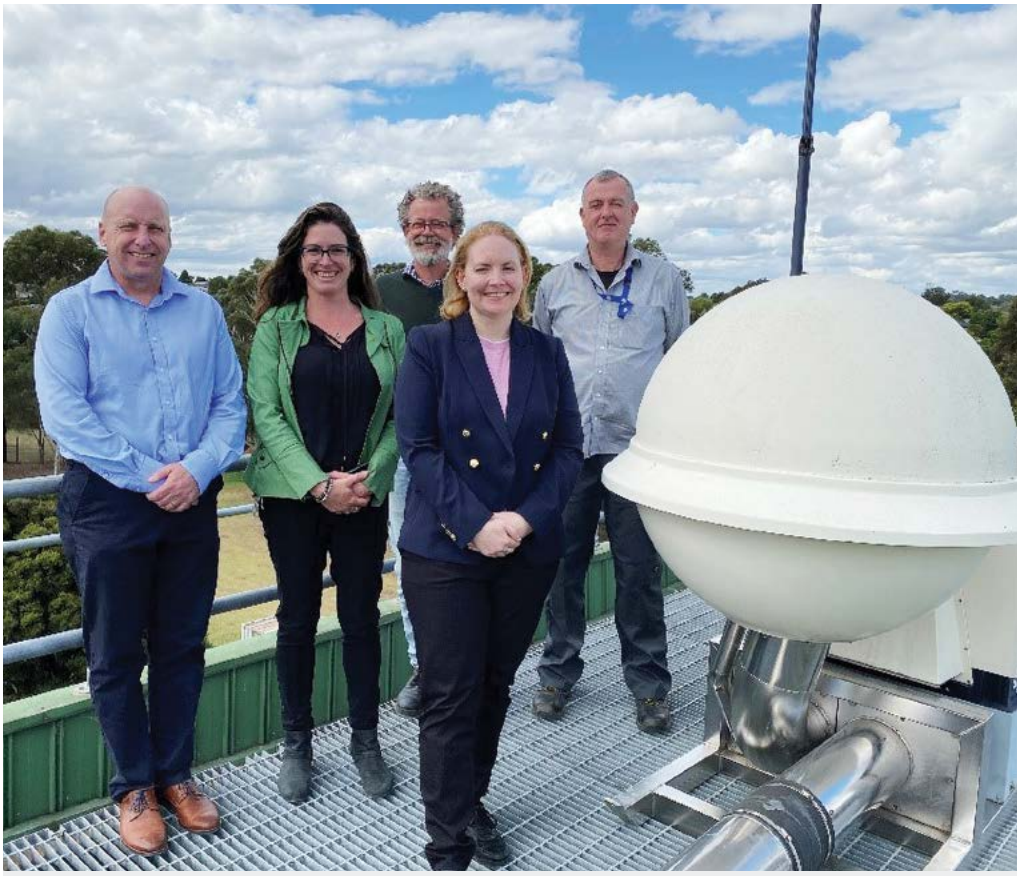
ASNO coordinates the involvement of Australians in training aimed at supporting the operation of the IMS and IDC. While around 90 per cent of CTBT IMS stations are now in place worldwide, detailed preparatory work is continuing to bring the IMS and IDC to satisfactory levels of readiness. ASNO coordinates Australia's contribution to the CTBTO's work in this area, working with technical specialists from Geoscience Australia and ARPANSA.

During the reporting period, Australian experts participated in online international workshops and training in support of CTBT verification or in relation to functions as IMS station operators. ASNO experts attended several webinars hosted by the CTBTO:

Underground Nuclear Explosion (UNE) Observables and Detection; Inspection Team Functionality; OSI Operations Support Centre; and OSI Field Laboratory.

Geoscience Australia had four personnel attend online training delivered by the CTBTO:

- Online Technical Training for Station Operators of IMS Infrasound Stations with Nanometrics and Guralp Equipment (26–30 April) – two attendees.
- Online Technical Training for Station Operators of IMS Seismic Stations and Hydroacoustic T-Phase Stations with Nanometrics and Guralp Equipment (22–26 March) – two attendees.



Australia's RN04 radionuclide monitoring station in Melbourne, part of the CTBTO International Monitoring System, with the dedicated ARPANSA team, during a visit from ASNO.

### Civil and Scientific uses of IMS data

Selected IMS data continues to be used for civil and scientific purposes in Australia. For example, data from seismic stations is used in the Australian National Earthquake Alert Centre for the detection and location of numerous Australian and overseas earthquakes and for tsunami warning. In addition, IMS infrasound data has even been used to confirm meteor sightings and data from the Cape Leeuwin hydrophone array is used in studies of the marine environment such as whale movements.

### Outreach

During the reporting period, the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization held elections for the next Executive Secretary.

On 18 September 2020, Australia's Minister for Foreign Affairs, Senator Marise Payne, announced that ASNO's Director General Dr Robert Floyd was Australia's candidate for the position of Executive Secretary of the Preparatory Commission CTBTO. This important international post leads the joint efforts of 185 countries to ensure a permanent end to nuclear weapon test explosions.

Dr Floyd was elected as the Executive Secretary of the Comprehensive Nuclear-Test-Ban Treaty Organisation (CTBTO) on 20 May 2021 after an extended election process. Dr Floyd received 96 votes in support of his election (of 146 states voting), achieving the two-thirds majority required for election as Executive Secretary of the CTBTO. ASNO worked closely with DFAT colleagues throughout the campaign.

Dr Floyd took up his appointment as CTBTO Executive Secretary on 1 August 2021, succeeding Dr Lassina Zerbo. Dr Floyd aims to build on Dr Zerbo's legacy to further universalise the CTBT and engage diverse voices in the disarmament community in the important work of the CTBTO.

Australia's nomination and support for the election of Dr Floyd as Executive Secretary of the CTBTO offered numerous opportunities for bilateral discussions on promoting the CTBT and encouraging adherence to it. In addition to engagement by Australia's candidate with most Vienna-based CTBTO missions, outreach included approximately 70 countries through their representatives in New York, Geneva, Berlin and Canberra. Australian diplomatic posts engaged with host governments in around 175 countries on the importance of the CTBT as part of the election campaign.

# Output 1.7: Other Non-Proliferation Regimes

Contribution to the development and strengthening of other weapons of mass destruction non-proliferation regimes.

## Performance Measures

- Provide support and assistance to Australia's Permanent Mission to the Conference on Disarmament (CD) in Geneva in their efforts to advance Australia's non-proliferation and disarmament objectives, in particular on seeking to commence the negotiation of an internationally verifiable Fissile Material Cut-off Treaty (FMCT).
- Contribute to technical developments in the field of nuclear disarmament relevant to Australia's interests, in particular through the International Partnership for Nuclear Disarmament Verification.
- Support other developments in the field of non-proliferation and disarmament that are relevant to Australia's interests.

## Performance Assessment

ASNO contributes routinely to Australia's efforts to strengthen international non-proliferation efforts by participating in a range of forums or by providing advice and input for briefing and papers prepared by DFAT, such as papers Australia co-authors with like-minded countries to help shape and influence multilateral processes.

### Fissile Material Cut-off Treaty

A ban on the production of fissile material for use in nuclear weapons has long been considered a companion to the CTBT in that it would work to impose a cap on the size of nuclear arsenals. As an effective, verifiable treaty banning the production of fissile material for nuclear weapons or other nuclear explosive devices, a Fissile Material Cut-Off Treaty (FMCT) has the potential to deliver substantial benefits for the security of all states, furthering the twin goals of nuclear disarmament and nuclear non-proliferation. The term 'fissile material' refers to kinds of nuclear material that are capable of being used in a nuclear weapon.

While there remain significant challenges before such negotiations can commence, a FMCT remains a next logical step in progressing global nuclear disarmament, and continues to be one of Australia's priority nuclear disarmament objectives. ASNO continued during the year to provide expert support for Australia's efforts to build confidence and momentum in the

Conference on Disarmament (CD) towards the commencement of negotiations on an FMCT.

## International Partnership for Nuclear Disarmament Verification (IPNDV)

Future steps in nuclear disarmament will pose significant verification challenges. Success in addressing these future challenges will require the development and application of new technologies or concepts, and all states have an interest in the success of these efforts. ASNO alongside DFAT and ANSTO continue Australia's active contribution to the IPNDV's work.

In 2019, IPNDV completed its second two-year work phase with publication at www.ipndv.org of reports addressing verification of nuclear weapon declarations, verification of reductions, and technologies for verification. The current third work-phase aims to build on this work through practical exercises, including scenario-based discussions and technology demonstrations to examine how concepts and other elements of a verification "tool-kit" can be implemented. ASNO's former Director General Dr Robert Floyd and Malcolm Coxhead co-chaired the task group examining issues from the perspective of future inspectors. Other task groups examined the perspectives of an inspected state and focus on technology issues.

Although physical meetings of IPNDV partner countries paused due to COVID-related restrictions, virtual meetings continued. Two virtual exercises were conducted. One in December 2020 explored similarities and differences in perspectives between inspectors and hosts during verification of the dismantlement of 500 warheads under a fictional nuclear weapons reduction treaty. A second exercise in June 2021, simulated the verification and monitoring of the removal, and subsequent placement in storage, of a warhead from its road-mobile intercontinental ballistic missile.

# Output 1.8: Advice to Government

Provision of high-quality, timely, relevant and professional advice to Government.

## Performance Measures

- Provide policy advice, analysis and briefings that meet the needs of Ministers and other key stakeholders.
- Contribute to the development of Australia's policies by DFAT in the area of weapons of mass destruction (WMD) arms control, disarmament and non-proliferation.
- Cooperate on technical issues of common interest with departments and agencies such as ANSTO, ARPANSA, Department of Defence, Department of Industry, Science, Energy and Resources, and the Australian Intelligence Community.

## Performance Assessment

### ASNO's role in providing independent expert advice

ASNO continues to provide independent expert advice on various non-proliferation policy and regulatory issues. In this regard, ASNO's remit is supported by section 43(d) of the *Nuclear Non-Proliferation (Safeguards) Act 1987*, which states that one of the functions of the Director General is 'to undertake, co-ordinate and facilitate research and development in relation to nuclear safeguards'.

ASNO continued its work on providing advice to the Department of Industry, Science, Energy and Resources (DISER) and the Australian Radioactive Waste Agency (ARWA) regarding the National Radioactive Waste Management Facility including: a detailed business case; licensing process; design of a waste information management system; and safeguards and security by design support to the work of ANSTO and ARWA on the detailed engineering design for the facility.[27]



27 ASNO is working with ANSTO to ensure the engineering designs for the facility can meet requirements to facilitate ongoing IAEA verification while seeking to minimise costs associated with verification.

On 12 March 2020, Dr John Kalish, Assistant Secretary ASNO, appeared before the Victorian Government's Environment and Planning Committee to provide input to the Inquiry into Nuclear Prohibition. The inquiry considered the potential benefits to Victoria in removing prohibitions enacted by the *Nuclear Activities (Prohibitions) Act 1983* and the final report was tabled on 26 November 2020. [28]

Over the reporting period ASNO continued working closely with ARPANSA on best practices for the security of nuclear material, including:

- Spent fuel management, and
- Periodic Safety and Security Review of ANSTO's OPAL Research Reactor.

ASNO worked actively with DFAT throughout the year supporting Australia's successful campaign for the election of Dr Floyd as Executive Secretary of the CTBTO. This included input to advice to Ministers. ASNO's history of engagement with the CTBTO was critical to shaping campaign strategy and messaging.





28 Inquiry into Nuclear Prohibition, Parliament of Victoria.

# Output 2.1: Public Information

Provision of public information on the development, implementation and regulation of weapons of mass destruction in non-proliferation regimes, and Australia's role in these activities.

## Performance Measures

- Effective public education and outreach.

## Performance Assessment

Due to the restrictions imposed by the COVID–19 pandemic, ASNO had to curtail its efforts to ensure Australia's WMD non-proliferation objectives are understood in the public, private, non-government and academic sectors, suspending most presentations, training and other outreach activities. Outreach through social media continued, including in connection with the campaign for election of Australia's candidate as CTBTO Executive Secretary.

ASNO continued however to provide as much guidance and regulatory support possible to permit holders and other general enquiries via extended calls, virtual meetings and online responses. ASNO will continue to attend peak industry forums, conduct on-site outreach visits, and give lectures and presentations in academic and other fora as activities prudent to the pandemic will allow.

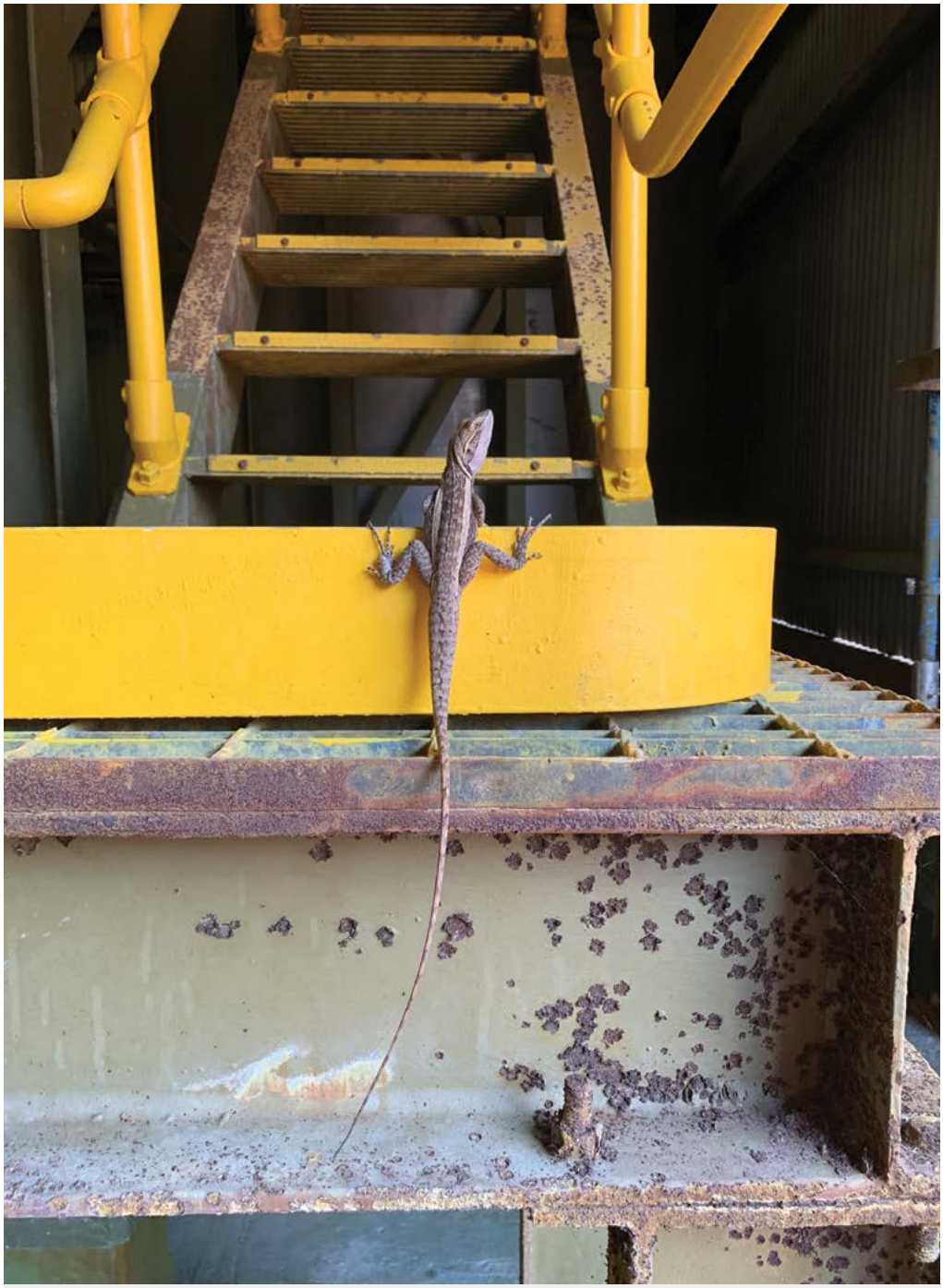
For example, during 2020–21 ASNO attended peak industry forums, conducted on-site outreach visits, and gave lectures and presentations in academic and other fora. ASNO delivered modules and assisted with tutorials on safeguards for the online Master of Nuclear Engineering course Nuclear Safety, Security and Safeguards at the University of New South Wales (UNSW).

ASNO also supported public information and outreach activities through attendance and discussions at the Minerals Council of Australia.

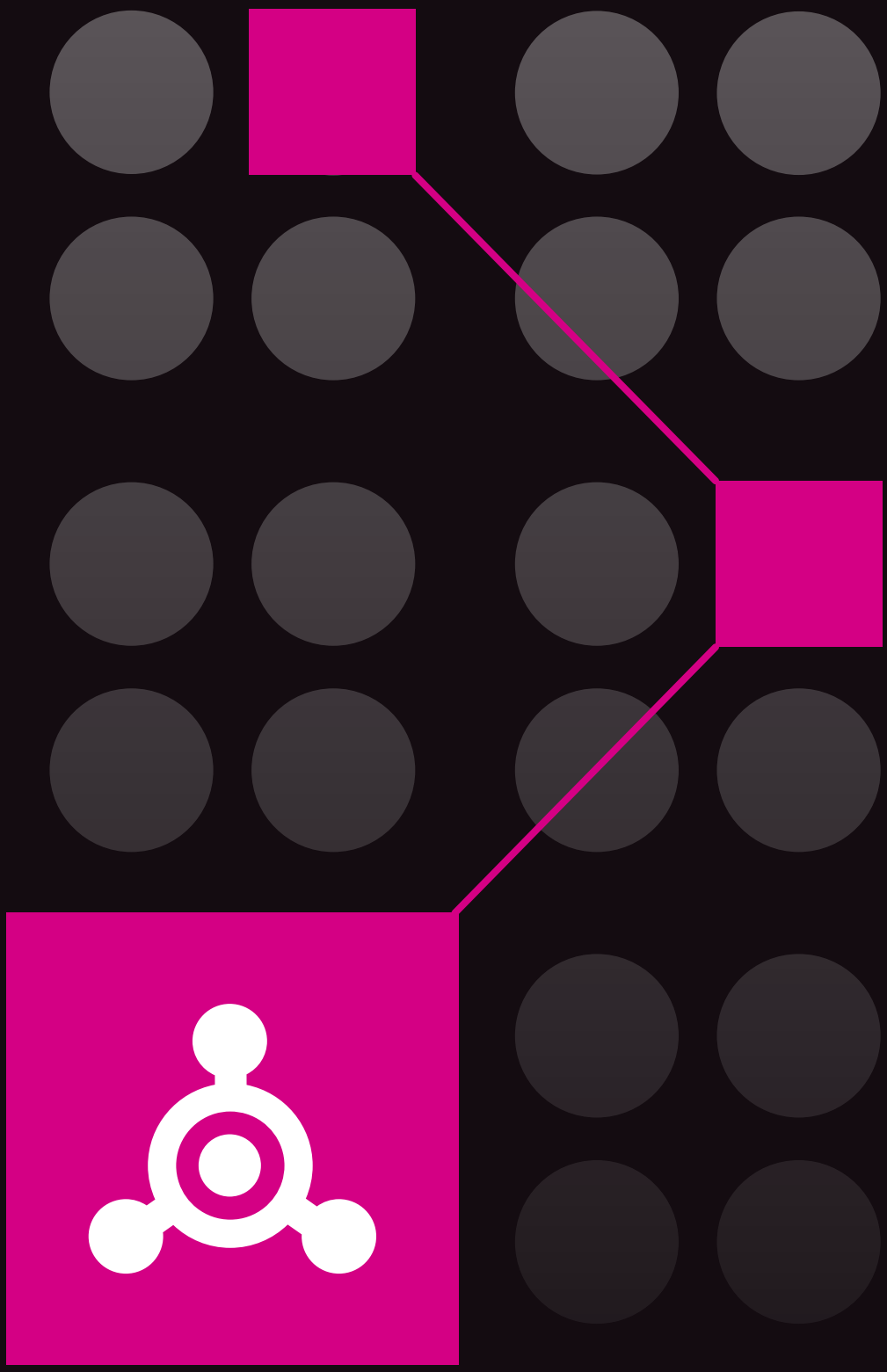
During 2020–21, ASNO updated a number of its template permits and compliance codes for ASNO's current permit and authority holders. In the interests of informing future potential permit holders and the general public on regulatory requirements, ASNO made the updated template permits and compliance codes publicly available online.[29]



29 Template Permits and Compliance Codes, ASNO, DFAT.



Gilbert's dragon (*Lophognathus gilberti*) resting on stairs at the Ranger Uranium Mine.



SECTION 5

# MANAGEMENT AND ACCOUNTABILITY

# Corporate Governance

## Portfolio Minister

Responsibility for administration of the legislation under which ASNO operates – the *Nuclear Non-Proliferation (Safeguards) Act 1987*, *Chemical Weapons (Prohibition) Act 1994* and *Comprehensive Nuclear Test-Ban Treaty Act 1998* – rests with the Minister for Foreign Affairs.

## Director General ASNO

The Director General ASNO reports directly to the Minister for Foreign Affairs. The position combines the statutory offices of the:

- Director of the national authority for nuclear safeguards (formerly Director of Safeguards), as established by the *Nuclear Non-Proliferation (Safeguards) Act 1987;*
- Director of the national authority for the Chemical Weapons Convention, as established by the *Chemical Weapons (Prohibition) Act 1994*; and
- Director of the national authority for the Comprehensive Nuclear-Test-Ban Treaty, as established by the *Comprehensive Nuclear-Test-Ban Treaty Act 1998*.

The Director General ASNO is a statutory position, appointed by the Governor-General. Remuneration for this position is determined by the Remuneration Tribunal.

Dr Robert Floyd held the position of Director General ASNO from the 29 November 2010 until he stepped down on 30 July 2021. Dr John Kalish will act in the position until the appointment of a new Director General.

## Assistant Secretary ASNO

The Assistant Secretary ASNO deputises for the Director General and is responsible for the day-to-day operations of the office.

Dr John Kalish has held this position since 21 April 2010.

## ASNO Staff

ASNO staff, other than the Director General, are employed under the *Public Service Act 1999* as a division within the Department of Foreign Affairs and Trade (DFAT) and subject to the DFAT Enterprise Agreement. Further details can be found in Table 20 and the DFAT Annual Report 2020–21.

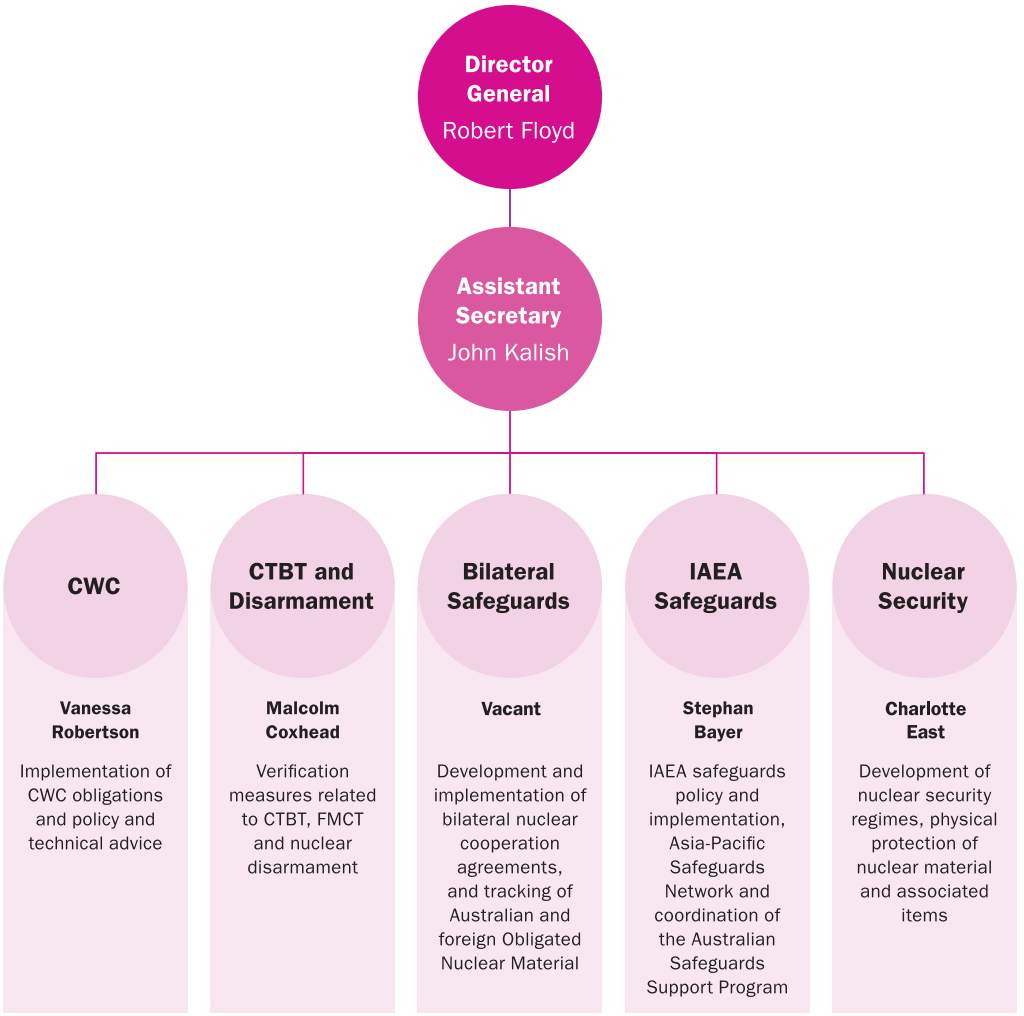
In 2020–21 ASNO had an allocated staff level of 16 FTE.

ASNO's organisational structure is closely aligned with its outputs and can be found in Figure 4.

**Table 20: ASNO Staff at 30 June 2021**

| | Male | Female | Total |
|---|---|---|---|
| SES B2 | 1 | 0 | **1** |
| SES B1 | 1 | 0 | **1** |
| Executive Level 2 | 2 | 2 | **4** |
| Executive Level 1 | 2 | 2 | **4** |
| APS Level 6 | 1 | 1 | **2** |
| APS Level 5 | | | **0** |
| APS Level 4 | | | **0** |
| **TOTAL** | **7** | **5** | **12** |

## Figure 6: ASNO's Organisational Structure at 30 June 2021



## Training and Development

ASNO's primary training requirements are professional development of specialist skills. ASNO is proactive in managing this training, in part through participation in IAEA and OPCW led training courses and participation in international conferences and negotiations. Further details are in Table 21.

**Table 21: Training and Development Activities during 2020–21**

| Training and development activity | Person days |
|---|---|
| Formal DFAT courses | 21 |
| Structured work unit and on-the-job training, including planning days | 36 |
| Seminars, workshops, conferences, overseas negotiations | 32 |
| External formal courses | 14 |
| Academic study | 3 |
| IAEA Consultancy | 18 |
| **TOTAL** | **125** |


Two ASNO staff participated in an online regional training course on Additional Protocol Commodity Identification run jointly between the Japan Atomic Energy Agency (JAEA) and the Korea Institute of Nuclear Nonproliferation and Control (KINAC) on behalf of the IAEA. (Photo courtesy of the JAEA.)

# Financial Management

The *Audit Act 2001* requires ASNO to submit an annual Financial Statement to the Auditor-General. As ASNO is funded as a division of DFAT, this financial statement is published in the DFAT Annual Report. Further details of ASNO activities relating to financial management and performance are also contained in the DFAT Annual Report.

## Administrative Budget

Operational running costs (general) reduced by $177,000 due to the impact of COVID–19 which restricted travel and led to the postponement of plans to host a meeting of the International Partnership on Nuclear Disarmament Verification event in Sydney during the year. The figure in Table 22 reflects the reduced amount.

**Table 22: ASNO Administrative Costs**

| | 2019–20 | 2020–21 |
|---|---|---|
| Salaries | 2,509,272 | 2,280,254 |
| Running Costs | | |
| (General) | 379,447 | 247,228 |
| Seismic monitoring[1] | 558,794 | 558,204 |
| Sub-Total | 938,241 | 805,432 |
| **Total** | **$3,447,513** | **$3,085,686** |

1 Undertaken by Geoscience Australia.

## Regulatory Reform

As a portfolio regulator within DFAT, in 2020–21 ASNO completed its sixth year of participation in the Government's Regulator Performance Framework.[2] The Government developed the Framework to measure the performance of regulators in regard to reducing the cost to businesses. The goal of the program is to measure and report performance that will give businesses, the community, and individuals confidence that regulators manage risk effectively and flexibly.

The Framework consists of six mandatory outcome-based key performance indicators (KPIs) covering reduction in regulatory burden, communications, risk-based and proportionate approaches, efficient and coordinated monitoring, transparency, and continuous improvement. ASNO has identified seven metrics against the six KPIs outlined in Table 23 below.

In the future, Regulatory Performance reporting will be undertaken in line with a principles-based approach to regulatory performance.[3]

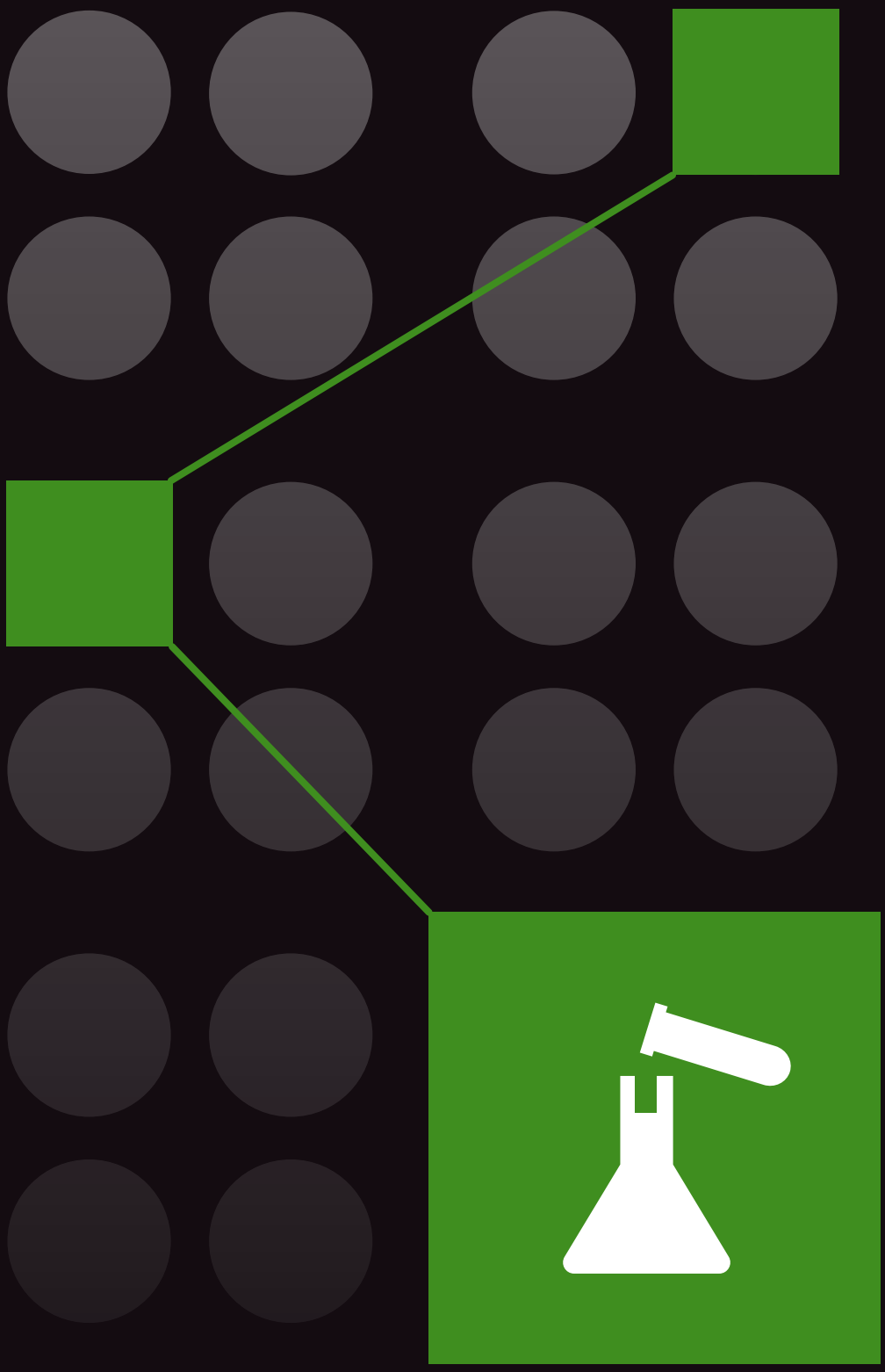
**Table 23: ASNO Regulatory Performance Framework Metrics 2020–21**

| |
|---|
| Timely processing of permit applications and approvals. |
| Regulations and permit conditions are reviewed for clarity and suitability. |
| Implement risk-informed regulatory program. |
| Establish streamlined compliance and inspection processes. |
| Outreach activities conducted to communicate regulatory requirements to stakeholders and receive feedback. |
| Meetings attended to influence international policy. |
| Engagement with other regulators to explore opportunities for regulatory efficiencies. |

## Uranium Producers Charge

ASNO is responsible for the Uranium Producers Charge. This charge is payable to Consolidated Revenue on each kilogram of uranium ore concentrate production (set on 1 December 2018 at 13.5502 cents per kilogram). The charge rate was not changed in 2019 and 2020.

2 ASNO's full Regulator Performance Framework self-assessment reports can be found on the DFAT website.
3 https://deregulation.pmc.gov.au/priorities/regulator-best-practice-and-performance/regulator-performance-guide



SECTION 6

# APPENDICES

# Appendix A: Australia's Nuclear Cooperation Agreements

**Table 24: Australia's Nuclear Cooperation Agreements at 30 June 2021**

| Country / Region | Date of Entry into Force |
|---|---|
| Republic of Korea (ROK) | 2 May 1979 |
| Finland | 9 February 1980 |
| Canada | 9 March 1981 |
| Sweden | 22 May 1981 |
| France | 12 September 1981 |
| Philippines | 11 May 1982 |
| Japan | 17 August 1982 |
| Switzerland | 27 July 1988 |
| Egypt | 2 June 1989 |
| Mexico | 17 July 1992 |
| New Zealand | 1 May 2000 |
| United States (covering cooperation on Silex Technology) | 24 May 2000 |
| Czech Republic | 17 May 2002 |
| United States (covering supply to Taiwan) | 17 May 2002 |
| Hungary | 15 June 2002 |
| Argentina | 12 January 2005 |
| People's Republic of China[1] | 3 February 2007 |
| Russian Federation | 11 November 2010 |

1 Australia has two agreements with China: one covering nuclear material transfers and one covering nuclear cooperation.

| Country / Region | Date of Entry into Force |
|---|---|
| United States | 22 December 2010 |
| Euratom[2] | 1 January 2012 |
| United Arab Emirates | 14 April 2014 |
| India | 13 November 2015 |
| Ukraine | 15 June 2017 |
| United Kingdom | 1 January 2021 |

Note: The above list does not include Australia's Comprehensive Safeguards Agreement with the International Atomic Energy Agency, concluded on 10 July 1974 or the Protocol Additional to that Safeguards Agreement concluded on 23 September 1997. In addition to the above Agreements, Australia has an Exchange of Notes constituting an Agreement with Singapore Concerning Cooperation on the Physical Protection of Nuclear Materials, which entered into force on 15 December 1989.

2 Euratom is the European Atomic Energy Community. The Australia-Euratom NCA covers all 27 Member States of the European Union.

# Appendix B: IAEA Statements of Conclusions and Other Inspection Findings for Australia in 2020–21

## IAEA Inspection Regime in Australia

The IAEA conducts verification activities (under different names, but all essentially inspections) in Australia under the Comprehensive Safeguards Agreement[3] and under the Additional Protocol,[4] with the scope and focus differing between these two agreements.

Under the Comprehensive Safeguards Agreement the IAEA conducts inspections to verify nuclear material inventory and facility design features. There are four types of inspection conducted in Australia each year under the Comprehensive Safeguards Agreement:

- **Physical inventory verification (PIV):** a scheduled inspection in a selected material balance area (MBA)[5] to verify the stocktake of physical inventory (known as a physical inventory taking) from that MBA. PIVs involve a more complete verification of inventory than short notice random inspections (SNRI,[6] see below). The frequency of PIVs depends on the types and quantities of nuclear material held in each MBA. In Australia's case, PIVs are scheduled annually for ANSTO's OPAL reactor (AS-F), R&D laboratories (AS-C), and storage areas (AS-D). PIVs for each MBA are scheduled together each year so the IAEA can complete them all in one visit to Australia. In total these usually take five days to complete in conjunction with DIVs (see below). For MBAs AS-E, ASE1 and AS-I, the IAEA schedules a PIV approximately once every four years for AS-E/ASE1 combined, selecting one location (usually a university) taken as a representative sample of all such locations; and once every four years for one of CSIRO's locations in MBA AS-I. These PIVs are usually conducted in one day.
- **Interim inventory verification (IIV):** an inspection in a selected MBA to verify specific types of nuclear material, scheduled at a time other than during the PIV. The IAEA conducted an IIV at ANSTO's R&D laboratories (AS-C) in August 2020 to measure the uranium content in solid waste from molybdenum–99 (Mo–99) radiopharmaceutical production using an active well coincidence counter (AWCC). It is anticipated that the IAEA will schedule an IIV approximately once every two years for AS-C.

3 See Schedule 3 of the *Nuclear Non-Proliferation (Safeguards) Act 1987.*
4 Published in IAEA document INFCIRC/540 (corrected).
5 Australia's material balance areas for IAEA safeguards are described in Table 3 in Output 1.1.
6 ASNO uses the term 'short notice random inspections' for these inspections because they are performed on short notice on a date chosen by the IAEA at random. These inspections may also be referred to as 'random interim inspections' because they do not coincide with the ending date of a material balance period.

- **Short notice random inspection (SNRI):** an inspection called by the IAEA at a random time with limited notice. The IAEA calls an SNRI once or twice each year at the OPAL reactor with three hours' notice to ASNO and ANSTO. These inspections usually last for one or two days.
- **Design information verification (DIV):** an inspection to verify the correctness and completeness of the design features of a facility relevant to the application of safeguards. The IAEA typically conducts DIVs together with the annual PIVs.

Under the Additional Protocol the IAEA has the right to conduct verification activities (essentially inspections) known as **complementary access**. A complementary access may have three purposes:

1. assuring the absence of undeclared nuclear material or activities in Australia (Article 4.a.i);
2. resolving any questions or inconsistencies related to the correctness and completeness of Australia's declarations under the Additional Protocol (Article 4.a.ii); and/or
3. confirming the decommissioned status of a facility (Article 4.a.iii).

The IAEA has conducted a total of 85 complementary accesses in Australia since 1998.

Article 4.a.i complementary accesses are the most common. Since 1998 the IAEA has conducted only two complementary accesses under Article 4.a.ii, and one under Article 4.a.iii. Complementary access activities called while IAEA inspectors are already on the ANSTO site for other inspections can be conducted at any building on-site with two hours' notice. Complementary access activities for locations outside ANSTO (e.g. universities, uranium mines) require a minimum of 24 hours' notice, however given the considerable distances in Australia are often issued with at least several days' notice. The IAEA typically conducts two to three complementary access activities in Australia each year, a few at ANSTO buildings, and one outside of ANSTO.

## IAEA Conclusions on Australia's Compliance

The IAEA's conclusions for Australia are provided at two levels: the IAEA's overarching summary of findings and conclusions published in the IAEA's Safeguards Statement for 2020 (see Appendix C) for all States with safeguards agreements with the IAEA; and the statements of conclusions of inspections in Australia.

The highest-level conclusion the IAEA draws, known as the 'broader conclusion', is in paragraph 1(a) of the Safeguards Statement:

*'the Secretariat found no indication of the diversion of declared nuclear material from peaceful nuclear activities and no indication of undeclared nuclear material or activities. On this basis, the Secretariat concluded that, for these States, all nuclear material remained in peaceful activities.'*

Australia is on the list of countries covered by the IAEA's broader conclusion in the Safeguards Statement for 2020. Australia was the first country to receive the 'broader conclusion' in 2000 and has received it every subsequent year.

The IAEA's statements of conclusions related to inspections in Australia are provided in several ways:

- **Article 91(a)** of Australia's Comprehensive Safeguards Agreement: the results of inspections at individual material balance areas (MBAs),
- **Article 91(b)** of Australia's Comprehensive Safeguards Agreement: the conclusions the IAEA has drawn from all its verification activities (headquarters analysis and inspections) in Australia for each individual MBA[7],
- Statement of results of design information verification activities (DIVs),
- **Article 10.a** of the Additional Protocol: Statement on complementary access activities undertaken,
- **Article 10.b** of the Additional Protocol: Statement of results of activities in respect of any questions or inconsistencies the IAEA has raised with Australia, and
- **Article 10.c** of the Additional Protocol: Statement on the conclusions the IAEA has drawn from complementary access activities.

## IAEA Conclusions and Findings for Each Material Balance Area

### Material balance area: AS-A (HIFAR)
### Material balance period: N/A (safeguards status: closed down)

| Inspection activity | Date(s) of inspection | Inspection location | Statement of results | Date statement provided |
|---|---|---|---|---|
| Design Information Verification | 30 April 2021 | ANSTO | "Based on the activities conducted and the information available to date in connection with such activities, the results of the DIV were satisfactory" | 21 May 2021 |



7 Note: under the standard NPT safeguards agreement printed in IAEA document INFCIRC/153 these provisions are in paragraphs 90(a) and 90(b). Australia's Comprehensive Safeguards Agreement has an additional paragraph that is not in INFCIRC/153.

## Material balance area: AS-C (research and development laboratories) Material balance period: 8 May 2019–3 June 2020

| Inspection activity | Date(s) of inspection | Inspection location | Statement of results | Date statement provided |
|---|---|---|---|---|
| Physical Inventory Verification | 4–10 June 2020 | ANSTO | "Based on the activities conducted and the information available to date in connection with such activities, the results from this inspection were satisfactory" | 27 July 2020 |
| Design Information Verification | 4–10 June 2020 | ANSTO | "Based on the activities conducted and the information available to date in connection with such activities, the results of the DIV were satisfactory" | 27 July 2020 |
| 91(b) Statement of Conclusions (19 October 2020) | | | "The IAEA has concluded from its verification activities carried out at AS-C during the material balance period from 8 May 2019 to 3 June 2020, and based on the information available to date in connection with such activities, that all declared nuclear material has been accounted for and that there were no indications of the undeclared presence, production or processing of nuclear material. The Agency continues to monitor the amount of nuclear material left unverified and notes the work being carried out jointly between the State, the Facility Operator and the Agency to deploy dedicated nondestructive analysis equipment that will allow the verification of the irradiated nuclear material left unverified at AS-C." | |

The IAEA's statement noted "the work being carried out jointly…to deploy dedicated non-destructive analysis equipment" relates to the IAEA's active well coincidence counter (AWCC) for quantifying the uranium in solid waste from ANSTO's molybdenum–99 radiopharmaceutical production process. The AWCC was successfully deployed in the interim inventory verification inspection on 24–27 August 2020, as shown in the table below. See Output 1.1 for further details.

Material balance area: AS-C (research and development laboratories)
Material balance period: 4 June 2020–3 June 2021

| Inspection activity | Date(s) of inspection | Inspection location | Statement of results | Date statement provided |
|---|---|---|---|---|
| Interim Inventory Verification | 24–27 August 2020 | ANSTO | "Based on the activities conducted and the information available to date in connection with such activities, the results from this inspection were satisfactory" | 27 October 2020 |
| Design Information Verification | 30 April 2021 | ANSTO | "Based on the activities conducted and the information available to date in connection with such activities, the results of the DIV were satisfactory" | 24 May 2021 |
| Physical Inventory Verification | 4, 8 and 9 June 2021 | ANSTO | Not available at time of publication of this Annual Report | N/A |
| Design Information Verification | 4, 8 and 9 June 2021 | ANSTO | Not available at time of publication of this Annual Report | N/A |
| 91(b) Statement of Conclusions | | Not available at time of publication of this Annual Report | | |

## Material balance area: AS-D (vault storage)
## Material balance period: 6 May 2019–2 June 2020

| Inspection activity | Date(s) of inspection | Inspection location | Statement of results | Date statement provided |
|---|---|---|---|---|
| Physical Inventory Verification | 3 June 2020 | ANSTO | "Based on the activities conducted and the information available to date in connection with such activities, the results from this inspection were satisfactory" | 27 July 2020 |
| Design Information Verification | 3 June 2020 | ANSTO | "Based on the activities conducted and the information available to date in connection with such activities, the results of the DIV were satisfactory" | 27 July 2020 |
| 91(b) Statement of Conclusions<br>(28 August 2020) | "The IAEA has concluded from its verification activities carried out at AS-D during the material balance period from 6 May 2019 to 2 June 2020, and based on the information available to date in connection with such activities, that all declared nuclear material has been accounted for and that there were no indications of the undeclared presence, production or processing of nuclear material." | | | |

## Material balance area: AS-D (vault storage)
## Material balance period: 3 June 2020–8 June 2021

| Inspection activity | Date(s) of inspection | Inspection location | Statement of results | Date statement provided |
|---|---|---|---|---|
| Physical Inventory Verification | 9 June 2021 | ANSTO | Not available at time of publication of this Annual Report | N/A |
| Design Information Verification | 9 June 2021 | ANSTO | Not available at time of publication of this Annual Report | N/A |
| 91(b) Statement of Conclusions | Not available at time of publication of this Annual Report | | | |

Material balance area: AS-F (OPAL)
Material balance period: 7 May 2019–1 June 2020

| Inspection activity | Date(s) of inspection | Inspection location | Statement of results | Date statement provided |
|---|---|---|---|---|
| Short Notice Random Inspection | 8–9 October 2019 | ANSTO | "Based on the activities conducted and the information available to date in connection with such activities, the results from this inspection were satisfactory" | 21 January 2020 |
| Short Notice Random Inspection | 3 February 2020 | ANSTO | "Based on the activities conducted and the information available to date in connection with such activities, the results from this inspection were satisfactory" | 6 May 2020 |
| Physical Inventory Verification | 2 June 2020 | ANSTO | "Based on the activities conducted and the information available to date in connection with such activities, the results from this inspection were satisfactory" | 27 July 2020 |
| Design Information Verification | 2 June 2020 | ANSTO | "Based on the activities conducted and the information available to date in connection with such activities, the results of the DIV were satisfactory" | 27 July 2020 |
| 91(b) Statement of Conclusions<br>(7 September 2020) | | | "The IAEA has concluded from its verification activities carried out at AS-F during the material balance period from 7 May 2019 to 1 June 2020, and based on the information available to date in connection with such activities, that all declared nuclear material has been accounted for and that there were no indications of the undeclared presence, production or processing of nuclear material." | |

Material balance area: AS-F (OPAL)
Material balance period: 2 June 2020–6 June 2021

| Inspection activity | Date(s) of inspection | Inspection location | Statement of results | Date statement provided |
|---|---|---|---|---|
| Short Notice Random Inspection | 28 April 2021 | ANSTO | "Based on the activities conducted and the information available to date in connection with such activities, the results from this inspection were satisfactory" | 28 May 2021 |
| Physical Inventory Verification | 7 June 2021 | ANSTO | Not available at time of publication of this Annual Report | N/A |
| Design Information Verification | 7 June 2021 | ANSTO | Not available at time of publication of this Annual Report | N/A |
| 91(b) Statement of Conclusions | Not available at time of publication of this Annual Report | | | |

## Additional Protocol Assessment Period: 1 January 2019–31 December 2019

| Date of Complementary Access (CA) | Location | 10(a) Statement of activities | Date statement provided |
|---|---|---|---|
| 9 May 2019 | Lucas Heights Science and Technology Centre: Buildings 21B Ext, 21E and 21H | "The IAEA was able to carry out all planned activities during the CA" | 27 August 2019 |
| 20 May 2019 | Beverley and Four Mile uranium mines (Heathgate Resources) | "The IAEA was able to carry out all planned activities during the CA" | 27 August 2019 |
| 8 October 2019 | Lucas Heights Science and Technology Centre (PN001-ANSTO): Buildings 80, 41, 88, 54 | "The IAEA was able to carry out all planned activities during the CA" | 7 January 2020 |
| 10(c) Statement of Conclusions<br>(9 March 2020) | "The Agency has concluded from its activities carried out during this period, and based on the information available to date in connection with such activities that access pursuant to Article 4.a.(i) did not indicate the presence of undeclared nuclear material or activities at:<br>• LHSTC – Lucas Heights Science and Technology Centre<br>• Beverley<br>• PN001-ANSTO*<br>Note that conclusions marked with an asterisk (*) are pending the results and evaluation of environmental samples." | | |

## Additional Protocol Assessment Period: 1 January 2020 – 31 December 2020

| Date of Complementary Access (CA) | Location | 10(a) Statement of activities | Date statement provided |
|---|---|---|---|
| 4 February 2020 | Lucas Heights Science and Technology Centre: Buildings 88, 23A/B, 54 | "The IAEA was able to carry out all planned activities during the CA" | 5 March 2020 |
| 11 June 2020 | Lucas Heights Science and Technology Centre: Buildings 93, 91 | "The IAEA was able to carry out all planned activities during the CA" | 30 July 2020 |
| 28 August 2020 | CSIRO – North Ryde, NSW | "The IAEA was able to carry out all planned activities during the CA" | 20 October 2020 |
| 10(c) Statement of Conclusions<br>(17 March 2021) | The Agency has concluded from its activities carried out during this period, and based on the information available to date in connection with such activities that access pursuant to Article 4.a.(i) did not indicate the presence of undeclared nuclear material or activities at:<br>• PN013 – CSIRO North Ryde<br>• PN001 – ANSTO (Lucas Heights) | | |

## Additional Protocol Assessment Period: 1 January 2021– 31 December 2021

| Date of Complementary Access (CA) | Location | 10(a) Statement of activities | Date statement provided |
|---|---|---|---|
| 28 April 2021 | Lucas Heights Science and Technology Centre: Buildings 80, 54 | Not available at time of publication of this Annual Report | N/A |
| 29 April 2021 | Lucas Heights Science and Technology Centre: Buildings 88, 23A/B, 76 | Not available at time of publication of this Annual Report | N/A |
| 11 June 2021 | CSIRO – Lucas Heights, NSW | Not available at time of publication of this Annual Report | N/A |
| 15 June 2021 | Honeymoon uranium mine (in care and maintenance, Boss Uranium) | Not available at time of publication of this Annual Report | N/A |
| 10(c) Statement of Conclusions | 10(c) statements of conclusions are provided early in the year following the assessment period | | |

# Appendix C: IAEA Safeguards Statement for 2020 [1,2]

*This statement plus further details on safeguards implementation is available at: https://www.iaea.org/sites/default/files/21/06/statement-sir-2020.pdf.*

*This statement is copied verbatim from the IAEA's publication, including footnotes.*

"In 2020, safeguards were applied for 183 States[3, 4] with safeguards agreements in force with the Agency. The Secretariat's findings and conclusions for 2020 are reported below with regard to each type of safeguards agreement. These findings and conclusions are based upon an evaluation of all safeguards relevant information available to the Agency in exercising its rights and fulfilling its safeguards obligations for that year.

1. One hundred and thirty-one States had both comprehensive safeguards agreements and additional protocols in force[5]:
   a. For 72 of these States,[6] the Secretariat found no indication of the diversion of declared nuclear material from peaceful nuclear activities and no indication of undeclared nuclear material or activities. On this basis, the Secretariat concluded that, for these States, all nuclear material remained in peaceful activities.
   b. For 59 of these States, the Secretariat found no indication of the diversion of declared nuclear material from peaceful nuclear activities. Evaluations regarding the absence of undeclared nuclear material and activities for each of these States remained ongoing. On this basis, the Secretariat concluded that, for these States, declared nuclear material remained in peaceful activities.
2. Safeguards activities were implemented for 44 States with comprehensive safeguards agreements in force, but without additional protocols in force. For these States, the Secretariat found no indication of the diversion of declared nuclear material from peaceful nuclear activities. On this basis, the Secretariat concluded that, for these States, declared nuclear material remained in peaceful activities.
3. As of the end of 2020, 10 States Parties to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) had yet to bring into force comprehensive safeguards agreements with the Agency as required by Article III of that Treaty. For these States Parties, the Secretariat could not draw any safeguards conclusions.

1 The designations employed and the presentation of material in this report, including the numbers cited, do not imply the expression of any opinion whatsoever on the part of the Agency or its Member States concerning the legal status of any country or territory or of its authorities, or concerning the delimitation of its frontiers.
2 The referenced number of States Parties to the NPT is based on the number of instruments of ratification, accession or succession that have been deposited.
3 These States do not include the Democratic People's Republic of Korea (DPRK), where the Agency did not implement safeguards and, therefore, could not draw any conclusion.
4 And Taiwan, China.
5 Or an additional protocol being provisionally applied, pending its entry into force.
6 And Taiwan, China.

4. Three States had safeguards agreements based on INFCIRC/66/Rev.2 in force, requiring the application of safeguards to nuclear material, facilities and other items specified in the relevant safeguards agreement. One of these States, India, had an additional protocol in force. For these States, the Secretariat found no indication of the diversion of nuclear material or of the misuse of the facilities or other items to which safeguards had been applied. On this basis, the Secretariat concluded that, for these States, nuclear material, facilities or other items to which safeguards had been applied remained in peaceful activities.
5. Five nuclear-weapon States had voluntary offer agreements and additional protocols in force. Safeguards were implemented with regard to declared nuclear material in selected facilities in all five States. For these States, the Secretariat found no indication of the undeclared withdrawal from safeguards of nuclear material to which safeguards had been applied. On this basis, the Secretariat concluded that, for these States, nuclear material in selected facilities to which safeguards had been applied remained in peaceful activities or had been withdrawn from safeguards as provided for in the agreements."

# Appendix D: Information Publication Scheme Statement

Agencies subject to the *Freedom of Information Act 1982* (FOI Act) are required to publish information for the public as part of the Information Publication Scheme (IPS). This requirement is in Part II of the FOI Act and has replaced the former requirement to publish a section 8 statement in an annual report. Each agency must display on its website a plan showing what information it publishes in accordance with the IPS requirements.

An agency plan showing what information is published in accordance with IPS requirements is accessible from https://www.dfat.gov.au/about-us/corporate/freedom-of-information/Pages/freedom-of-information.

## Presentations and Submissions

ASNO produced a range of publications and conducted various presentations to increase community awareness and understanding of ASNO responsibilities and issues for which it has expertise. ASNO also made a number of submissions to Parliamentary and other inquiries. Presentations include:

Stephan Bayer, *Attributes of Resilient Organisations and Systems in Practice – ASNO Experience*, Regional Seminar for State Authorities, Building Resilience in Safeguards Implementation: Experiences, Lessons and Good Practices in Preparing for Unforeseen Events, 2–4 March 2021, Virtual.

John Kalish, Stephan Bayer, Kalman Robertson, Lyndell Evans, *Safeguards Implementation During COVID–19 Outbreak – Australia*, 11th Annual Meeting of Asia-Pacific Safeguards Network, 2 December 2020, Virtual.

Kalman Robertson, Lyndell Evans, *Safeguards Implementation During COVID–19 Outbreak*, Regional Seminar for State Authorities, Building Resilience in Safeguards Implementation: Experiences, Lessons and Good Practices in Preparing for Unforeseen Events, 2–4 March 2021, Virtual.

Vanessa Robertson, *Chemical Weapons Convention*, Regulatory Science Network Presentation, 25 February 2021, Virtual.

Vanessa Robertson, *Domestic and International Obligations for Old Chemical Weapons*, 22 March 2021, Virtual.

# Glossary

| Term | Description |
|---|---|
| Additional Protocol (AP) | An agreement designed to complement a state's safeguards agreement with the IAEA in order to strengthen the effectiveness and improve the efficiency of the safeguards system. The text of the Model Additional Protocol is set out in IAEA document INFCIRC/540 (Corrected). |
| Asia-Pacific Safeguards Network (APSN) | A professional network that draws upon safeguards expertise in the Asia-Pacific to facilitate the exchange of safeguards information, knowledge, and practical experience among members in order to strengthen safeguards capabilities in the region. |
| Australian Nuclear Science and Technology Organisation (ANSTO) | ANSTO is the Australian public research organisation focused on nuclear science and technology with applications in health including radiopharmaceutical production, engineering, materials science, the environment and the nuclear fuel cycle. ANSTO's operations include the OPAL research reactor and ANSTO Nuclear Medicine (ANM). |
| Australian Obligated Nuclear Material (AONM) | Nuclear material exported from Australia and nuclear material derived therefrom, which is subject to obligations pursuant to Australia's bilateral nuclear cooperation agreements. |
| Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) | The Australian Government's primary authority on radiation protection and nuclear safety. ARPANSA regulates Commonwealth entities that use radiation with the objective of protecting people and the environment. |
| Australian Safeguards Support Program (ASSP) | ASSP is one of 21 programs established by Member States and the European Commission to assist the IAEA in safeguards research and development and is coordinated by ASNO. |
| Broader Conclusion (nuclear) | The IAEA can draw the "broader conclusion" for a State as a whole that "all nuclear material remain in peaceful activities". This is a more fulsome assessment for a State than "declared nuclear material remain in peaceful activities". |
| Central Nervous System-Acting Chemicals (CNSACs) | Toxic (and potentially lethal) chemicals that target the central nervous system. |

| Term | Description |
|---|---|
| Challenge Inspection | (For CWC purposes) an inspection, requested by a CWC State Party, of any facility or location in the territory or in any other place under the jurisdiction or control of another State Party. |
| Chemical Weapon Production Facility (CWPF) | Provisions for dealing with chemical weapon production facilities are addressed in Article V of the CWC. |
| Chemical Weapons Convention (CWC) | Commonly used name given to the Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction. |
| Complementary Access (CA) | The right of the IAEA, pursuant to the Additional Protocol, for access to a site or location to carry out verification activities. |
| Comprehensive Nuclear-Test-Ban Treaty (CTBT) | The CTBT bans all nuclear explosions. While there is almost universal adoption of the Treaty, it will not enter into force until the 44 States specified in Annex 2 have signed and ratified the Treaty. |
| Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) | The Vienna-based international organisation established to implement the CTBT |
| Comprehensive Safeguards Agreement (CSA) | Agreement between a State and the IAEA for the application of safeguards to all of the State's current and future nuclear activities (equivalent to 'full scope' safeguards) based on IAEA document INFCIRC/153 (corrected). |
| Convention on the Physical Protection of Nuclear Material (CPPNM) | The CPPNM establishes physical protection measures that must be applied to nuclear material in international transport, as well as measures related to criminal offenses related to nuclear material. |
| Amended Convention on the Physical Protection of Nuclear Material (A/CPPNM) | The amended CPPNM additionally requires physical protection measures for nuclear facilities and material in domestic use, storage and transport. It also requires States to criminalise malicious acts involving nuclear facilities and material and expands State-to-State cooperation in responding to such acts. |
| Conversion | Purification of uranium ore concentrates or recycled nuclear material and conversion to a chemical form suitable for isotopic enrichment or fuel fabrication. |
| CWC-Scheduled Chemicals | Chemicals listed in the three Schedules to the Chemical Weapons Convention. Some are chemical warfare agents and others are dual-use chemicals that can be used in industry or in the manufacture of chemical warfare agents. |
| Defence Science and Technology Group (DSTG) | The Australian Government's lead agency responsible for applying science and technology to defence and national security. |

| Term | Description |
|---|---|
| Democratic People's Republic of Korea (DPRK) | Also known as North Korea |
| Depleted Uranium (DU) | Uranium with a $^{235}U$ content less than that found in nature (e.g. the uranium contains less than 0.711% $^{235}U$). Depleted uranium is usually the waste product of the uranium enrichment processes. |
| Direct-Use Material | Nuclear material defined for safeguards purposes as being usable for nuclear explosives without transmutation or further enrichment, e.g. plutonium, High Enriched Uranium (HEU) and $^{233}U$. |
| Discrete Organic Chemical (DOC) | Any chemical belonging to the class of chemical compounds consisting of all compounds of carbon, except for its oxides, sulphides and metal carbonates, identifiable by chemical name, by structural formula, if known, and by Chemical Abstracts Service registry number, if assigned. Long chain polymers are not included in this definition. |
| Enrichment | A physical or chemical process for increasing the proportion of a particular isotope. Uranium enrichment involves increasing the proportion of $^{235}U$ from its level in natural uranium, 0.711%. For Low Enriched Uranium (LEU) fuel used in a power reactor the proportion of $^{235}U$ (the enrichment level) is typically increased to between 3% and 5%. |
| Euratom | The European Atomic Energy Community of the European Union. Euratom's safeguards office, called the Directorate-General of Energy E – Nuclear Safeguards, is responsible for the application of safeguards to all nuclear material in Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden; and to all nuclear material in civil facilities in France. |
| Facility | (For CWC purposes) a plant, plant site or production/processing unit.<br><br>(For safeguards purposes) a reactor, critical facility, conversion plant, fabrication plant, reprocessing plant, isotope separation plant, separate storage location, or any location where safeguards-significant amounts of nuclear material are customarily used. |
| Fact-Finding Mission (FFM) | The United Nations can establish FFMs to discover facts, often in troubled areas, within clear legal and political parameters. |

| Term | Description |
|---|---|
| Fissile | Referring to a nuclide capable of undergoing fission by neutrons of any energy, including 'thermal' neutrons (e.g. $^{233}U$, $^{235}U$, $^{239}Pu$ and $^{241}Pu$). |
| Fissile Material Cut-off Treaty (FMCT) | A proposed international treaty to prohibit production of fissile material for nuclear weapons. |
| Fission | The splitting of an atomic nucleus into roughly equal parts, often triggered by a bombarding neutron.<br><br>In a nuclear reactor, a neutron collides with a fissile nuclide (e.g. $^{235}U$) that then splits, releasing energy and further neutrons. Some of these neutrons go on to collide with other fissile nuclei, setting up a nuclear chain reaction. |
| Fissionable | Referring to a nuclide capable of undergoing fission by 'fast' neutrons (e.g. $^{233}U$, $^{235}U$, $^{238}U$, $^{239}Pu$, $^{240}Pu$, $^{241}Pu$ and $^{242}Pu$). |
| Full-Scope Safeguards | The application of IAEA safeguards to all of a State's present and future nuclear activities. Now more commonly referred to as comprehensive safeguards. |
| Geoscience Australia (GA) | Geoscience Australia is Australia's leading public sector geoscience organisation. GA conducts nuclear monitoring activities on behalf of the Australian Government agreed through a Letter of Understanding between ASNO and GA. GA is also involved in the installation and maintenance of some of the CTBT IMS stations in Australia and its territories. These activities play an important role in ensuring Australia fulfils its obligations under the CTBT. |
| GW | Gigawatt (Giga = billion, $10^9$) |
| GWe | Gigawatts of electrical power |
| GWt | Gigawatts of thermal power |
| Heavy Water ($D_2O$) | Water enriched in the 'heavy' hydrogen isotope deuterium ($^2H$) which consists of a proton and a neutron. $D_2O$ occurs naturally as about one part in 6000 of ordinary water. $D_2O$ is a very efficient moderator, enabling the use of natural uranium in a nuclear reactor. |
| High Flux Australian Reactor (HIFAR) | The 10 MWt research reactor located at ANSTO, Lucas Heights. Undergoing decommissioning. |
| High enriched uranium (HEU) | Uranium enriched to 20% or more in $^{235}U$. Weapons-grade HEU is typically enriched to over 90% $^{235}U$. |
| Hydroacoustic | Term referring to underwater propagation of pressure waves (sounds). One category of CTBT IMS station monitoring changes in water pressure generated by sound waves in the water. |

| Term | Description |
|---|---|
| Indirect-Use Material | Nuclear material that cannot be used for a nuclear explosive without transmutation or further enrichment (e.g. depleted uranium, natural uranium, LEU and thorium). |
| INFCIRC | IAEA Information Circular. A series of documents published by the IAEA setting out, inter alia, safeguards, physical protection and export control arrangements. https://www.iaea.org/publications/documents/infcircs |
| INFCIRC/153 (Corrected) | The model agreement used by the IAEA as a basis for comprehensive safeguards agreements with non-nuclear-weapon states party to the NPT. |
| INFCIRC/225 Rev.5 (Corrected) | IAEA document entitled 'Nuclear Security Recommendations on Physical Protection of Nuclear Materials and Nuclear Facilities'. Its recommendations reflect a consensus of views among IAEA Member States on desirable requirements for physical protection measures on nuclear material and facilities, that is, measures taken for their physical security. |
| INFCIRC/540 (Corrected) | The model text of the IAEA's Additional Protocol. |
| INFCIRC/66 Rev.2 | The model safeguards agreement used by the IAEA since 1965. Essentially, this agreement is facility-specific. For NNWS party to the NPT it has been replaced by INFCIRC/153. |
| Infrasound | Sound in the frequency range of about 0.02 to 4 Hertz.<br>One category of CTBT IMS stations will monitor sound at these frequencies with the aim of detecting explosive events such as a nuclear test explosion at a range up to 5000 km. |
| Integrated safeguards | The optimum combination of all safeguards measures under comprehensive safeguards agreements and the Additional Protocol to achieve maximum effectiveness and efficiency. |
| International Atomic Energy Agency (IAEA) | The IAEA is the international centre for cooperation in the nuclear field. The Agency works with its Member States and multiple partners worldwide to promote the safe, secure and peaceful use of nuclear technologies. Based in Vienna. |
| International Data Centre (IDC) | Data gathered by monitoring stations in the CTBT IMS network are compiled, analysed to identify events and archived by the Vienna-based IDC. IDC products are available to CTBT signatories. |
| International Framework for Nuclear Energy Cooperation (IFNEC) | An international forum for cooperation on the use of nuclear energy for peaceful purposes that is efficient, safe and secure and does not aid proliferation. |

| Term | Description |
|---|---|
| International Monitoring System (IMS) | A network of monitoring stations and analytical laboratories established pursuant to the CTBT which, together with the IDC, gather and analyse data with the aim of detecting any nuclear explosion. IMS data is available to all CTBT signatories. |
| International Partnership of Nuclear Disarmament Verification (IPNDV) | IPNDV is an initiative, begun in 2015, of more than 25 countries with and without nuclear weapons. The Partners are identifying challenges associated with nuclear disarmament verification and developing potential approaches and technologies to address those challenges. |
| International Physical Protection Advisor Service (IPPAS) | The IAEA created IPPAS in 1995 to provides peer advice on implementing international instruments and Agency guidance on the protection of nuclear and other radioactive material, associated facilities and associated activities. |
| Inventory Change Report (ICR) | A formal report from a national safeguards authority to the IAEA on changes to nuclear materials inventories in a given period. |
| Isotopes | Nuclides with the same number of protons, but different numbers of neutrons, e.g. $^{235}U$ (92 protons and 143 neutrons) and $^{238}U$ (92 protons and 146 neutrons). The number of neutrons in an atomic nucleus, while not significantly altering its chemistry, does alter its properties in nuclear reactions.<br><br>As the number of protons is the same, isotopes are different forms of the same chemical element. |
| Joint Investigative Mechanism (JIM) | The Security Council adopted resolutions for a joint UN-OPCW investigation into the use of chemical weapon weapons in the Syrian Arab Republic. |
| Light water | $H_2O$. Ordinary water. |
| Light water reactor (LWR) | A power reactor which is both moderated and cooled by ordinary (light) water. In this type of reactor, the uranium fuel must be slightly enriched in $^{235}U$ (that is, LEU). |
| Low Enriched Uranium (LEU) | Low Enriched Uranium. Uranium enriched to less than 20% $^{235}U$. Commonly, LEU used as fuel in light water reactors is enriched to between 3% and 5% $^{235}U$. |
| Material Balance Area (MBA) | A delineation for nuclear accounting purposes as required under comprehensive safeguards agreements. It is a defined and delineated area in or outside of a facility such that: (a) the quantity of nuclear material in each transfer into or out of the material balance area can be determined; and (b) The physical inventory of nuclear material in the material balance area can be determined, in order that the nuclear material balance can be established for IAEA safeguards purposes. |

| Term | Description |
|---|---|
| Material Balance Report (MBR) | A formal report from a national safeguards authority to the IAEA comparing consolidated inventory changes in a given period with the verified inventories at the start and end of that period. |
| Material Unaccounted For (MUF) | A term used in nuclear materials accountancy to mean the difference between operator records and the verified physical inventory. A certain level of MUF is expected due to measurement processes. MUF does not usually indicate 'missing' material – because it is a difference due to measurement, MUF can have either a negative or a positive value. |
| Mixed oxide fuel (MOX) | Mixed oxide reactor fuel, consisting of a mixture of uranium and plutonium oxides. The plutonium content of fresh MOX fuel for an LWR is typically around 5–7%. |
| Moata | Small training reactor previously located at Lucas Heights. |
| Moderator | A material used to slow fast neutrons to thermal speeds where they can readily be absorbed by $^{235}U$ or plutonium nuclei and initiate a fission reaction. The most commonly used moderator materials are light water, heavy water or graphite. |
| MWe | Megawatts of electrical power |
| MWt | Megawatts of thermal power |
| Natural uranium | In nature, uranium consists predominantly of the isotope $^{238}U$ (approx. 99.3%), with the fissile isotope $^{235}U$ comprising only 0.711%. |
| Non-nuclear-weapon state(s) (NNWS) | States not recognised by the NPT as having nuclear weapons at 1 January 1967 when the Treaty was negotiated. |
| NPT | The NPT is the commonly used acronym for the Treaty on the Non-Proliferation of Nuclear Weapons, whose objective is to prevent the spread of nuclear weapons and weapons technology, promote cooperation in the peaceful uses of nuclear energy and to further the goal of nuclear disarmament. |
| Nuclear material | Any source material or special fissionable material as defined in Article XX of the IAEA Statute (in practice, this means uranium, thorium and plutonium). |
| Nuclear-weapon state(s) (NWS) | States recognised by the NPT as having nuclear weapons at 1 January 1967 when the Treaty was negotiated, namely the United States, Russia, the United Kingdom, France and China. |

| Term | Description |
|---|---|
| Nuclide | Nuclear species characterised by the number of protons (atomic number) and the number of neutrons. The total number of protons and neutrons is called the mass number of the nuclide. |
| NUMBAT | 'Nuclear Material Balances and Tracking' – ASNO's custom built nuclear database used to fulfil reporting requirements under Australia's safeguards agreements with the IAEA, track Australian Obligated Nuclear Material (AONM) overseas, and maintain a register of permit holders, as required under the *Nuclear Non-Proliferation (Safeguards) Act 1987*. |
| Old Chemical Weapons (OCW) | Defined under the Chemical Weapons Convention as:<br>• chemical weapons produced before 1925; or<br>• chemical weapons produced between 1925 and 1946 that have deteriorated to such extent that they can no longer be used as chemical weapons. |
| On-Site Inspection (OSI) | A short-notice, challenge-type inspection provided for in the CTBT as a means for investigating concerns about non-compliance with the prohibition on nuclear explosions. |
| Open Pool Australian Light-Water reactor (OPAL) | The 20 MWt research reactor located at ANSTO, Lucas Heights, reached full power on 3 November 2006 and was officially opened on 20 April 2007. |
| Organisation for the Prohibition of Chemical Weapons (OPCW) | OPCW is an intergovernmental organisation and the implementing body for the Chemical Weapons Convention based in The Hague, Netherlands. It oversees the global endeavour for the permanent and verifiable elimination of chemical weapons. |
| Other Chemical Production Facility (OCPF) | Defined under the Chemical Weapons Convention as all plant sites that:<br>• produced by synthesis during the previous calendar year more than 200 tonnes of unscheduled discrete organic chemicals; or<br>• comprised one or more plants which produced by synthesis during the previous calendar year more than 30 tonnes of an unscheduled discrete organic chemical containing the elements phosphorus, sulphur or fluorine. |
| Physical Inventory Listing (PIL) | A formal report from a national safeguards authority to the IAEA on nuclear materials inventories at a given time (generally the end of a Material Balance Report period). |

| Term | Description |
|---|---|
| Production | (For CWC purposes) the formation of a chemical through chemical reaction. Production of chemicals specified by the CWC is declarable, even if produced as intermediates and irrespective of whether or not they are isolated.<br><br>(For safeguards purposes) Nuclear Production is the generation of special fissionable material through irradiation of fertile material in a reactor. |
| Provisional Technical Secretariat (PTS) | The PTS assists the CTBTO Preparatory Commission in the establishment of a global verification regime to monitor compliance with the CTBT. |
| $^{239}$Pu | An isotope of plutonium with atomic mass 239 (94 protons and 145 neutrons). $^{239}$Pu is the fissile isotope of plutonium most suitable for nuclear weapons. |
| R&D | Research and Development |
| Radionuclide | An isotope with an unstable nucleus that disintegrates and emits energy in the process. Radionuclides may occur naturally, but they can also be artificially produced, and are often called radioisotopes. One category of CTBT IMS stations is used to detect radionuclide particles in the air. Other IMS stations are equipped with radionuclide noble gas technology to detect the abundance of the noble gas xenon in the air. |
| Reprocessing | Processing of spent nuclear fuel to separate uranium and plutonium from highly radioactive fission products. |
| Safeguards Inspector | For domestic purposes, a person declared under section 57 of the Safeguards Act to undertake inspections to ensure compliance with provisions of the Act and to assist IAEA inspectors in the conduct of IAEA inspections and complementary access in Australia. |
| Seismic | Referring to the movements of the earth and its crust that can be generated by, among other things, earthquakes, explosions and large impacts (e.g. meteors). The seismic component of the CTBT's IMS is a network of 50 primary stations and 120 auxiliary stations. Analysis of seismic waves can be used to distinguish between earthquakes and explosive events. |
| Small Quantities Protocol (SQP) | A protocol to a state's safeguards agreement with the IAEA, for states with small quantities of nuclear material and no nuclear facilities. The protocol holds in abeyance most of the provisions of the state's safeguards agreement. |
| Source Material | Uranium containing the mixture of isotopes occurring in nature; uranium depleted in the isotope $^{235}$U; thorium; or any of the foregoing in the form of metal, alloy, chemical compound, or concentrates. |

| Term | Description |
|---|---|
| Special Fissionable Material (SFM) | $^{239}Pu$; $^{233}U$; uranium enriched in the isotopes 235 or 233; any material containing one or more of the foregoing. The term special fissionable material does not include source material. |
| Standing Advisory Group on Safeguard Implementation (SAGSI) | An international group of experts appointed by, and advising, the IAEA Director General on safeguards implementation matters. |
| Technical Assistance Visit (TAV) | The Technical Secretariat of the OPCW can, through a TAV, provide technical assistance and technical evaluation to States Parties in the implementation of the provisions of this Convention, including evaluation of scheduled and unscheduled chemicals. |
| Temporary Working Group (TWG) | The OPCW's Director-General may, in consultation with the members of the Scientific Advisory Board, establish temporary working groups of scientific experts to provide recommendations on specific issues within a specific time frame. |
| $^{232}Th$ | The only naturally occurring isotope of thorium, having an atomic mass of 232 (90 protons and 142 neutrons). |
| $^{233}U$ | An isotope of uranium containing 233 nucleons, usually produced through neutron irradiation of $^{232}Th$. |
| $^{235}U$ | An isotope of uranium containing 235 nucleons (92 protons and 143 neutrons) which occurs as 0.711% of natural uranium. |
| $^{238}U$ | An isotope of uranium containing 238 nucleons (92 protons and 146 neutrons) which occurs as about 99.3% of natural uranium. |
| United Nations Security Council Resolution (UNSCR) | Formal expressions of the opinion or will of United Nations organs. |
| Uranium ore concentrate (UOC) | A commercial product of a uranium mining and milling operation usually containing a high proportion (greater than 90%) of uranium oxide. |
| Weapons of Mass Destruction (WMD) | Refers to nuclear, chemical, biological and occasionally radiological weapons. |

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**Australian Safeguards and Non-Proliferation Office**

Telephone: (+61) 6261 1920

Internet: www.dfat.gov.au/asno

ABN 47 065 634 525