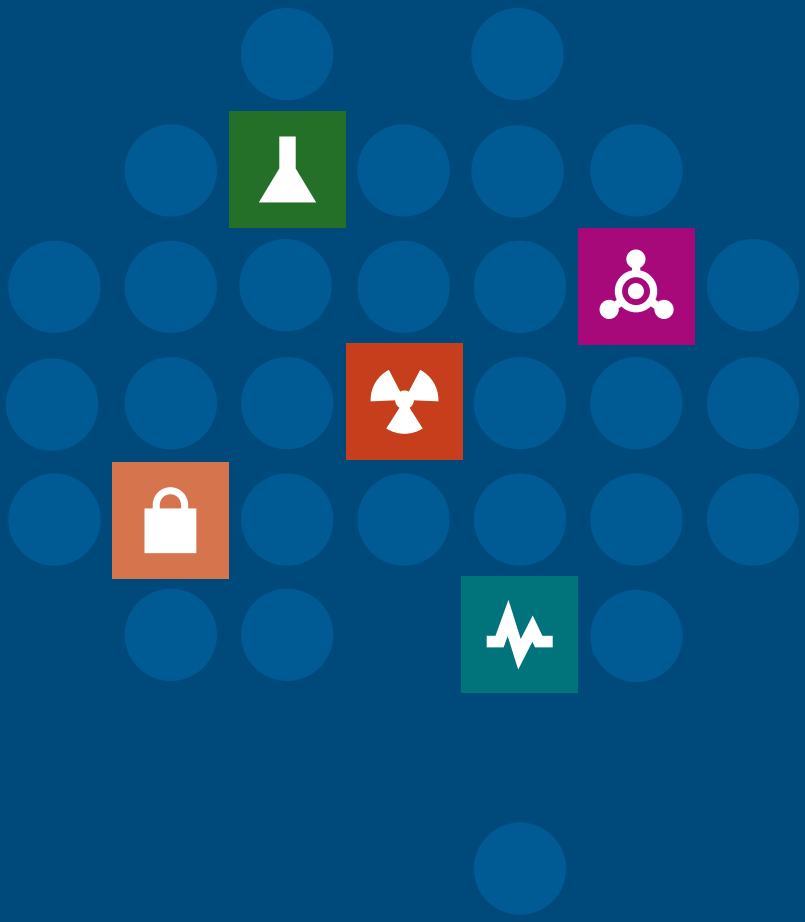
Australian Government

Australian Safeguards and Non-Proliferation Office



ANNUAL REPORT

2018–2019

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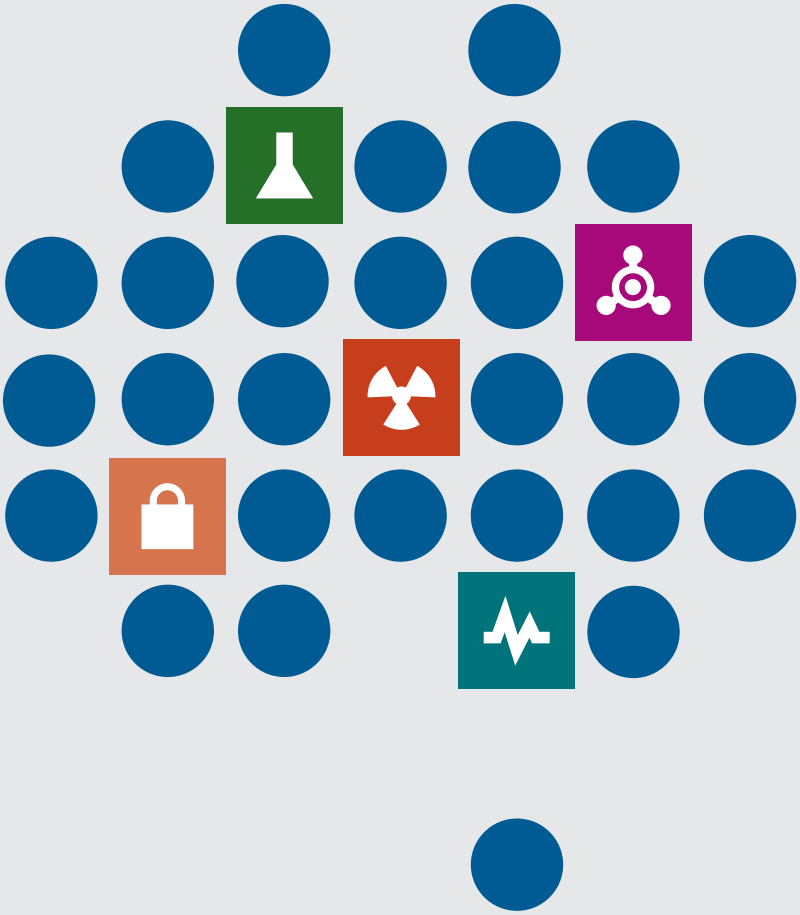

ANNUAL REPORT

2018–2019

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:

- report by the Director General ASNO on key non-proliferation developments in 2018–19 and a preview of the year ahead
- summary of current major issues
- functional overview of ASNO, including its operating environment and outcomes – outputs structure – the first outcome demonstrates accountability to Government; the second outlines public outreach and education
- report on ASNO's performance during 2018–19
- key features of ASNO's corporate governance and the processes by which ASNO is directed, administered and held accountable.

Because 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
- ecologically sustainable development and environmental performance.

LETTER OF TRANSMITTAL

Australian Government

Australian Safeguards and Non-Proliferation Office

1 October 2019

The Hon Marise Payne
Minister for Foreign Affairs and Minister for Women
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 2019. 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 Robert Floyd
Director General

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

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DIRECTOR GENERAL'S REPORT

Dr Robert Floyd
Director General
Australian Safeguards and
Non-Proliferation Office

THE YEAR IN REVIEW

NUCLEAR NON-PROLIFERATION AND SAFEGUARDS DEVELOPMENTS

The International Non-Proliferation Environment

Key developments in the non-proliferation sphere during the 2018–19 reporting period included further talks on denuclearisation between the United States (US) and the Democratic People's Republic of Korea (DPRK); developments in Iran's nuclear program and initiation of procedures to add new chemicals to the Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction (Chemical Weapons Convention CWC) for the first time. Despite the challenges, the overwhelming majority of States are compliant with their Treaty on the Non-Proliferation of Nuclear Weapons (NPT) and CWC obligations and the critically important roles of the International Atomic Energy Agency (IAEA) and the Organisation for the Prohibition of Chemical Weapons (OPCW) continue to be demonstrated.

Despite the US withdrawal from the Joint Comprehensive Plan of Action (JCPOA) on 8 May 2018, the other parties to the deal have continued with its implementation. ASNO provided technical advice to a review of the JCPOA led by the Department of Prime Minister and Cabinet in 2018. Following the review, the Government decided to maintain Australia's position on the JCPOA, subject to Iran's continuing compliance.

Iran announced on 8 May 2019 that it will incrementally scale back its compliance with the JCPOA while remaining within the arrangement. Iran has argued the move was justified under the JCPOA given the international community's failure to preserve the deal's promised economic benefits in the face of the US' 'maximum pressure' campaign on Iran. In July 2019, the Director General of the IAEA reported that, consistent with Iran's declared intentions, Iran had exceeded the limits prescribed by the JCPOA on its total enriched uranium stockpile (300 kg UF_6 equivalent) and the enrichment level of uranium produced at Natanz (3.67 per cent). Iran announced—against the backdrop of increased tensions with

the US and incidents in The Gulf and Gulf of Oman – that it would take further steps every 60 days unless the international community made tangible progress to ensure economic benefits for Iran, including on its oil exports. So far, Iran has continued to implement and accept IAEA verification of its other nuclear-related commitments under the deal.

After escalating tensions in 2017 on the Korean peninsula following DPRK's nuclear tests and missile launches, tensions decreased during 2018–19 in light of renewed US and Republic of Korea (ROK) diplomatic efforts. US President Donald Trump and DPRK leader Kim Jong-un met twice during the reporting period while Kim and ROK President Moon Jae-in met once. The February 2019 US-DPRK summit in Hanoi, Vietnam concluded without an agreement. On 30 June 2019, the two leaders met again at the Korean Demilitarised Zone, promising to resume working-level talks on denuclearisation. ASNO has provided advice to the Government on how Australia might support any eventual international efforts to verify any concrete DPRK denuclearisation.

The OPCW has confirmed that the chemical detected in the United Kingdom's March and June 2018 chemical incidents was one of a family of nerve agents known as 'Novichoks'. 'Novichok' nerve agents and their related precursor chemicals are not currently listed in the CWC's Schedules of prohibited substances. The CWC does prohibit the use of any toxic chemical as a weapon, even if it is not specifically listed in the Schedules. In response to the use of nerve agent in the United Kingdom, the addition of 'Novichoks' to the CWC Schedules will be discussed at the Conference of States Parties in November 2019.

Although the Comprehensive Nuclear-Test-Ban Treaty (CTBT) has not entered into force, the International Monitoring System (IMS) continues to play a vital role in monitoring for nuclear tests. In August 2018 testing and certification of Australia's final International Monitoring System (IMS) facility – an infrasound monitoring station at Davis Station, Australian Antarctic Territory – was completed by experts from the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO). Australia ranks third among countries hosting the largest number of monitoring facilities. It covers all four technologies used for nuclear test detection. Worldwide around 90 per cent of all CTBT IMS stations, intended for 89 countries, are now in place and detailed preparatory work continues that will allow the CTBT verification regime to be fully operational before the Treaty enters into force.

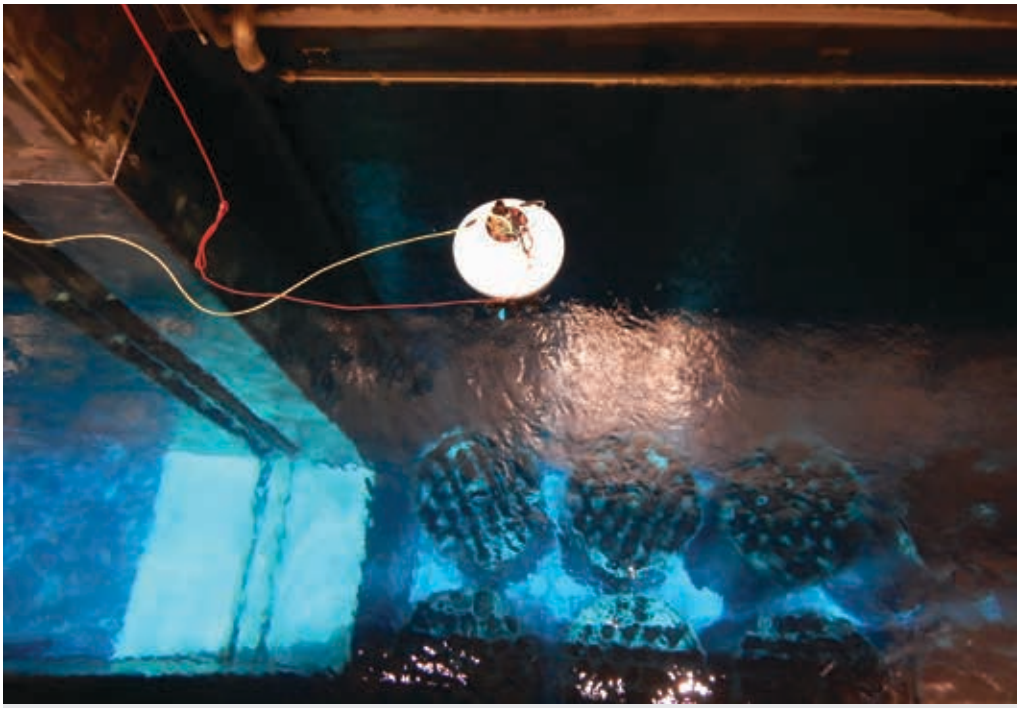
It is with deep sadness that ASNO notes the recent passing of IAEA Director General Yukiya Amano in July 2019. DG Amano led the IAEA for a decade during which time the organisation faced many challenges, from the negotiation of the JCPOA and developments in DPRK, to responding to the Fukushima nuclear accident. He was deeply committed to the peaceful use of nuclear technology and multilateralism and it has been an honour for DG ASNO to chair DG Amano's Standing Advisory Group on Safeguards Implementation (SAGSI) for the past seven years.

International Atomic Energy Agency Safeguards

ASNO assesses that the IAEA continues to effectively fulfil its objective of verifying that states uphold their respective non-proliferation commitments, using the tools available under safeguards agreements and under Additional Protocols (when in place). The IAEA uses a combination of in-field inspections of nuclear material, facilities, and research and development (R&D) activities; as well as its analysis of information at its headquarters in Vienna. The overarching framework the IAEA uses to prioritise and optimise verification activities is the use of state-level approaches. These are customised approaches to how the IAEA applies safeguards in each State, based on a standardised methodology using acquisition path analysis of technically plausible pathways for the acquisition of nuclear material suitable for a weapons program.

The environment the IAEA operates in is one of steadily increasing quantities of nuclear material and facilities under safeguards, as well as an evolving risk profile for the international nuclear fuel cycle. The IAEA therefore needs to be adaptive and innovative with technology and analytical tools to help improve the efficiency and effectiveness of safeguards implementation to stay ahead of the curve. This is achieved by the combined effort of the IAEA and Member States to keep pace with evolving challenges, as well as opportunities from emerging technologies and analytical techniques. Safeguards is a niche area for R&D that has traditionally relied somewhat on more mainstream tools for measuring and verifying nuclear material. However, IAEA safeguards can benefit significantly from work in technical fields that have developed and evolved for applications quite unrelated to safeguards, such as data analytics, novel detector technologies, and robotics.

To support this, in recent years the IAEA has been conducting broader searches for novel technologies and tools by engaging with research leaders with limited or no prior experience servicing safeguards needs. To assist the IAEA in broadening its engagement to other sectors, ASNO has helped promote research efforts at CSIRO and the University of New South Wales (UNSW) in areas related to safeguards. This complements the technology development support Australia has been providing since the 1980s, particularly through a range of projects led by Australian Nuclear Science and Technology Organisation (ANSTO). A highlight in efforts to broaden collaboration reported in last year's Annual Report was the Robotics Challenge hosted by CSIRO in Brisbane, November 2017. Since that time, the IAEA selected three robotic devices for proof-of-concept testing in a spent fuel pond at the Loviisa Nuclear Power Plant in Finland in November 2018. And in January 2019, the IAEA announced Datastart Ltd of Hungary the winner of the challenge. The IAEA is exploring how to further refine and test the design to ensure it is compliant with all applicable requirements.



The winning design by Datastart Ltd from the Robotics Challenge undergoing testing at the Loviisa Nuclear Power Plant in Finland.

Another highlight is the work by researchers at the UNSW's Faculty of Engineering across projects related to safeguards, and presented at the IAEA's Symposium on International Safeguards in November 2018. One of these was a student project on using machine learning tools to identify discrete terms that can be used to differentiate literature on uranium mining/milling processes from the processing of other minerals in open-source datasets. Another project underway at UNSW relates to an application of blockchain technology to nuclear accountancy. Blockchain is a technology developed in 2009 for crypto-currencies that is designed to ensure the consistency and immutability of electronic data held among multiple parties. Blockchain has potential well beyond crypto-currencies, such as improving the efficiency, data integrity and security of systems that manage and report to the IAEA on nuclear accountancy transactions. UNSW has recently commenced collaboration with the Stimson Center and Finland's nuclear regulator (STUK) on a project to develop a blockchain-based nuclear accountancy prototype based on Finland's safeguards system with a focus on accountancy for Finland's deep geological spent fuel repository. Further details on these and other projects under the Australian Safeguards Support Programme are described in Output 1.4.

While innovation by the IAEA is important, it is also important for each Member State to ensure effective domestic systems are maintained for managing and reporting on safeguards obligations. IAEA safeguards are fundamentally about maintaining international confidence of the compliance of States with non-proliferation commitments, so there is an important role for States to assist each other in raising awareness and promoting better practice. The IAEA continues to work directly with individual States to address specific issues and conducts outreach and awareness-raising activities through workshops and meetings. Australia plays a role through participating in reviews of safeguards approaches and training courses, such as through DG ASNO's chairing of the Standing Advisory Group on Safeguards Implementation (SAGSI), and through ASNO's membership of the Asia-Pacific Safeguards Network (APSN) and assistance with capacity building in the region, such as the safeguards training course that ASNO contributed to in Timor-Leste in February 2019. More details on ASNO's work in these areas are in Output 1.4.

Domestic Developments

In 2019, 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 use activities for Australia every year since 2000.[1]

During the reporting period, the IAEA conducted various verification activities (under different names but all essentially inspections) in Australia under the Comprehensive Safeguards Agreement and the Additional Protocol.

In total, twelve separate inspections, plus one technical visit, were carried out at ANSTO, CSIRO and Heathgate Resources Beverley uranium mine sites. The IAEA generally combine several inspections together, so these twelve inspections were all conducted over four separate visits and the IAEA's findings (where available at the time of publication of this Annual Report) are in Output 1.1 and Appendix B.

Along with completing routine reports to the IAEA and overseeing IAEA inspections, ASNO also works to ensure that IAEA safeguards can be effectively implemented. One focus of this work is in relation to ANSTO's new Nuclear Medicine (ANM) radiopharmaceutical

1 The IAEA can only draw the broader conclusion after a period of successfully implementing both a comprehensive safeguards agreement and an additional protocol. Australia was the first country to conclude an additional protocol with the IAEA in 1997 and it was among the first countries to achieve the broader conclusion in 2000.

production plant. When operational the plant is designed to ensure security of supply of nuclear medicines to Australian patients and has the capacity to supply a significant proportion (up to 25 per cent) of the world's requirements for molybdenum–99. ANSTO commenced hot commissioning of ANM in September 2018.

There are technical challenges with verification of the uranium content in the solid waste stream end of the plant so the IAEA has developed a customised detector to do this measurement in a hot cell. In February 2019, the IAEA conducted a hot commissioning test of this detector in a hot cell at ANSTO. Over time the uranium content in solid waste will accumulate. It is important therefore that the IAEA is able to verify the uranium content so that Australia can demonstrate to the international community that all nuclear material is accounted for.

Another focus of ASNO's work was contributing to the Department of Industry, Innovation and Science's National Radioactive Waste Management Facility project. ASNO is working with ANSTO to ensure that the engineering designs of the facility can meet requirements to facilitate IAEA verification of any nuclear material held, while seeking to minimise costs associated with verification and facility design. ASNO presented a paper to the Symposium on International Safeguards in November 2018 on the application of the concept of safeguards by design to facilities for long-term storage or disposal of nuclear material in low and intermediate-level waste repositories.

Nuclear Security Developments

As part of its regular inspection program, ASNO conducted 10 security inspections including at ANSTO, CSIRO, BHP Olympic Dam, Heathgate Resources Beverley, Silex Systems Limited and uranium oxide concentrate (UOC) transporters. These are further described in Section 4 – Output 1.2.

The preparatory process for the Article 16 Conference of States Parties for the Amended Convention on the Physical Protection of Nuclear Material began with an unofficial meeting of Parties, which developed a provisional roadmap for the Conference due to held in 2021. The first meeting in the roadmap will take place in July 2019, for which Director General, ASNO accepted an invitation to Co-chair with Argentina.

Australia provided expertise to assist the IAEA regarding identification of undeclared gas centrifuge enrichment plants (GCEP) for high enriched uranium (HEU) production and revision of the IAEA physical model related to uranium enrichment processes.

A summary of international nuclear security developments can be found in the IAEA's 2019 nuclear security report, released during its annual General Conference.

Bilateral Safeguards Developments

During 2018–19, 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. They also require that appropriate nuclear security measures are applied to AONM exported overseas, as well as a number of supplementary conditions.

A new Australia-UK NCA was signed in August 2018. Australia's domestic treaty-making processes have been completed and the NCA is ready to enter into force to allow continued exports of Australian uranium to the UK, should the UK formally withdraw from the European Union (EU). Around a fifth (worth more than $120 million annually) of all Australian uranium exports are supplied to the UK, for use and/or processing on behalf of third countries within Australia's network of NCAs. The UK holds almost one third of the total Australian uranium inventory in the EU.

The Australia-Ukraine NCA became operational in September 2018, allowing for the use of Australian uranium in Ukrainian nuclear power plants. Ukraine has 15 nuclear power plants that supply about half of the country's electricity. The NCA provides another avenue for Ukraine to diversify nuclear fuel services, currently largely dependent on Russia.

There has been a successful first year of operation of the new Nuclear Material Balance and Tracking (NUMBAT) database in relation to the approval of shipments to transfer UOC internationally. This has led to streamlined approvals and communications with permit holders and domestic and international counterparts.

CHEMICAL WEAPONS CONVENTION DEVELOPMENTS

Domestic Developments

During the reporting year, ASNO submitted comprehensive and timely annual declarations in accordance with the requirements of the Chemical Weapons Convention (CWC) to the Organisation for the Prohibition of Chemical Weapons (OPCW). These declarations included reports of Australia's CWC-related chemical trade and other relevant chemical activities within industry and Defence laboratories, as well as Australia's national programs for assistance and protection against chemical weapons.

ASNO facilitated a routine OPCW inspection at Clariant (Australia) Pty Ltd, designated as an 'Other Chemical Production Facility', in Victoria. This brings the total number of inspections in Australia to 57 since entry-into-force of the CWC in 1997. The inspection report confirmed Australia's declared information, including the absence of any undeclared CWC-Schedule 1 chemicals and/or their production.

ASNO has continued to inform Australia's policy positions through provision of technical advice on CWC and verification-related issues.

International Developments

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. To this end, ASNO works closely with key stakeholders in the fields of non-proliferation and counter-proliferation. ASNO has a close relationship with the International Security Division within the Australian Department of Foreign Affairs and Trade – Australia's lead on most international non-proliferation and counter-proliferation policy issues – as well the Australian Posts in Vienna, The Hague and Geneva.

According to the OPCW there are now 193 States Parties to the CWC. This leaves only four countries that have yet to join – Egypt, Israel (signed but not ratified), North Korea and South Sudan. South Sudan announced its intention to join the CWC at the 22nd Conference of the States Parties (CSP) in 2017; however, they have not yet completed this action. There remains 71 States Parties yet to enact comprehensive implementing legislation that is required in order to reduce the threat of the use of chemical weapons by non-State actors, including terrorists.

Since entry into force of the CWC, the OPCW inspectorate has conducted 7,139 routine inspections at 3,217 chemical weapon-related and 3,922 industrial sites in around 80 States Parties. Aside from routine verification work, OPCW resources continued to be stretched by non-routine inspections and fact-finding missions to investigate allegations of chemical weapons use.

On 25 July 2018, Ambassador Fernando Arias of Spain replaced Ambassador Ahmet Üzümcü of Turkey as Director-General of the OPCW. Director-General Arias had a challenging first year.

Between 2014 to 2018, the OPCW's Fact-Finding Mission (FFM) worked to investigate allegations of toxic chemical use

as a chemical weapon in Syria. The mandate of the FFM was to determine whether, or not, a chemical weapon has been used, and to verify the identity of any chemicals used in a specific chemical attack.

The FFM determined that chlorine, sulfur mustard and sarin have all been used as chemical weapons in Syria. On 1 March 2019, the OPCW released the FFM's final report addressing allegations of chemical weapons use in Syria the April 2018. The report outlined that the FFM had conducted on-site visits, analysed environmental and biomedical samples, interviewed witnesses, and undertook toxicological and ballistic analysis. The FFM report concluded that chlorine had been used as toxic chemical in Douma, Syria, on 7 April 2018.

At the end of the last reporting period, on 27 June 2018; the 4th Special Session of the CSP to the CWC empowered the OPCW to attribute responsibility for the use of chemical weapons in Syria. They further agreed to consider options for universal attribution of all uses of chemical weapons in the territory of any State Party.

With a mandate given by the Special Session the Technical Secretariat established an Investigation and Identification Team that had the authority to identify perpetrators of the use of chemical weapon use in Syria.[2]

Future allegations of the use of toxic chemicals as weapons in Syria will be investigated by the Investigation and Identification Team which will seek to attribute those responsible for chemical attacks. The Decision of the Fourth Special Session of the CSP also decided that, if requested by a State Party, the OPCW could provide technical expertise to identify, amongst others, perpetrators of CW use. The Technical Secretariat is currently developing its capability to be able to attribute use of CW.

Permanent Representative of Australia to the OPCW, H.E. Ambassador Matthew Neuhaus and OPCW Director-General, H.E. Mr Fernando Arias on the occasion of Australia's contribution of funding to the OPCW's Trust Fund for Syria Missions. Photo courtesy of the OPCW.

2 paragraph 10 of C-SS-4/DEC.3, https://www.opcw.org/sites/default/files/documents/CSP/C-SS-4/en/css4dec3_e_.doc.pdf

In March 2019, Australia contributed EUR100,000 to the OPCW's Trust Fund for Syria Missions. The funds will contribute to the OPCW's ability to investigate and attribute responsibility for use of chemical weapons in Syria. Other countries, including Norway, Denmark and Switzerland, have also made significant contributions to identify the perpetrators of chemical weapon use.

The 23rd CSP and the Fourth Review Conference of the CWC were held back-to-back in The Hague in November 2018. There were useful discussions during the meetings; however, consensus was not reached on the Review Conference Report. A Chairperson's Report was released; although not legally binding it provides a guide for States Parties for the following year.

Following the use of 'Novichok' chemicals in the United Kingdom last year, the OPCW received two proposals for a technical change to Schedule 1 of the Annex of the CWC. In October 2018, Canada, The Netherlands and United States of America submitted a joint proposal to include additional toxic chemicals to the list of Schedule 1 chemicals. Although supported by the Executive Council, one State Party objected. The Russian Federation submitted an alternative proposal that included the chemicals listed on the first proposal as well as additional toxic chemicals to be added to Schedule 1. This proposal also received an objection from another State Party. Both proposals will be considered in November 2019 at the CSP. The proposals are significant in that the Schedules of chemicals in the CWC have not been updated since the convention entered into force in 1997.

Central Nervous System Acting Chemicals (CNSACs) are chemicals, such as fentanyl and its analogues, that act as anaesthetics, sedatives and analgesics. CNSACs have been used in aerosolised form for law enforcement purposes outside Australia. Australia remains committed to raising awareness of the dangers of the use of CNSACs and such advocacy continues to gather momentum and support for discussions within the OPCW.

Worldwide chemical weapon destruction continues. As at 31 May 2019, 70,161 metric tonnes (97.04 per cent) of declared Schedule 1 chemical weapons has been destroyed. Iraq, Libya, the Russian Federation and the Syrian Arab Republic have verifiably destroyed their declared chemical weapon stockpiles, and the Syrian Arab Republic has destroyed all of its chemical weapon production facilities under OPCW verification. Progress on the US chemical weapon destruction program continues and is on track to be completed in advance of the planned completion date in 2023.

COMPREHENSIVE NUCLEAR-TEST-BAN TREATY (CTBT)

Although the Comprehensive Nuclear-Test-Ban Treaty (CTBT) is not in force, its normative value is significant. The support of the great majority of states for the aims of the CTBT is strong. Most continue to provide active support to development of all aspects of the verification regime, including the provisional operation of the International Monitoring System (IMS). Around 90 per cent of IMS facilities have been established. Only the Democratic People's Republic of Korea (DPRK) has conducted nuclear test explosions in the 21st century, and the international community has condemned each test.

With the certification in late 2018 of an infrasound monitoring station at Davis station in the Australian Antarctic Territory, all of Australia's 21 IMS facilities are in place and providing monitoring data to all CTBT signatory states. ASNO continues to provide support for outreach to promote the CTBT as well as support for development of the verification regime. Details are set out in Section 4 — Output 1.6.

Minister for Foreign Affairs and Minister for Women, Marise Payne at the 9th Ministerial Meeting of the Friends of the CTBT, New York, September 2018. Photo courtesy of The Official CTBTO Photostream

OTHER NON-PROLIFERATION AND DISARMAMENT ACTIVITIES

International Partnership for Nuclear Disarmament Verification (IPNDV)

Practical steps toward nuclear disarmament will need to be underpinned by effective verification. The International Partnership for Nuclear Disarmament Verification (IPNDV) 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.

Nearing the end of a second two-year work phase, commitment to the IPNDV from its diverse membership is firm. IPNDV's Working Group 4 (co-chaired by the UK and Poland) is focusing on verification to confirm weapons holdings. Working Group 5 (co-chaired by Australia (DG ASNO Floyd) and the Netherlands) focuses on verification of weapons dismantlement and processing of the resulting nuclear material. Working Group 6 (co-chaired by the US and Sweden) considers technology requirements for verification. Products of this work will be published on IPNDV's website in the lead-up to the 2020 NPT Revcon.

IPNDV engages a wide range of states in its work, including three of the five NPT Nuclear Weapons States, as well as states that support measures such as the nuclear weapons ban treaty.

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, impasse in the Conference on Disarmament (CD) has prevented negotiations on a fissile material cut-off treaty (FMCT). Australia has actively supported a number of initiatives to advance international discussions on an FMCT, both to promote the commencement of negotiations, and to develop proposals that could assist negotiators.

The 71st session of the UN General Assembly agreed to form a High Level Expert Preparatory Group (EPG) to consider and make recommendations on substantial elements of a future FMCT. The EPG met for two two-week sessions during 2017–18 and its report was released in July 2018. DG ASNO led Australia's contribution to a successful outcome of the process that led to the report. ASNO continues to support Australia's efforts to promote international negotiations on the FMCT.

THE YEAR AHEAD

Each few years the CTBTO conducts field exercises to help to test equipment and procedures for conducting an on-site inspection, in order to refine preparedness for entry into force of the CTBT. ASNO's Malcolm Coxhead is contributing to a group of experts developing viable and technically sound scenarios for a further series of exercises in 2019–20.

A ban on the production of fissile material for nuclear weapons is integral to progress on nuclear disarmament and Australia will continue to promote the commencement of negotiations on a treaty on fissile material. Australia will have additional opportunities to promote this objective when it takes on the presidency of the Conference on Disarmament for part of 2020.

IPNDV will conclude its second two-year work phase in late 2019, elaborating concepts, procedures and technologies for verified nuclear disarmament. IPNDV participants see a larger role for practical exercises as its third work phase gets underway. A joint Franco-German exercise on verified dismantlement of a nuclear explosive device is planned for late September. ASNO experts will participate in evaluation of this exercise.

On efforts to promote effective safeguards implementation internationally, ASNO will continue its leadership role in the Asia-Pacific Safeguards Network (APSN), including at the upcoming 10th anniversary meeting in Bali in August 2019. Another important aspect of influencing developments in IAEA safeguards, is DG ASNO's role as Chair of the IAEA Director General's Standing Advisory Group on Safeguards Implementation (SAGSI). This has been extended until 2021.

Regarding domestic nuclear security, ASNO will focus on ANSTO's conduct of a Periodic Safety and Security Review of the OPAL reactor and also continued oversight of associated technology and UOC storage and transport. Internationally ASNO will be deeply involved with preparations for the 2021 Review Conference of the Amended CPPNM with DG ASNO co-chairing the preparatory process. We will continue to engage in the Nuclear Security Contact Group and chair (Director, Nuclear Security Section, Bayer) the Nuclear Security Guidance Committee. ASNO will also actively participate in the third International Conference on Nuclear Security in February 2020, which will involve a ministerial component.

Development of the new Nuclear Material Balance and Tracking (NUMBAT) database in mid–2018 provided an opportunity to reflect how way reporting and tracking procedures under our Administrative Arrangements (AA), pursuant to our nuclear cooperation agreements, function in practice. Other aspects of NUMBAT to be developed over the coming year should improve the efficiency of ASNO and permit holder management of inventory records and reports.

In 2019–2020 ASNO will be undertaking a stocktake of the various AAs to identify ways to modernise and simplify reporting, communication protocols and AA text.

Preparations continue for the practical implementation of the new bilateral Australia-UK NCA, once it enters into force, should the UK formally withdraw from the EU. ASNO will continue to encourage close cooperative approaches by likeminded counterparts to manage the transition from the Australia-Euratom NCA to the Australia-UK NCA, should that take place.

ASNO will continue to work with the IAEA and ANSTO on the deployment of the IAEA's customised active well coincidence

counter (AWCC) detector to measure the nuclear material content in solid waste from the ANSTO Nuclear Medicine (ANM) molybdenum–99 production plant. After the successful hot test of that detector in February 2019 the next step is to deploy the system for formal IAEA verification purposes.

A key challenge for ASNO over the coming year, will be the assisting with the development and implementation of a new chemical database to support Australia's reporting obligations under the CWC. ASNO will work with the 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 functions.

Finally, it is anticipated that Australia's resumption of a seat on the OPCW Executive Council for a two-year term from May 2020 will mean increased demands on ASNO to provide technical advice and support in the development of Australia's policy positions on issues being considered at the OPCW.

IAEA Complementary Access Inspection of Beverley and Four Mile uranium mines (Heathgate Resources)

SECTION 2

CURRENT TOPICS

CONCEPTS FOR MULTILATERAL VERIFICATION OF REDUCTIONS IN NUCLEAR WEAPONS

Whatever vision one may have for how to advance nuclear disarmament, verification needs to be part of it. And, even in a difficult international environment for arms control and disarmament, we don't need to wait before working on verification tools. Indeed, we shouldn't wait. Agreement on instruments such as the Chemical Weapons Convention and the Comprehensive Nuclear-Test-Ban Treaty was greatly facilitated by technical work that began many years before each treaty was negotiated.

Since 2015, the International Partnership for Nuclear Disarmament Verification (IPNDV) has engaged a diverse group of countries to work on technical solutions for verifying key steps that nuclear weapon possessors could take as part of a disarmament agreement. All countries would want confidence in such steps and IPNDV has focused on verification that is multilateral or plurilateral. That is, the process would allow a wide range of countries to participate in and gain assurance from verification.

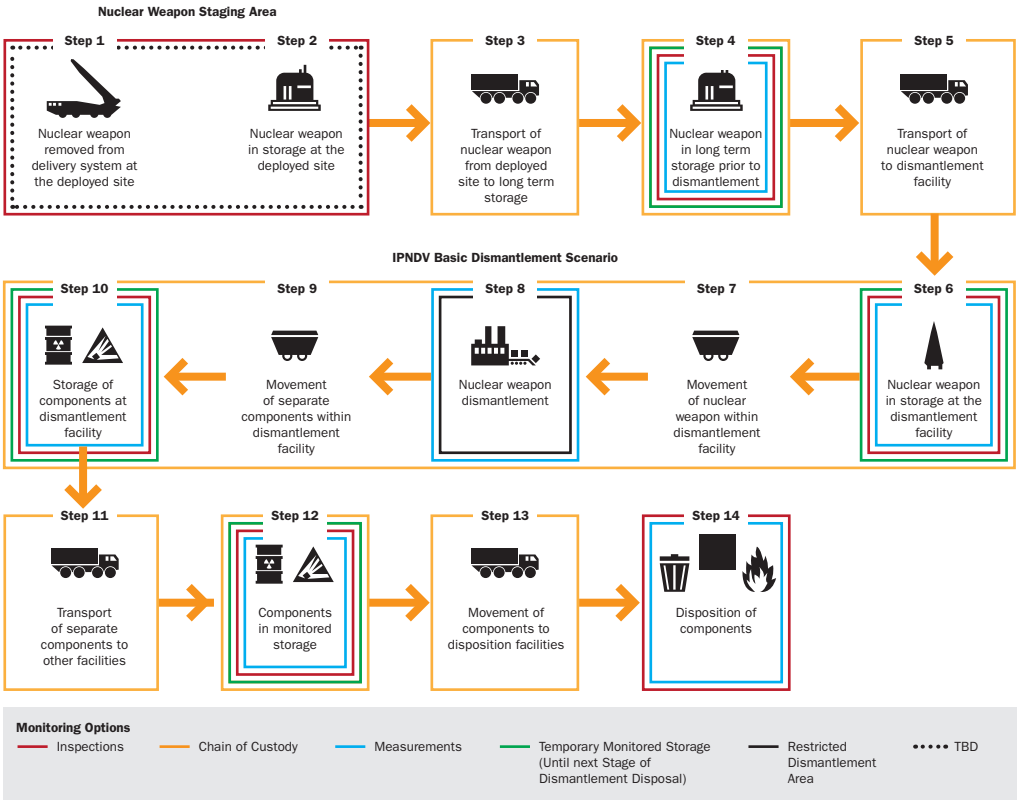
IPNDV will complete its second two-year work phase in late 2019. Detailed products will be available at www.ipndv.org early in 2020. These, along with products from the first work phase, have developed important concepts and principles that could inform the work of future treaty negotiators.

This article focuses on IPNDV's work on concepts and principles related to verification of the dismantlement of nuclear weapons and of the treatment of nuclear material from dismantled weapons. Of course, the verification of nuclear weapon dismantlement should be part of a broader process of nuclear disarmament, including measures related to fissile material, limits on numbers of nuclear weapons and delivery systems as well as the ban on nuclear weapon tests. IPNDV is also considering some of these aspects, and in Phase II began discussion on how to verify numbers of nuclear weapons held by a country.

IPNDV has advanced its work on verifying nuclear weapon dismantlement using a 14-step conceptual model depicted below. This model is intended to describe all of the possible dismantlement steps until the disposition (disposal or civil reuse) of the resulting nuclear material.

The 14-step model is a valuable analytic tool and has been used to frame verification objectives at each step, possible inspection approaches to achieve those objectives, as well as associated technologies. This sequence of 14 steps is not prescriptive. The steps in an actual process of dismantlement would reflect the specifics of each national nuclear weapons program.

Figure 1: **Monitoring and verification activities, as identified by the IPNDV, for the key steps in the process of dismantling nuclear weapons**[1]



* We make the assumption that there will be declaration at each step in the process.

Verification would aim to provide assurance that a designated number or group of nuclear weapons is dismantled and that the nuclear material is not diverted for re-use in a weapon. Such assurance will rely on the results of on-site inspections carried out by technical specialists. The measures applied by inspectors would track a weapon from its removal from a delivery system until its dismantlement. Dismantlement would be confirmed through measurements to demonstrate the separation of nuclear material from the high explosive components. Specialised measurements on other components to demonstrate that they have been part of a weapon could be possible also. Thereafter, the nuclear material would be tracked through storage and processing to remove sensitive characteristics prior to possible reuse for civil purposes or to enable disposal in a geological repository.

Various measurements would be made at appropriate points through the 14-step process to check that each item under verification is consistent with its declared type or identity. Containment and surveillance measures, as well as physical integrity checks of storage buildings would aim to deter and detect any diversion of items under verification. Confidence that dismantlement of a nuclear weapon has taken place will result from an amalgam of many observations, with different inspection findings reinforcing each other and, as needed, compensating for limits on procedures and technologies at given steps. Confidence should also grow as the dismantlement process is followed over time.

1 www.ipndv.org/reports-analysis/deliverable-2-assessment-monitoring-objectives-information-requirements-basic-dismantlement-scenario/

The main challenge for the design of verification arrangements is to create procedures and technical tools that are effective and efficient but which do not disclose information that might pose a risk for nuclear weapons proliferation, or that might affect the safety or security of nuclear weapons and related facilities. IPNDV has put special emphasis on ensuring that parties to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) can act in accordance with non-proliferation obligations. IPNDV partners judge that verification can be done consistently with these obligations where inspection teams include members from non-nuclear weapons states.

IPNDV will decide in late 2019 on the scope of its third work phase. Conceptual work of the kind described here will continue, but should be complemented by additional exercise-based activities to test and refine the work done so far.

AUSTRALIA'S URANIUM PRODUCTION AND EXPORTS

Statistics related to Australia's exports of Uranium Ore Concentrates (UOC) are listed in Table 1.

Table 1: **UOC export and nuclear electricity statistics**

ITEM	DATA
Total Australian UOC exports 2018–19	7,571 tonnes
Value Australian UOC exports	$734 million
Australian exports as percentage of world uranium requirements[2]	9.6%
Number of reactors (GWe) these exports could power[3]	39
Power generated by these exports	253 TWh
Expressed as percentage of total Australian electricity production[4]	97%

Australia has around one third of the world's uranium resources, and is the world's third ranking producer, accounting for approximately 10 per cent of annual global production. There are currently three operating uranium mines: Ranger in the Northern Territory, and Olympic Dam and Beverley Four Mile in South Australia. The Ranger uranium mine is scheduled to close in January 2021. The Honeymoon uranium mine in South Australia was placed in care and maintenance in 2013 but has since been purchased by Boss Resources Limited, which has plans to restart and expand the operation. There are four projects in Western Australia with state environmental

2 Based on August 2017 world requirements of 65,014 tonnes UOC from the World Nuclear Association's World Nuclear Power Reactors & Uranium Requirements (as of July 2019) – http://world-nuclear.org/information-library/facts-and-figures/world-nuclear-power-reactors-and-uranium-requireme.aspx

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 (as of July 2019) – http://world-nuclear.org/information-library/facts-and-figures/world-nuclear-power-reactors-and-uranium-requireme.aspx

4 Based on Australia's electricity generation in 2018 of 261.4051 TWh from the Bureau of Resources and Energy Economics, 2018 Australian Energy Statistics (published March 2019) – https://www.energy.gov.au/publications/australian-energy-statistics-table-o-electricity-generation-fuel-type-2017-18-and-2018

approval: Cameco Australia's Yeelirrie and Kintrye projects, Toro Energy's Wiluna project and Vimy Resources' Mulga Rock project.[5] The Government of Western Australia has decided it will not approve any other uranium mine projects.

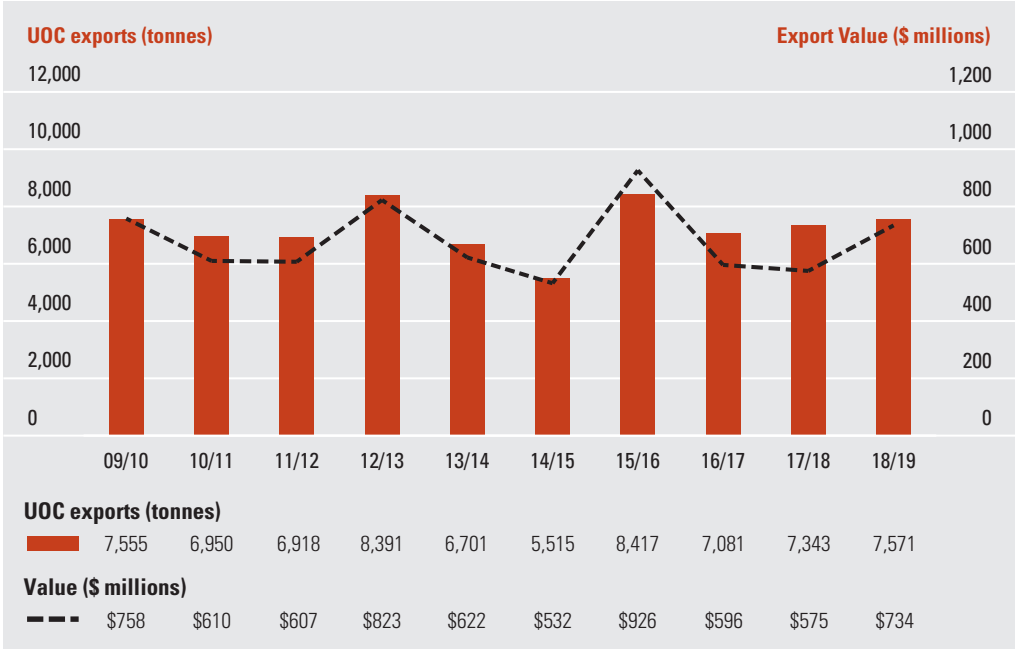
Uranium prices have been recently influenced by large production decreases by Kazakhstan and Canada. Challenges facing the uranium processing industry have also resulted in significant shifts to where Australian uranium is exported.[6] The uranium stockpiles developed by several Asian countries during the period of lower uranium prices, may decrease future purchasing requirements and reduce future imports into those countries. Therefore, promising forecasts of new nuclear reactor builds in the Asian region may not necessarily equate to increased demand for Australian uranium – as countries may choose to draw down on their stocks.

The United States is the largest market for Australian uranium – accounting for over half of final demand (including both direct exports, and exports that are processed in third countries). In July 2018, the US Secretary of Commerce initiated an investigation into US imports of uranium. Under US law; *Section 232 of the Trade Expansion Act*, the US President can impose measures to reduce imports of a good, if an investigation finds that the import of that good threatens to impair US national security. On 12 July 2019, President Trump concluded that uranium imports do not threaten the US' national security. President Trump announced the establishment of a United States Nuclear Fuel Working Group, '…to develop recommendations for reviving and expanding domestic nuclear fuel production…' and '…examine the current state of domestic nuclear fuel production to reinvigorate the entire nuclear fuel supply chain, consistent with US' national security and non-proliferation goals.'[7] This working group is expected to submit a report in mid-October 2019 to the US President. Recommendations from this working group could impact the destination of Australian uranium exports.

Drums of uranium ore concentrate (UOC) being prepared for export

5 http://www.dmp.wa.gov.au/Uranium-1459.aspx
6 See Table 14
7 https://www.whitehouse.gov/presidential-actions/memorandum-effect-uranium-imports-national-security-establishment-united-states-nuclear-fuel-working-group/

Figure 2: **Quantity and value of Australian UOC exports from 2009/10 to 2018/19 FY**



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);[8] 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, as well as a number of 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 through the use of 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.

8 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.

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 to third parties, enrichment to 20 per cent or more in the isotope ^{235}U and reprocessing[9]
- 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 nuclear material 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.[10]

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, 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 and nuclear consumption, and nuclear production
- knowledge of the fuel cycle in each country
- regular reconciliation and bilateral visits to counterparts
- regular liaison with counterpart organisations and with industry and
- IAEA safeguards activities and IAEA conclusions on each country.

9 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.

10 Twenty-eight of the countries making up this total are European Union member states.

AUSTRALIA'S URANIUM TRANSHIPMENT SECURITY POLICY

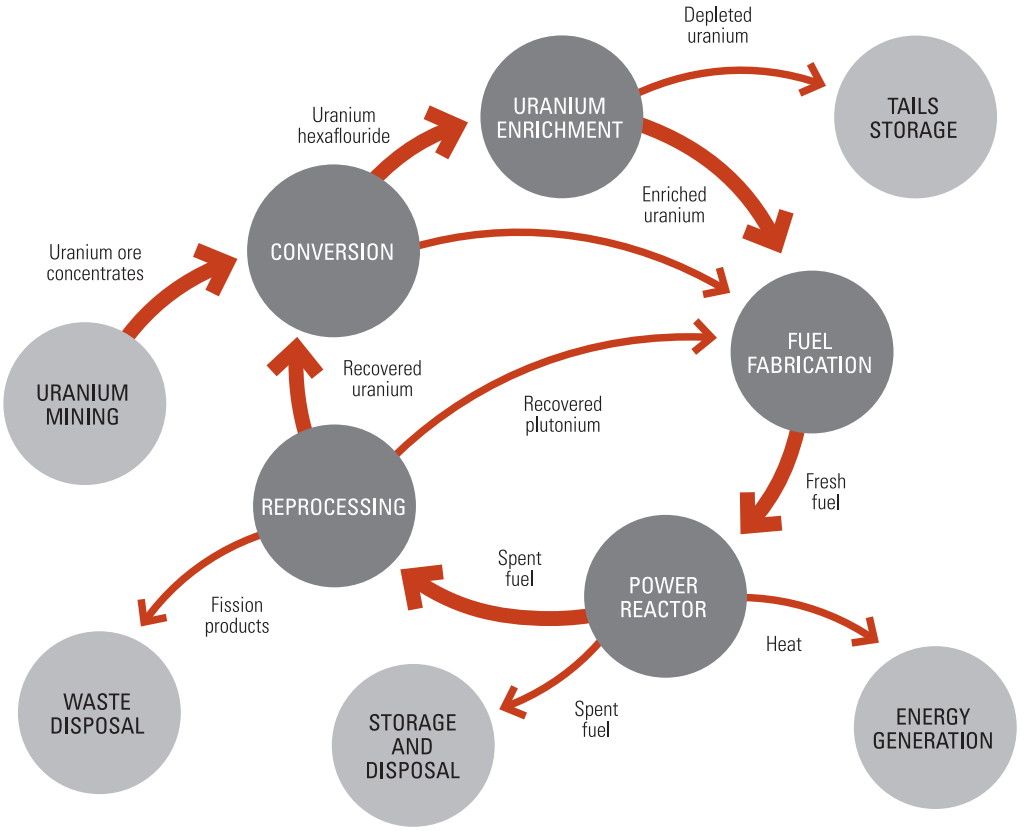
For states with which Australia does not have a bilateral nuclear cooperation agreement in force, but through which Australian uranium ore concentrates (UOC) are transhipped, there must be arrangements in place with such States to ensure the security of UOC during transhipment. If the State:

- 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.[11] Any such arrangement of this kind would be subject to risk assessment of port security.

For States that do not meet the above requirements, treaty-level arrangements on appropriate security may instead be required.

Figure 3: **Civil Nuclear Fuel Cycle**



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

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 is able to ensure its exports do not contribute to military applications by applying safeguards obligations to the overall quantity of material it exports.

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.

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 action 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.[1] India, Israel, Pakistan and South Sudan have never joined the NPT. The Democratic People's Republic of Korea (DPRK) 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

1 According to the United Nations Office for Disarmament Affairs, https://www.un.org/disarmament/wmd/nuclear/npt/. This number includes the DPRK.

- 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 (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 (PrepCom) was established in 1997, made up of CTBT States Signatories and supported by a Provisional Technical Secretariat. The tasks of the PrepCom 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 PrepCom 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 PrepCom 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.

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 PrepCom 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 and
- 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, but such powers are exercised only in exceptional circumstances. 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 in the formulation of verification policy and by providing practical implementation assistance and advice.

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.

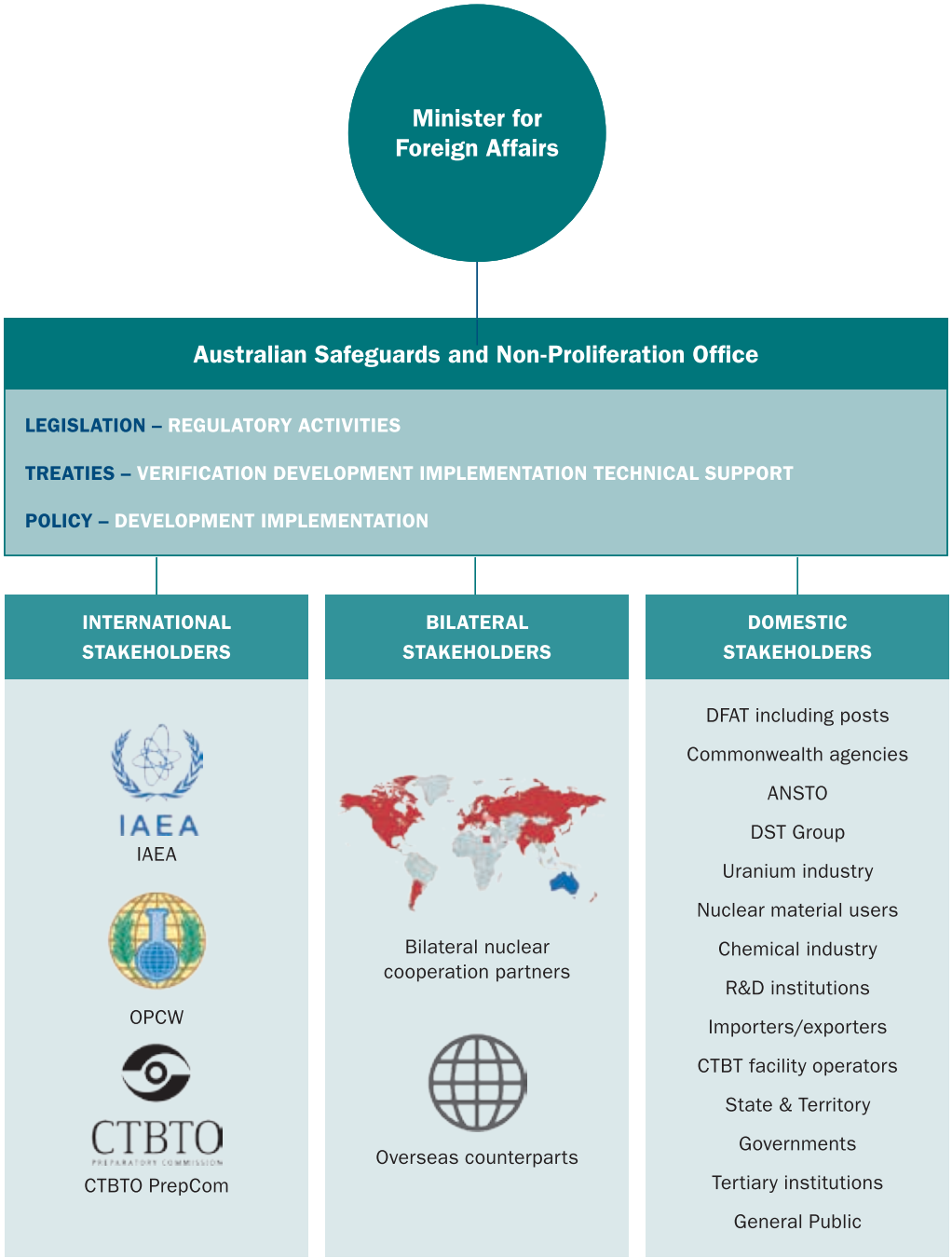
The SPNFZ Treaty has three protocols. Under Protocol 1, the US, UK and France are required to apply the basic provisions of the Treaty to their respective territories in the zone established by the Treaty. Under Protocol 2, the US, France, UK, Russia and China agree not to use or threaten to use nuclear 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. However, these were submitted to the US Senate on 2 May 2011 for advice and consent as part of the process prior to ratification.

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 South Pacific Nuclear Free Zone Treaty (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

Joint Working Group of the International Partnership for Nuclear Disarmament Verification in June 2019, Utrecht, Netherlands, Photos courtesy of Kick Smeets / Dutch Ministry of Foreign Affairs 2019

SECTION 4

PERFORMANCE

OUTPUT 1.1: NATIONAL SAFEGUARDS SYSTEM

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

PERFORMANCE MEASURES

- Australia's obligations are met under Australia's safeguards agreement with the IAEA.
- Australia's system of safeguards permits and authorities is administered in a timely and effective manner.
- Australian uranium at mines and in transit is accounted for properly.

PERFORMANCE ASSESSMENT

International Obligations

Reporting Obligations under the Australia–IAEA Comprehensive Safeguards Agreement

ASNO met all of Australia's obligations during the reporting period for the submission of declarations and notifications on nuclear materials, facilities and activities, as required by Australia's safeguards agreements with the IAEA.

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 below.

There were efficiency improvements during 2018–19 as the majority of inventory transactions and physical inventory takings were submitted to ASNO via ASNO's NUMBAT (NUclear Material Balance And Tracking) database portal by permit holders.

The portal allows permit holders to manage many aspects of their permit without paper forms, including updates to their nuclear material inventory and authorised points of contact.

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 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 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	2017–18	2018–19
ANSTO research laboratories	AS-C	958	997
HIFAR (de-fuelled 2007)	AS-A	0	0
ANSTO vault storage	AS-D	359	336
OPAL reactor	AS-F	701	343[1]
Other locations	AS-E ASE1 AS-I	2737	2405
TOTAL		**4755**	**4081**

1 The reduction in the number of line entries for the OPAL reactor resulted from a change to the structure of ASNO's reports to the IAEA on the movements of target plates for the production of the radiopharmaceutical, molybdenum-99.

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

TYPE OF DATA	2017–18	2018–19
Inventory Change Report (monthly)	2151	1449
Physical Inventory Listing (annual)	2341	2422
Material Balance Report (annual)	263	210

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 2019**

CATEGORY	QUANTITY	INTENDED END-USE
Source Material		
Uranium Ore Concentrates (UOC)	961 tonnes	Export for energy use pursuant to bilateral agreements
	3.5 tonnes	Storage
Natural Uranium (other than UOC)	4,492 kg	Research, storage
Depleted Uranium	28,159 kg	Research, shielding
Thorium Ore Residues	59 tonnes	Storage/disposal
Thorium (other than Thorium Ore Residues)	1,942 kg	Research, industry
Special Fissionable Material		
^{235}U – low enriched	128,787 grams[2]	Research, radioisotope production, storage
^{235}U – high enriched	2,746 grams	Research, storage
^{233}U	3.8 grams	Research
Plutonium (other than ^{238}Pu)	1,203 grams	Research, neutron sources

2 The quantity of ^{235}U in low enriched uranium in Australia decreased by approximately 100 kg between 30 June 2018 and 30 June 2019, primarily due to the export of spent fuel assemblies from the OPAL reactor to France (refer to Output 1.2).

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.

The Safeguards Act requires permits for possession of 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[3] in Australia at 30 June 2019**

CATEGORY	QUANTITY	INTENDED END-USE
Associated Material		
Deuterium and heavy water	20.9 tonnes	Research, reactors
Nuclear grade graphite	83.4 tonnes	R&D and storage
Associated Equipment		
HIFAR[4]	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[5]	1	Reactor
OPAL control rods	14	Reactor components
OPAL control rod drives	6	Reactor components
Nuclear-grade zirconium tubes	<50 kilograms	R&D and storage

Reporting Obligations under the Australia–IAEA Additional Protocol

The Additional Protocol (AP) 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, also that states do not have any undeclared nuclear material or activities. Australia was the first country to sign and ratify an AP with the IAEA, which came into force for Australia on 12 December 1997.

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

ASNO prepares and provides annual declarations under a range of AP 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 AP 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.

Table 8: **Number of Entries Made under the Additional Protocol**

TYPE OF DECLARATION UNDER ARTICLE 2.A AND 2.B OF THE ADDITIONAL PROTOCOL		2013 –14	2014 –15	2015 –16	2016 –17	2017 –18	2018 –19
2.a.i	Government funded, authorised or controlled nuclear fuel cycle-related research and development activities not involving nuclear material	2	2	3	8	10	13
2.a.ii	OPAL operational schedules	-	1	1	2	1	1
2.a.iii	General description of each building on each site, e.g. ANSTO, universities	175	154	156	289	274	273
2.a.iv	Manufacturing or construction of specified nuclear related equipment	1	1	2	2	2	0
2.a.v	Location, operational status and production capacity of uranium or thorium mines or concentration plants	4	4	4	4	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	8	7	7	7
2.a.vii	Information on nuclear material exempted from safeguards	6	6	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

6 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.

TYPE OF DECLARATION UNDER ARTICLE 2.A AND 2.B OF THE ADDITIONAL PROTOCOL		2013 –14	2014 –15	2015 –16	2016 –17	2017 –18	2018 –19
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	3	3	3	4	4	5[7]
2.b.i	Nuclear fuel cycle-related research and development activities not involving nuclear material and not funded, authorised or controlled by the Government	1	1	2	-	-	-

Safeguards Developments in Australia

The IAEA implements safeguards in Australia in accordance with the provisions in a range of instruments: the Comprehensive Safeguards Agreement; Additional Protocol; Subsidiary Arrangements; and facility 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 analysis activities under these instruments is the State-level approach for Australia, which was updated in 2016.

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. During the reporting period the IAEA conducted some inspections of the ANM plant, and completed a hot test of a customised active well coincidence counter (AWCC) for verifying the ^{235}U content in solid waste (see further details at page 43).

As reported in the 2017–2018 Annual Report, a new permit and MBA was created to centrally manage safeguards and security across all Commonwealth Scientific and Industrial Research Organisation (CSIRO) sites. The new MBA structure streamlines managements and reporting of CSIRO's small inventory of nuclear material, and allows for more efficient adaptation to changes in business units and research functions. For IAEA safeguards purposes, CSIRO is categorised as a Location Outside Facility (LOF) as it holds only small quantities of nuclear material and has no nuclear facilities. The LOF MBA for CSIRO is of the same type as the two LOF MBAs (described in Table 3) covering locations such as Australian universities, laboratories, State radiation safety regulators, and others. During the reporting period, ASNO and the IAEA finalised what

7 The additional entry for 10-year plans relates to the Australian Government project to site, design and build a national radioactive waste management facility.

is known as a LOF Attachment for CSIRO outlining implementation rules in relation to reporting, record keeping and inspections. On 3 May 2019 the IAEA conducted its first physical inventory verification (PIV) inspection of CSIRO, to verify the starting inventory of CSIRO under the new MBA structure.

ASNO continues to engage with the Department of Industry, Innovation and Science's (DIIS) process to establish a facility for Australia's radioactive waste. During the reporting period, ASNO provided advice to DIIS and ANSTO on IAEA safeguards requirements that may influence aspects of the engineering designs for the facility.

Table 9: **Status of Permits and Authorities under the Safeguards Act as at 30 June 2019**

PERMIT OR AUTHORITY	CURRENT TOTAL	GRANTED	VARIED	REVOKED	EXPIRED
Possess nuclear material	110	5	24	0	3
Possess associated items	10	1	2	1	0
Transport nuclear material	19	1	1	0	1
Transport associated items	0	0	0	0	0
Establish a facility	2	0	1	0	0
Decommission a facility	1	0	0	0	0
Communicate information contained in associated technology	7	1	1	1	0
TOTAL	**149**	**8**	**29**	**2**	**4**

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. Notice 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 is in Table 9.

As reported in the last few Annual Reports, in line with the governance and risk management policies under the Government's regulatory reform agenda, ASNO re-designed the models for permits under the Safeguards Act to follow a small number of template permits with a compliance code format for different ranges of nuclear material holdings. During the reporting period all but one permit holder have now transitioned to the new permit model[8] – with the last permit to be updated in the coming months.

8 Templates available at: https://dfat.gov.au/international-relations/security/asno/Pages/template-permits-and-compliance-codes.aspx

Essential to this work 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 design and testing of ASNO's NUMBAT database. A significant milestone in the reporting period, was the first use in July 2018 of NUMBAT's online portal for permit holders to update inventory records directly. Each July ASNO collects updated inventory records from around 100 permit holders, to check and compile into inventory, inventory change and material balance reports to the IAEA (see Tables 4 and 5), following its detailed reporting schema. The online portal worked well, with generally positive feedback from permit holders, significantly reducing overall effort required on this process.

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. Inspections were conducted at ANSTO's Lucas Heights site, CSIRO's Black Mountain (Acton, ACT) site, and Beverley and Four Mile Mines (Heathgate Resources). The IAEA conducted its annual, scheduled physical inventory verification inspection at ANSTO in May, and a short notice random inspection in October. Details on all inspections are provided in Table 10, 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. As reported in ASNO's 2017–18 Annual Report (page 46), there is a technical challenge regarding the IAEA measuring uranium content in solid waste from molybdenum–99 (Mo–99) radiopharmaceutical production. ASNO and ANSTO have been working closely with the IAEA on a solution, and the IAEA has now constructed a detector for measuring the uranium content in the waste. The detector is an active well coincidence counter (AWCC) that measures uranium by counting multiple neutrons in coincidence produced by fission induced by a small, built-in neutron source. A successful hot commissioning test of the detector was completed at ANSTO in February 2019 using Mo–99 production solid waste.

Table 10: **IAEA Safeguards Inspections 2018–19**

Date	Facility	Material balance area[9]	Type[10]
9–11 October 2018	ANSTO	AS-C and AS-F	Complementary Access (4.a.i)
		AS-F	Short Notice Random Inspection
		AS-C	Complementary Access (4.a.i)
18–21 February 2019	ANSTO	AS-C	Technical visit for hot commissioning test of AWCC detector and testing dual sealing application
2–3 May 2019	CSIRO – Black Mountain	AS-I	Physical Inventory Verification
6–10 May 2019	ANSTO	AS-D	Design Information Verification & Physical Inventory Verification
		AS-C	Design Information Verification & Physical Inventory Verification
		AS-F	Design Information Verification & Physical Inventory Verification
		AS-C	Complementary Access (4.a.i)
20 May 2019	Beverley and Four Mile uranium mines (Heathgate Resources)	AS-E	Complementary Access (4.a.i)

The IAEA recognises that this is a technical challenge for which a solution is well advanced with plans to begin using the AWCC detector for routine verification of solid waste in 2020, subject to approval by ARPANSA. Accordingly, this has not affected its overall conclusions for this material balance area or for Australia as a whole. The IAEA's 91b statement for material balance area AS-C for 2017–2018 (see Appendix B) concludes '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'. Furthermore, the IAEA has maintained the broader conclusion for Australia that 'all nuclear material remained in peaceful activities' (see Appendix B).

The AS-I Material Balance Area (established February 2018, see Annual Report 2017–2018, p 44) covers CSIRO sites that hold nuclear material. While the IAEA periodically conducts complementary access inspections at locations within AS-I, a physical

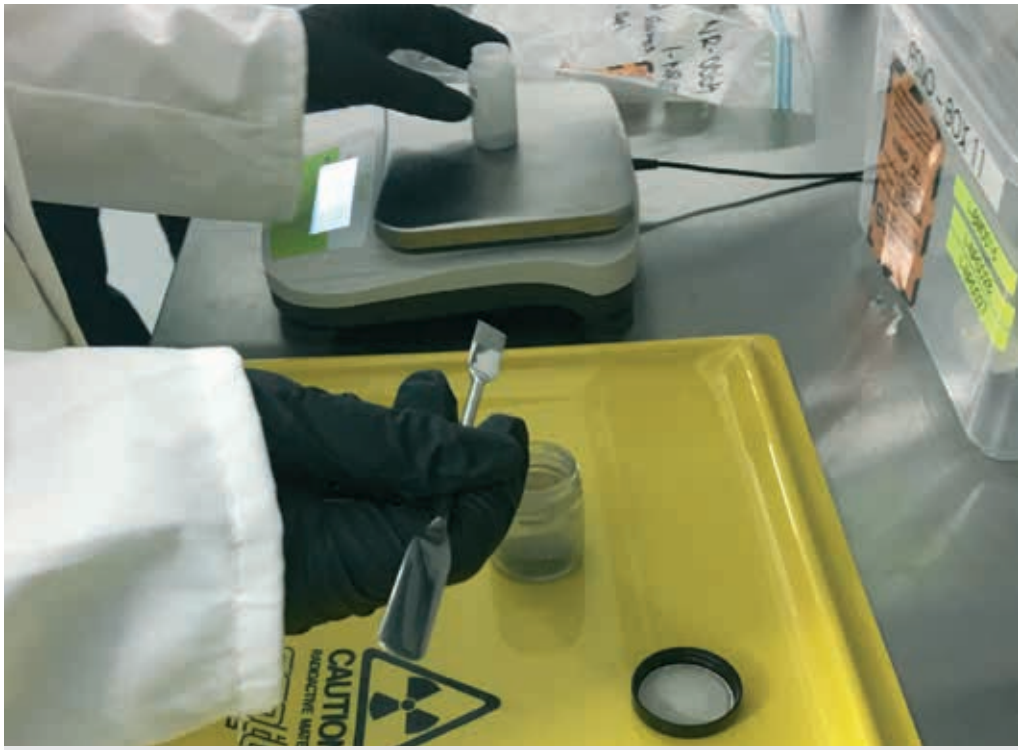
9 See explanation of each material balance area in Table 3.
10 Details on different types of inspections are outlined in Appendix B.

inventory verification (PIV) will be conducted about every four years at a location selected by the IAEA. This frequency is reflective of the small quantities of nuclear material held across all of these locations.

The first PIV in AS-I was conducted in May 2019. The IAEA selected CSIRO's Black Mountain (Acton, ACT) site for inspection and IAEA inspectors completed a thorough check of all nuclear material inventory. An explanation of how the IAEA reports on the outcomes of these inspections is included in Appendix C.

The active well coincidence counter (AWCC) detector designed to measure the uranium content of solid waste at ANSTO.

IAEA inspectors performing a measurement on a target plate used for molybdenum–99 production at ANSTO during physical inventory verification in May 2019.



Taking a sample of nuclear material for analysis during physical inventory verification at CSIRO – Black Mountain in May 2019.

ASNO Inspections

During 2018–19, ASNO accompanied the IAEA on all of the inspections listed above. ASNO attended these inspections to ensure Australia's obligations are met in a timely and efficient manner, and to ensure the inspections are 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 conducted a safeguards inspection at CSIRO to prepare for the scheduled IAEA physical inventory verification inspection. ASNO also conducted two visits to CSIRO to assist with characterising small legacy items of nuclear material and adding them to the inventory records. Some safeguards aspects were also included in some of the security inspections conducted by ASNO.

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 11. These were primarily due to re-measurement of batches by permit holders with small holdings of nuclear material (e.g. universities, research institutes).

Table 11: **Inventory Differences Recorded during 2018–19**

MATERIAL BALANCE AREA	DIFFERENCE BETWEEN BOOK AND PHYSICAL INVENTORY*	COMMENT
Other locations (MBA AS-E)	14.70 kg depleted uranium –0.02 kg natural uranium 0.02 kg thorium	Primarily due to one radiography device previously on the physical inventory having been found not to contain depleted uranium, and due to re-measurements of other batches.
Other locations (MBA ASE1)	0.68 kg depleted uranium –0.18 kg natural uranium 0.12 kg thorium	Primarily due to re-measurements of batches.
CSIRO (MBA AS-I)	22.98 (0.68) g enriched ^{235}U 0.16 kg natural uranium 0.20 g plutonium 0.07 kg thorium	Re-measurement of batches as part of CSIRO's campaign to characterise legacy inventory in storage.

* Figures in brackets refer to isotope weight.

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

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

Table 12: **Distribution of Permits Holders according to security category**

Nuclear Material Category	Type of 'Facility'	Number of Permit Holders
Category II[11]	Research Reactor, Storage	1
Category III	Storage, Scientific Research	1
Category IV[12]	Scientific Research	1
Uncategorised[13]	LOFs	97
Natural Uranium (UOC)	Uranium Mines and Concentration Plants	4
Transport of nuclear material	Transport Companies, Ports, Shipping Lines	25

11 Nuclear material category is based on IAEA Nuclear Security Series No. 13
12 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)
13 i.e. below Category IV quantities

Nuclear Material Category	Type of 'Facility'	Number of Permit Holders
Associated Items		
Associated Equipment and Technology	Enrichment Research, Storage and Archives	4
Associated Technology	Patent Attorneys	3

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 CPPNM, its 2005 Amendment and relevant bilateral nuclear cooperation agreements, as well as being in accordance with IAEA recommendations. ASNO also met Australia's international shipment notification obligations under the CPPNM by notifying relevant parties of the transhipment of uranium ore concentrates (UOC) exported from Australia.

Exports of Australian Uranium

Transport of all Australian UOC to destinations abroad is done in accordance with new model transport permit requirements that include verifying the integrity of containers holding UOC. Container seals are checked at each port of unloading or transhipment to detect any breaches of integrity. There were no security incidents (malicious acts) involving the transport of UOC in Australia during the reporting period.

In October 2018, two (of twenty) containers, from a shipment of Australian UOC, were opened at a conversion facility finding snapped or loose cargo strapping used to tie-down UOC drums. This allowed for movement of a few drums within these containers. After unloading, damage to a single drum of UOC was identified. A small amount of UOC leaked from the damaged drum but was retained within the container ensuring full recovery of UOC. Subsequent investigation could not conclusively determine the initiating event for the strapping failure.

Nuclear Security of UOC at Australian Mines and in Transport

On 17 September 2018, ASNO conducted an inspection at the Olympic Dam uranium mine. The purpose of the inspection was to verify that the requirements of their Permit to Possess Nuclear Material are met and that the performance of physical protection and material accountancy systems are adequate. As part of the inspection ASNO reviewed changes to transport arrangements, security measures in the uranium production plant, computer security and contracted security arrangements. ASNO conducted an inspection of the Beverley Uranium Mine on 21 March 2019. The inspection included evaluating draft revisions of security plans and procedures against ASNO's permit requirements. This inspection included changes to plant, performance of physical protection, material accountancy and future expansion including a new pipeline installed directly from the Four Mile West tenement to the Beverley Plant. For both facility inspections, ASNO concluded that BHP and Heathgate continue to meet permit conditions related to security and accountancy to satisfactory levels.

ASNO Inspectors at the Beverley Uranium Mine of Heathgate Resources

The physical protection of UOC in transport extends from mine to port and in keeping with ASNO's outreach and engagement activities, a scheduled inspection conducted on 18 September 2018 of a transport company included being a passenger during conveyance of UOC from mine to port. ASNO observed that security procedures were correctly implemented by the carrier.

On 19 September 2018 and 20 March 2019, ASNO inspectors conducted follow-up inspections of a storage compound for UOC incidental to transport. ASNO approved the completed installation of physical protection measures and updated transport security plans. On 20 March 2019 ASNO also conducted an inspection of an alternate interim storage location for the carrier at Flinders Port.

Nuclear Security at Lucas Heights

As part of the OPAL reactor regulatory licencing requirements, ANSTO will submit a periodic safety and security review (PSSR) to the CEO of ARPANSA and to the Director General of ASNO. The integrated PSSR is an Australian leading first for research reactors worldwide. The PSSR examines all individual aspects and synergies of security and safety factors in place for the OPAL reactor, following relevant ARPANSA and ASNO regulatory requirements. Launched in March 2018, the PSSR is a large scope of work, which draws on current international best practice.

The new ANSTO Nuclear Medicine (ANM) facility commenced routine production that opens the way for Australia to supply a very significant proportion of the growing world market for nuclear medicine. ASNO worked with ARPANSA to approve ANSTO's security measures, benefitting from the recent follow-up IPPAS mission.

ASNO carried out an inspection of UOC transport operations in September 2018

Spent fuel from an ANSTO research reactor being loaded onto the vessel destined for France.

Shipment of Spent Fuel from the OPAL Reactor

On the evening of 28 July 2018, ANSTO working closely with several State and Federal Government agencies, executed a model example for transport of OPAL spent fuel assemblies to France for reprocessing. This was Australia's 10th routine transport of spent nuclear fuel assemblies. ASNO's involvement included approving the transport plan, granting transfer approvals under three nuclear cooperation agreements and giving prior notice to the IAEA. A subsequent debriefing session highlighted areas where arrangements for future shipments could be further improved.

Other holders of nuclear material

The consolidation of CSIRO's nuclear material holdings has required additional physical protection measures to be installed at an allocated storage facility. ASNO conducted an inspection of the protective security measures and found the storage arrangements to be satisfactory.

SILEX Enrichment Technology

ASNO conducted several routine inspections at Silex Systems Limited (SSL) during the reporting period, including 9 October 2018, 15 February 2019 and 19 June 2019 concentrating on matters raised in SSL's monthly security reports. ASNO provided regulatory oversight of change management of security matters related to personnel restructuring and changes to physical protection measures. No significant security deficiencies were found during the inspections.

SSL is working towards finalisation of a purchase agreement for the restructure of SILEX technology licensee GE-Hitachi Global Laser Enrichment LLC (GLE). This follows the signing of a Term Sheet on 5 February 2019. SSL continues to hold a permit to possess associated technology with ASNO and regulatory activities will be reviewed based on the future disposition of the technology in USA and Australia.

Other Enrichment Technologies

ASNO has issued a Permit to possess associated technology for a developing innovation into uranium enrichment. ASNO is working with the permit holder to apply nuclear security measures on a graded and risk based approach while providing appropriate training.

South Australian UOC Transport Working Group

The South Australia UOC Transport Working Group and a Transport Steering Committee have finalised a number of key outcomes such as:

- the Uranium Oxide Concentrate (UOC) Incident Communications Protocol/ Guideline
- the UOC Transport Management Plan Template
- an Incident Response Resource Table and
- an Overview of Consignor and Carrier Requirements for Safe Transport of Radioactive Material in South Australia.

These resources assist oversight by detailing the available capabilities of the mining industry, transporters and emergency services. ASNO contributed transport security expertise to the working group and the steering committee convened by the South Australian Environment Protection Authority (EPA) and attended by State Government, industry and first responders.

An import activity of the Working Group was the conduct, on 23 August 2018, of an Incident Management Desktop Exercise by State and Federal Government, industry, South Australia Police and first responders. The exercise 'Rocky River 2' was designed to discuss, develop and define consequence management arrangements in the event of a UOC spill in the Mid-North area of South Australia.

Regional Training Course – Introduction to nuclear forensics

In building ASNO's capacity in nuclear forensics, ASNO attended an IAEA Regional Training Course on nuclear forensics held in Sydney, hosted by ANSTO on 25 February – 01 March 2019. The training and exercises were designed to further awareness of analytical measurement techniques and procedures that can support a national response plan to nuclear incidents, to introduce current scientific methods for nuclear forensic analysis, and learn from internationally recognised experts.

Some of the participants at the IAEA Regional Training Course on nuclear forensics using equipment in an ANSTO laboratory

IAEA Consultancy Meetings

ASNO provided expert advice at two consultancy meetings in May 2019; firstly to review an IAEA acquisition path analysis for the development and deployment of an undeclared gas centrifuge enrichment plant (GCEP) for HEU production, and secondly to revise, enhance and improve the IAEA's Physical Model on uranium enrichment in order to further understand the technology, possible diversion paths, proliferation indicators, and emerging issues.

AusIMM

ASNO attended the Australasian Institute of Mining and Metallurgy (AusIMM) International Uranium Conference in Adelaide on 4–5 June 2019. The AusIMM uranium conference was an excellent opportunity to engage with uranium exploration companies and prospective uranium miners who do not yet have a formal regulatory relationship with ASNO, but may in the future require a permit.

Uranium Council Meeting

ASNO attended the annual Uranium Council meeting held in Adelaide on 6 June 2019. The meeting provides a forum for stakeholders (federal and state regulators and industry) to present on contemporary challenges as well as providing updated information of current developments in this field. The meeting sought to update and complete a number of fact sheets relating to Australia's export of UOC.

Preparation for the Conference of States Parties to the Amended CPPNM

In preparation for the Conference of States Parties to the Amended Convention on the Physical Protection of Nuclear Material, mandated under Article 16 of the Convention to take place in 2021, an informal meeting of States Parties was held in December 2018. The meeting developed a provisional roadmap to the Conference, which included a meeting of legal and technical experts and a preparatory committee to establish thematic and procedural matters for the Conference

itself. In June 2019, DG ASNO accepted an invitation to co-chair with Argentina the Meeting of Legal and Technical Experts, to take place 22 to 26 July 2019 and to also co-chair with Hungary the Preparatory Committee in 2020. The 2021 Conference will be co-chaired by Switzerland and Nigeria.

Nuclear Security Guidance Committee (NSGC)

The core role of the 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. Director, Nuclear Security (Dr Stephan Bayer) took up the Chair of the NSGC's third term in 2018. The 14th meeting of the NSGC, held in December 2018, concentrated on setting up a review of the top-tier documents of the Nuclear Security Series, approving the publication of a Nuclear Security Series Glossary and discussing the merits of a Nuclear Security Series publication on safety/security interfaces.

Integrated Regulatory Review Service (IRRS)

In November 2018, ASNO participated in an IAEA IRRS mission hosted by ARPANSA. The mission reviewed Australia's national, legal and governmental framework for nuclear and radiation safety against the IAEA's Safety Standards. Of interest to ASNO, mission also addressed the interface between nuclear safety and nuclear security, ASNO's cooperation with ARPANSA on nuclear regulatory matters and ASNO's role in accounting for Australia's holding of nuclear material. The mission report can be found on ARPANSA's web-site.

Post Nuclear Security Summit Activities

Australia is a member of the post-Nuclear Security Summit Nuclear Security Contact Group (NSCG), whose Statement of Principles[14] includes advancing implementation of nuclear security commitments and building a strengthened, sustainable and comprehensive global nuclear security architecture. The NSCG, currently chaired by Hungary, met in Vienna and Budapest during the reporting period to discuss collective commitments, core messaging on nuclear security as well as recent and upcoming nuclear security conferences. DG ASNO is Australia's NSCG designate. Australia continued leading a discussion on preparing for the Amended CPPNM review conference which is mandated to take place in 2021.

In further initiatives to promote nuclear security internationally, DG ASNO continues 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 been active in promoting the Nuclear Security Summits' goals and commitments.

14 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

- AONM 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 is satisfactorily accounted for. Details are provided in Table 13.

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 2018.

Signature text of the Australia-UK Nuclear Cooperation Agreement.

The then Foreign Minister Julie Bishop and then High Commissioner to Australia Menna Rawlings signing the Australia-UK Nuclear Cooperation Agreement, August 2018.

Table 13: **Summary of net accumulated AONM by category, quantity and location at 31 December 2018**[15]

CATEGORY	LOCATION	TONNES[16]
Depleted Uranium	Canada, China, European Union, Japan, Republic of Korea, Russia, United States	135,893
Natural Uranium	Canada, China, European Union, Japan, Republic of Korea, United States, India	28,583
Uranium in Enrichment Plants	China, European Union, Japan, United States	28,348
Low Enriched Uranium	Canada, China, European Union, Japan, Mexico, Republic of Korea, Switzerland, Taiwan, United States	19,026
Irradiated Plutonium	Canada, China, European Union, Japan, Mexico, Republic of Korea, Switzerland, Taiwan, United States	200
Separated Plutonium	European Union, Japan	1.6
TOTAL		**212,052**

15 Figures are based on yearly reports to ASNO in accordance with Australia's bilateral agreements and other information held by ASNO.

16 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.

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

Table 14: **Supply of Australian uranium by region during 2018**[17]

REGION	TONNES UOC (U_3O_8)	% OF TOTAL
Asia	0	0
Europe	4,375	62
North America	2,671	38
TOTAL	**7,046**	**100**

Table 15: **Summary of AONM Transfers during 2018**[18]

	DESTINATION	U (TONNES)
Conversion	Canada	1,233
	European Union	3,694
	United States	719
Enrichment	European Union	813
Fuel Fabrication	Republic of Korea	32
	Japan	33
	United States	142
	European Union	4
Reactor	Switzerland	11
	European Union	0.4
Reprocessing[19]	European Union	0.5

17 Export destinations for Australian uranium are decided by commercial factors including the availability of conversion capacity and customer preferences.
18 Figures are for transfers completed between jurisdictions from 1 January to 31 December 2018
19 Resultant from the export of spent fuel assemblies from Australia's OPAL reactor to France (refer Output 1.2)

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 confirmed to ASNO receipt of the shipment. ASNO also notified the IAEA of each export to non-nuclear weapon States pursuant to Article 35(a) of Australia's Safeguards Agreement with the IAEA, as well as to nuclear-weapon States under the IAEA's Voluntary Reporting Scheme. Countries which received these exports also report the receipts to the IAEA.

Bilateral Agreements

Reporting

Reports from ASNO's counterpart organisations were received in a timely fashion enabling efficient analysis and reconciliation with ASNO's records. Figures provided in Table 13 and Table 15 are based on ASNO's analysis of all available information at the time of publication.

There has been a successful first year of operation of the new Nuclear Material Balance and Tracking (NUMBAT) database in relation to the approval of shipments to transfer UOC internationally. The online portal allows mines to directly submit shipments for approval to ASNO, and for ASNO to approve shipments without the use of paper forms. This has led to streamlined approvals and communications with permit holders and domestic and international counterparts.

Australia-Ukraine Nuclear Cooperation

The Australia-Ukraine Nuclear Cooperation Agreement (NCA) entered into force on 15 June 2017. An associated Administrative Arrangement (AA) has since been concluded. The NCA became operational on 18 September 2018, when the AA was signed by ASNO, Dr Robert Floyd, and the Chairman of the State Nuclear Regulatory Inspectorate of Ukraine, Mr Hryhorii Plachkov on the sidelines of the IAEA General Conference in Vienna. Commercial transfers of Australian obligated nuclear material to Ukraine can now occur.

DG ASNO and the Chair of the State Nuclear Regulatory Inspectorate of Ukraine signing the Administrative Arrangement for the Australia-Ukraine Nuclear Cooperation Agreement.

Implications of Brexit and the United Kingdom leaving Euratom

In anticipation of the UK's planned withdrawal from the European Union (EU) and Euratom, a new bilateral Australia-UK nuclear cooperation agreement was signed in August 2018. Australia's domestic treaty-making processes have been completed and it is ready to enter into force. Australia and the UK have also finalised the associated Administrative Arrangement.

The Australia-UK Agreement will enter into force once the Australia-Euratom Agreement ceases to apply to the UK, and after the entry into force of the new bilateral Safeguards Agreement and Additional Protocol concluded between the UK and the International Atomic Energy Agency (IAEA). Once the new bilateral Australia-UK Agreement enters into force, cooperation between Australia and other Euratom member states will continue under the Australia-Euratom Agreement.

The updated Australia-UK NCA will continue to require Australian uranium to be used exclusively for peaceful purposes, be subject to IAEA safeguards, and be protected by internationally agreed standards of physical protection.

Implementation of the Australia-India Nuclear Cooperation Agreement

The Australia-India NCA entered into force on 13 November 2015 and the Civil Nuclear Transfers to India Act 2016 commenced on 8 December 2016.

In April 2019, ASNO visited its counterparts from the Indian Department of Atomic Energy (DAE) in Mumbai for meetings of the Australia-India Joint Committee. The meetings were constructive, and concentrated on the effective implementation of the Australia-India NCA. ASNO representatives also visited the Board of Radiation and Isotope Technology (BRIT) in Mumbai. BRIT is a unit of DAE and analyses the uses of radioisotope applications and radiation technology across sectors such as industry, healthcare and agriculture.

Meeting of the Joint Committee under the Australia-India Nuclear Cooperation Agreement.

Bilateral and multilateral engagement on Nuclear Cooperation Agreements

ASNO has continued to liaise closely with bilateral counterparts within our network of nuclear cooperation agreements to ensure the effective operation of the Agreements. This has included bilateral meetings with counterparts from China, the Czech Republic, France, Euratom, India, and the UK.

In 2019–20, ASNO will continue to engage our bilateral and multilateral counterparts to facilitate BSS' tracking and reporting obligations. ASNO is undertaking a stocktake of the various arrangements to identify ways to modernise and simplify reporting, communication protocols and streamlining AA text with our counterparts to ensure the practical implementation of Australia's nuclear cooperation agreements is as efficient as possible.

Meeting between ASNO and the Czech State Office for Nuclear Safety

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 fora, primarily through ASNO's membership of the Asia-Pacific Safeguards Network (APSN).

This engagement helps build and maintain 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. For example, ASNO continues its coordination of work on examining areas where Australia has technical capabilities that could potentially support an international verification effort in DPRK. This could draw on expertise in inspections and support areas within Australian Government agencies, as well as the specialised technical capabilities developed through the various Australian Safeguards Support Program (ASSP) projects. Developments in the 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. ASNO participated in the IAEA's Symposium on International Safeguards in November 2018 (held once every four years) presenting on aspects of safeguards implementation challenges and technology development projects. The breadth of Australia's contributions to this Symposium was greater than in previous Symposia. ASNO helped involve researchers from CSIRO and University of New South Wales (UNSW) to present on robotics and blockchain projects that may have applications for safeguards. In 2018, ASNO was also part of the Australian delegation to the IAEA General Conference meetings in September, contributing to the negotiation of the Safeguards Resolution ('Strengthening the Effectiveness and Improving the Efficiency of Agency Safeguards') which was agreed 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 since 1980.

Meeting between DG ASNO and BAPETEN

Nuclear Inspection Robots and Other Emerging Technologies

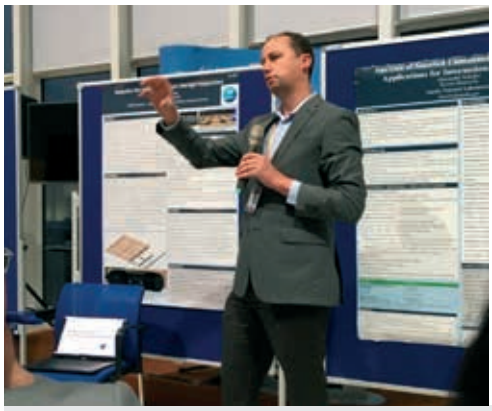
In November 2017, CSIRO hosted the IAEA's Robotics Challenge, an event aimed at developing robotic systems to help inspectors perform repetitive inspection tasks more efficiently and consistently, particularly in areas of nuclear facilities that may be difficult to access (see ASNO's Annual Report 2017–18). ASNO and the IAEA prepared a report evaluating the robots based on the extent to which each one fulfilled the inspection scenarios during the challenge.

Some of the robots were designed to propel themselves autonomously across the surface of a spent fuel pond, while holding a device for measuring radiation glow patterns (known as Cherenkov glow) from spent nuclear fuel. Based on the outcomes of the challenge, the IAEA selected three of these 'unmanned surface vehicles' for proof-of-concept testing in a spent fuel pond at the Loviisa Nuclear Power Plant in Finland in November 2018. In January 2019, the IAEA announced Datastart Ltd of Hungary the winner of the challenge. The IAEA is in discussions with Member States, nuclear facility operators and Datastart to further refine and test the design to ensure it is compliant with all applicable requirements and regulations.

Separate from the Robotics Challenge, ASNO, CSIRO and the IAEA are exploring how robotics can be developed further. CSIRO is developing robots for surveying radioactive material in drums in densely packed storage facilities. These robots may have safeguards applications, including building maps of storage facilities, identifying the locations of nuclear material, characterising that material, and verifying seals in otherwise inaccessible locations.

Researchers at the Faculty of Engineering, UNSW have developed a blockchain (shared ledger) platform to hold nuclear material accounting data that conforms to IAEA safeguards reporting requirements. Blockchain technology is designed to ensure the consistency and immutability of electronic data held among multiple parties, which may prove useful for reporting inventories and transactions among nuclear operators, state regulatory authorities and the IAEA.

The researchers performed a comparative evaluation of ASNO's existing centralised NUMBAT database and their blockchain platform, referred to as the Shared-Ledger nUclear Material Balance Tracking system (SLUMBAT), using data on hypothetical nuclear facilities. The blockchain platform offers potential advantages in terms of efficiency and data integrity. The Stimson Center, Finland's nuclear regulator (STUK) and UNSW are starting a project to develop a more detailed blockchain-based nuclear accountancy prototype based on Finland's safeguards system with a focus on accountancy for Finland's deep geological spent fuel repository.



Symposium on International Safeguards at the IAEA in Vienna in November 2018: (a) ASNO officers and other participants from Australia at the Symposium, (b) Paul Flick (Principal Research Engineer, CSIRO Data61) presenting on robots developed by CSIRO Data61 for inspection of radioactive material in drum storage facilities, (c) Master of Engineering Science (Nuclear Engineering) graduate Jasmin Diab presenting her research on natural language processing to enhance uranium mining safeguards.

Helping detect undeclared nuclear activities using mass spectrometers

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 2018–19, extensive testing has established that ANSTO has successfully resolved an issue with a source of naturally occurring uranium background in the system that had required a temporary suspension of routine analyses of swipe samples. ANSTO participated in an inter-comparison exercise with other NWAL members, sponsored by the IAEA and the US Department of Energy. The results demonstrate excellent performance of ANSTO's Accelerator Mass Spectrometry system, with results comparable to other leading NWAL members. ANSTO expects to resume routine analysis of samples for NWAL during 2019–20.

The University of Western Australia's Centre for Microscopy, Characterisation and Analysis continues to support the NWAL. The Centre uses its large-geometry secondary ion mass spectrometer (LG-SIMS) for quantifying uranium enrichment in environmental samples for nuclear safeguards. Due to staff turnover, the Centre did not process any IAEA samples from in-field verification activities during 2018–19, but it will resume analytical services in mid–2019. The lab participated in an inter-comparison exercise with other SIMS in the NWAL, with results expected in late 2019.

Assessment of Proliferation Pathways

In 2017, the IAEA commenced its first systematic review of the Physical Model since the early 2000s. The Physical Model is the IAEA's set of documentation that details the technology, possible diversion paths and proliferation indicators for each step of the nuclear fuel cycle. The IAEA Department of Safeguards uses the Physical Model in planning for inspections and in headquarters analysis. ASNO is contributing to updating the volume of the Physical Model on uranium enrichment. In May 2019, a technical expert from ASNO participated in a consultancy meeting and advised the IAEA on emerging safeguards and fuel cycle technology issues in uranium enrichment. The technical expert also participated in a consultancy meeting in May 2019 to review an IAEA draft guidance document on performing technical assessments of states' capabilities to develop and deploy undeclared gas centrifuge enrichment plants.

Proliferation Analysis Training

Since 2009, Australia has provided annual proliferation analysis training to IAEA safeguards staff to enhance their ability to analyse complex proliferation issues. In the last twelve months, the Office of National Intelligence and the Australian Department of Defence provided two proliferation analysis workshops to the IAEA. The content of the workshop is regularly updated and participant feedback has confirmed that the training continues to meet the needs of the IAEA Department of Safeguards.

Other Safeguards Innovations

Open-source analysis increasingly complements the IAEA's traditional in-field verification work. The IAEA Content Reification Engine (ICORE) utilises machine learning and natural language processing to identify indications of potential undeclared nuclear fuel cycle activities. A student at UNSW has supported the IAEA capability in this area through a Master of Engineering Science (Nuclear Engineering) dissertation focussing on identifying discrete terms that can be used to differentiate literature on uranium mining processes from the processing of other minerals in open-source datasets. This project has provided the IAEA with a dataset of key sentences and phrases from literature to help train ICORE to automatically identify relevant publications related to this stage of the nuclear fuel cycle in very large datasets of open source publications.

ASNO is currently considering additional projects that can provide the IAEA with training text for other stages of the nuclear fuel cycle.

ASNO is also participating in the Maker Games at UNSW. In consultation with the IAEA, ASNO challenged a team of UNSW Engineering students to design an ergonomic clipboard to help nuclear safeguards inspectors take notes, securely store paper documents, and carry out measurements during inspections at nuclear facilities.

Between June and August 2019, the team is developing a modular, wearable clipboard that will hold various equipment regularly used by inspectors while improving on the ergonomics of the conventional pen-and-paper solution and adhering to safety and security requirements applicable to nuclear facilities.

(a) The team of UNSW students and an ASNO safeguards officer participating in Maker Games, and (b) a simulated safeguards inspection activity at UNSW with an early prototype of the wearable clipboard.

Training course on IAEA safeguards held in Dili, Timor-Leste, February 2019.

Cooperation with other States Parties

ASNO has close and long-standing relationships with nuclear security and safeguards regulatory and policy agencies in several countries both in and outside the region. ASNO actively worked to maintain and strengthen relationships through both high-level and operational-level discussions and through projects under the Asia-Pacific Safeguards Network (APSN).

The 9th annual meeting of APSN was held on 1–2 November 2018 in Vienna, hosted by the Government of Korea and organised by KINAC (Korea Institute of Nuclear Nonproliferation and Control). The meeting was attended by 55 representatives from 13 regional countries including representatives from the IAEA and ESARDA. The venue and dates were selected to co-locate the meeting with the IAEA Safeguards Symposium to enable representatives to attend both the Symposium and the APSN meeting. Holding the APSN meeting in Vienna gave APSN members greater exposure to a diverse range of experts in the IAEA to gain a better understanding of safeguards requirements and methods, and provided the IAEA opportunities to discuss safeguards implementation challenges with many safeguards authorities together. Mr Massimo Aparo, Deputy Director General and Head of the Department of Safeguards, IAEA, set the scene with opening remarks on the importance of regional safeguards networks such as APSN. Cambodia joined the meeting as a member of APSN for the first time.

Australia coordinates the safeguards infrastructure, implementation and awareness-raising working group in APSN. Working Group 1 facilitated an information-sharing session on experiences with managing safeguards for locations outside facilities (LOFs) and the IAEA SSAC Advisory Service missions.

During the last twelve months, assistance, expert advice and training were provided to various other professionals in a range of countries and international organisations. Presentations related to these activities are included in the list in Annex D. In February 2019 ASNO assisted the US Department of Energy's National Nuclear Security Administration (NNSA) and the IAEA in a workshop on IAEA safeguards in Dili, Timor-Leste. This was the first ever workshop on IAEA safeguards for Timor-Leste, designed to inform officials on the basics of safeguards implementation, to assist Timor-Leste in bringing its Comprehensive Safeguards Agreement (CSA) and Additional Protocol (AP) into force. Timor-Leste would only have very small quantities of nuclear material subject to safeguards, possibly used for industrial shielding applications in the oil and gas industry. As such, Timor-Leste would be amongst more than 100 countries that have or qualify for a Small Quantities Protocols to their CSA, which holds in abeyance many safeguards implementation requirements under the CSA.

Mr Massimo Aparo, Deputy Director General and Head of the Department of Safeguards, IAEA at the Asia Pacific Safeguards Network (APSN) 9th Annual Meeting 1–2 November 2018, Vienna

Asia-Pacific Safeguards Network (APSN) exhibit at IAEA Safeguards Symposium 5–9 November 2018, Vienna

IAEA Standing Advisory Group on Safeguards Implementation

DG ASNO chairs the IAEA Director General's Standing Advisory Group on Safeguards Implementation (SAGSI). Dr Floyd's appointment started with the 77th series of SAGSI meetings in 2013. 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 and not 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.

SAGSI has two series of meetings each year, with each series usually comprising a working group meeting and a plenary meeting. During each series of meetings, SAGSI examines and provides advice on a list of safeguards implementation topics set by the IAEA Director General. One of the core topics examined over 2018–19 was the enhancement of the format and content of annual Safeguards Implementation Reports (SIRs) produced by the IAEA Secretariat. SAGSI discussed improvements to analytics and data visualisation, particularly graphics illustrating multi-year trends. SAGSI also considered options for adding context and analysis to the data in the SIR, particularly to help explain the impact of areas of difficulty in safeguards implementation, such as issues with the completeness, timeliness and accuracy of States' reports.

Other core topics included: opportunities to achieve broader use of safeguards by design among designers and vendors of new nuclear facilities; incorporation of key performance indicators into IAEA management processes and decision making; prioritisation of safeguards technical objectives; outcomes from the 2018 Symposium on International Safeguards; development of statistical methodologies to support state-level safeguards approaches; promotion of wider uptake of activities such as the voluntary reporting scheme; potential safeguards applications of passive gamma emission tomography (PGET) for verification of spent fuel; and updates to the content of the Physical Model, which acts as a technical reference for safeguards implementation by describing each stage of the nuclear fuel cycle.

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 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 38 facilities with CWC-relevant chemical production, processing or consumption activities during 2018 (declared in March 2019)
- Article VI declaration of anticipated activities at five CWC-Scheduled chemical facilities during 2019 (declared in September and October 2018) with an additional schedule 2 facility declared in April as the facility anticipated reaching the declaration threshold in 2019
- Article X, paragraph 4, declaration of Australia's national programs for protection against chemical weapons during 2018 (declared in April 2019)
- 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.

Since 1997, the OPCW has conducted 57 routine inspections at declared chemical plants and a Defence protective purposes laboratory in Australia in accordance with the provisions of Article VI of the CWC. In the current reporting period, ASNO facilitated one routine OPCW inspection of a declared 'Other Chemical Production Facilities' (OCPFs) in Victoria, from 7 to 8 March 2019. The inspection proceeded smoothly and received excellent support and cooperation from government and industry. The OPCW inspection team verified Australia's declarations, including the absence of any undeclared CWC-Schedule 1 chemical production, in accordance with the inspection mandates.

Clariant (Australia) Pty Ltd demonstrates compliance with the Chemical Weapons Convention by facilitating OPCW routine industry inspection with ASNO. Routine inspections of industrial chemical facilities build confidence that CWC member states are not developing chemical weapons.

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

Legislation and Regulation

The permit systems, under the *Chemical Weapons (Prohibition) Act 1994* (CWP Act) and Regulation 5J of the *Customs (Prohibited Imports) Regulations 1956*, continued to operate well. Table 16 provides statistics for the permits issued to facilities producing, processing or consuming CWC-Scheduled chemicals during the current reporting period. Thirty-four facility permits were in effect at 30 June 2019.

During the 2018–19 period two permits were issued for the import of CWC-Schedule 1 chemicals and 64 permits were issued for the import of CWC-Schedule 2 and 3 chemicals.

Table 16: **Permits for CWC-Scheduled Chemical Facilities**

CWC-SCHEDULED CHEMICALS	CWP ACT 1994	PERMIT TYPE	PERMITS AT 30 JUNE 2019[20]	NEW PERMITS 2018–19	RE-ISSUED PERMITS 2018–19	PERMITS CANCELLED 2018–19
Schedule 1	s19(4)	Production (Protective)	1	0	0	0
	s19(5)	Production (Research)	9	0	2	0
	s19(6)	Consumption	11	0	3	0
Schedule 2	s18(1)	Processing	10	1	1	0
Schedule 3	s18(1)	Production	3	0	3	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.

RSN membership includes:

- Australian Government Department of Agriculture and Water Resources (Agriculture)
- Australian Government Department of the Environment (Environment)
- 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)
- National Industrial Chemicals Notification and Assessment Scheme (NICNAS)
- 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 by:

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

The RSN committee meets regularly 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.

20 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.

In March 2019, Australia contributed EUR100,000 to the OPCW's Trust Fund for Syria Missions. The money will go towards boosting the OPCW's ability to investigate and attribute responsibility for use of chemical weapons.

ASNO provided responses to the following OPCW surveys and requests for information to assist the OPCW to enhance verification measures under the CWC and to share best practices that promote a chemical security culture in States Parties as part of chemical counter-terrorism efforts:

- questionnaire on the status of implementation of Article VII of the Chemical Weapons Convention and
- preparations for developing the second edition of a Needs and Best Practices Report included a Compilation of Tools, Guidance and Best Practices in Chemical Safety and Security Management in Australia.[21]

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. For example, ASNO:

- attended the 23rd Conference of the States Parties to the CWC held from 19–20 November 2018 and the Fourth Review Conference held from 21–30 November 2018, including various bilateral side meetings with the OPCW and other States Parties and
- attended the 17th Regional Meeting of National Authorities of States Parties in Asia held from 25 to 27 June 2019 in Ulaanbaatar, Mongolia.

Seventeenth Regional Meeting of National Authorities of States Parties in Asia held from 25 to 27 June 2019 in Ulaanbaatar, Mongolia. (Photo courtesy of Mongolian National Authority)

21 This 'Compilation' was made possible through contributions by federal and state/territory agencies, including industry associations that have responsibility for chemical safety and security management.

ASNO also attended, and presented at, the OPCW and Malaysian Government jointly hosted workshop in April on the 'Role of Implementing Legislation on the Chemical Weapons Convention (CWC) in addressing Threats arising from non-State actors'. The workshop was attended by representatives from 12 south-east Asian countries, the European Union, UN 1540 Committee, UN Interregional Crime and Justice Research Institute (UNICRI), World Customs Organization (WCO), UN Office on Drugs and Crime (UNODC), INTERPOL, the OPCW and Australia's National Authority for the CWC. ASNO provided presentations outlining the National Code of Practice of Chemicals of Security Concern that goes beyond the requirements of the Chemical Weapons Convention and aims to prevent the diversion of chemicals in Australia by non-state actors, and training initiatives for first responders. Presentations highlighted terrorist interest in the use of chemical weapons and the recent use of chemical weapons in targeted killings. Each State Party to the CWC is required implement legislation to enable prosecution for the use of chemical weapons within its borders or elsewhere by any of its citizens. Eight of the countries represented at the workshop had not yet introduced CWC implementing legislation. The aim of the workshop was to assist and encourage those countries to fulfil their obligations under the Chemical Weapons Convention.

Australia also has representatives, in their personal capacity, on the OPCW's Scientific Advisory Board and the Advisory Board on Education and Outreach.

Domestic Outreach

ASNO continued its close cooperation on CWC implementation issues with relevant Government agencies including the Department of Home Affairs; Defence Export Controls; Australian Border Force; Australian Bureau of Statistics; the National Industrial and Chemicals Notification and Assessment Scheme.

To assist ASNO in meeting its CWC reporting obligations and to 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 including Chemistry Australia and The Royal Australian Chemical Institute.

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

Of the 21 facilities that Australia will host for the CTBT International Monitoring System (IMS), all are in place and certified as operating to CTBTO technical specifications.

Work on the final facility to be established, an infrasound monitoring station at Davis Station, Australian Antarctic Territory, was completed in early 2018. Testing to certify that the station meets CTBT requirements, was completed in August 2018. With Geoscience Australia, ASNO arranged an event to mark that milestone as part of a visit to Australia by the CTBTO's Executive Secretary.

The uninterrupted operation of Australia's IMS stations is a routine focus for ASNO. During the year, ASNO has continued to work with the CTBTO and Western Australian Government agencies to reduce the risk of accidental damage to the seabed cable that brings to shore data from the Cape Leeuwin hydrophone array and to facilitate routine maintenance of the cable. 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.

Minister for Foreign Affairs and Minister for Women, Marise Payne at the 9th Ministerial Meeting of the friends of the CTBT, September 2018. Photo courtesy of The Official CTBTO Photostream

Nuclear-Test-Ban Verification

ASNO administers funding for Geoscience Australia to carry out nuclear test monitoring through its network of seismic stations as well as those of the CTBT's IMS. This arrangement, set out in a Letter of Understanding between Geoscience Australia and ASNO that is reviewed each year. ASNO is satisfied that Geoscience Australia has met its requirements 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. During the reporting period, Geoscience Australia has reported to ASNO on the detection of a number of small seismic events in the vicinity of the DPRK test site at P'unggye-ri. These appear to be a continuing series of aftershocks following the large September 2017 test explosion.

The operation of a National Data Centre (NDC) to verify an in-force CTBT will require additional activities. ASNO, ARPANSA and Geoscience Australia, together with the Department of Defence, continue to hold the question of Australia's future NDC requirements under review.

Table 17: **DPRK nuclear test explosions**

DATE	APPROXIMATE SEISMIC MAGNITUDE	ESTIMATED EXPLOSIVE YIELD (kT)	COMMENT
9 October 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 February 2013	mb 4.93	3 – 13	Seismic detection consistent with a simple fission device
6 January 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 September 2016	mb 5.06	4.4 – 19	Seismic detection consistent with a simple fission device
3 September 2017	mb 6.05	150–240	Seismic detection consistent with a more advanced weapon design – potentially thermonuclear as claimed by DPRK

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 mainly 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.

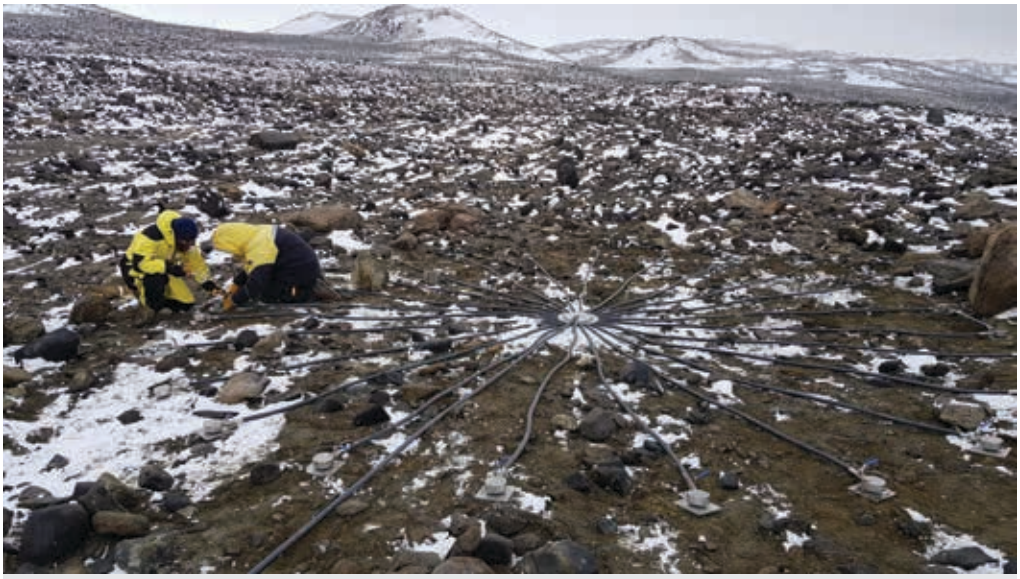
When the CTBT enters into force, it will provide for on-site inspections (OSI) to determine whether a nuclear explosion has taken place in a particular area. ASNO's Malcolm Coxhead, as Task Leader for the elaboration of an Operational Manual on the conduct of OSI, continued to chair discussions on this subject at the CTBTO Preparatory Commission's technical working group. During the year, Coxhead has worked with the CTBTO also on planning for a series of OSI build-up exercises in late 2019 and 2020.

From 4–7 December 2018, Australia hosted the Seventh Workshop on Signatures of Man-Made Isotope Production in Sydney (WOSMIP). The event was coordinated by the Australia Nuclear Science and

Technology Organisation. Around one hundred international and Australian experts discussed ways to mitigate the impact on nuclear explosion monitoring of radioxenon released from civil activities, even where such releases are well below regulatory limits.

During the reporting period, five Australian experts participated in international workshops in support of CTBT verification and two Australians participated in CTBTO training activities in relation to their function as operators of IMS stations. ANSTO's Alison Flynn is participating in regular events as part of a three-year program to train future specialists to conduct OSI under the CTBT. ASNO coordinates the involvement of Australians in this training. While around 90 per cent of CTBT IMS stations are now in place worldwide, detailed preparatory work is continuing to bring the IMS and International Data Centre to a good level of readiness. ASNO coordinates Australia's contribution to the CTBTO's work in this area, working with technical specialists from Geoscience Australia and ARPANSA.

Australia's 21st and final International Monitoring System Station, the Davis Infrasound Array in the Australian Antarctic Territory. Photo courtesy of the Official CTBTO Photostream



One of the four detectors at the Davis Infrasound Array, Australian Antarctic Territory. Photo courtesy of the Official CTBTO photostream

Outreach

A fundamental requirement for an effective CTBT will be the ability of States Parties to form sound technical judgements about the nature of events detected by the IMS. Australia continues to work with and alongside the CTBTO to promote relevant technical capacity in the National Data Centres of signatory states.

In November 2018, ARPANSA, DFAT worked with the CTBTO to host a workshop on the CTBT for states of the South Pacific.

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).
- Support other developments in the field of non-proliferation and disarmament that are relevant to Australia's interests, such as contribute to the 2019 Preparatory Committee for the 2020 Review Conference of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT).

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. An effectively 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. In July 2018, the report of the Expert Preparatory Group (EPG) for an FMCT was released. DG ASNO led Australia's contribution to a successful outcome of the process that led to the report. The EPG report builds on the report of the 2014–15 Group of Governmental Experts on an FMCT, in which Australia participated. Together, these reports lay out detailed proposals and options for a future FMCT and address related pros and cons. The consensus EPG outcome provides a practical compendium of possible treaty elements for when negotiations on a treaty may start.

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. This included support for the active engagement by Australia's mission in Geneva

in a 2018 subsidiary body of the CD that sought to establish common views on the shape of an FMCT.

International Partnership for Nuclear Disarmament Verifications (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. During the year, ASNO with DFAT and ANSTO continued Australia's active contribution to IPNDV's second two-year work phase.

The dismantlement of nuclear weapons could be part of either an incremental process of reductions or of a process to eliminate some or all nuclear weapons. IPNDV's Working Group 5 (co-chaired by DG ASNO) has analysed and described the essential features of multilateral inspections to verify each of the 14 steps of nuclear weapon dismantlement, beginning with monitoring the removal of weapons from delivery systems and ending with the recycling of nuclear material from the weapons for civilian use, or its disposal in proliferation-resistant forms. The group has focused on preparing a detailed description of inspection methodologies, and of the technologies required to support them. The group also examined a number of options for the disposition of sensitive nuclear material arising from the dismantlement of nuclear explosive devices and how processes leading to non-weapons uses, or disposal, could be verified.

In the current work phase, IPNDV's Working Group 4 is undertaking an examination of approaches for verifying declarations a state may make about its nuclear weapons as a precursor to their potential dismantlement. IPNDV's Working Group 6 continue to examine technology requirements to support the work of IPNDV. Australian experts contribute to all three working groups.

Because developing new monitoring and verification technologies and mechanisms will require sustained resources and commitment, the work initiated by the International Partnership will be a long-term effort.

Dr Floyd at the International Partnership on Nuclear Disarmament Verification (IPNDV) Joint Working Group Meeting in Helsinki, March 2019. Photo courtesy of the IPNDV

Preparatory Committee for the 2020 Review Conference for the NPT (NPT PrepCom)

In May 2019, Dr John Kalish Assistant Secretary ASNO moderated a side-event on *The Additional Protocol (AP) as the Safeguards Standard* during the 2019 Preparatory Committee for the 2020 Review Conference of the NPT in New York. The panel discussion covered why states should adhere to the AP and what support was available to help states bring it into force and implement it. Strong IAEA safeguards are a cornerstone of the NPT and the AP is the basis for providing assurances that all nuclear material in the state is under safeguards to verify its peaceful use, in accordance with the NPT.

Dr John Kalish Assistant Secretary ASNO chaired a side-event *The Additional Protocol as the Safeguards Standard* during the NPT Preparatory Committee Meeting at the United Nations, New York, May 2019

Dr John Kalish Assistant Secretary ASNO and other members of the Australian delegation to the NPT Preparatory Committee Meeting met with students from the Nagasaki Youth Delegation of the Nagasaki Council for Nuclear Weapons Abolition at the United Nations, New York, May 2019

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 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, Innovation and Science 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, Innovation and Science's National Radioactive Waste Management Facility detailed business case; licensing process; design of a waste information management system; and, safeguards by design support to the work of ANSTO on the detailed engineering design for the facility.[22]

ASNO also works closely with ARPANSA on best practices for the security of nuclear material, including:

- Spent fuel management
- Periodic Safety and Security Review
- an Emergency Exercise, 'Hail Caesium', run by ARPANSA and the Department of Health and involving multiple government agencies, designed to test arrangements in response to various radiological accident scenarios,
- the Conference on Protective Security in Government, and
- the IAEA's Integrated Regulatory Review Service mission to support ARPANSA's ongoing implementation of international best practice for nuclear and radiation safety and security

ASNO contributed technical advice on the implementation of IAEA safeguards in Iran for the Review of the Joint Comprehensive Plan of Action (JCPOA) led by the Department of Prime Minister and Cabinet.

ASNO has also provided advice to the Government in relation to the DPRK's discussions with the United States on denuclearisation, including on how Australia might support international efforts to verify any new commitments. ASNO coordinates technical activities in Australia monitoring nuclear testing by the DPRK, or others.

22 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.

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.

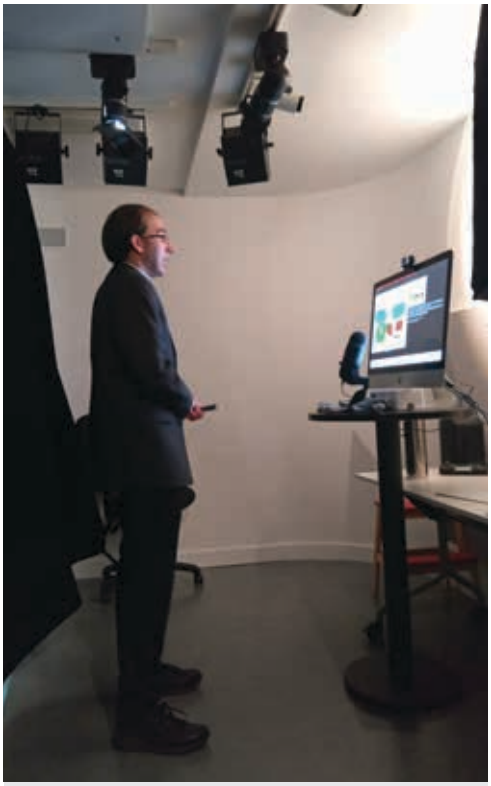
PERFORMANCE ASSESSMENT

ASNO works to ensure Australia's WMD non-proliferation objectives are understood in the public, private, non-government and academic sectors, through presentations, training and other outreach activities. For example, over 2018–19 ASNO has attended peak industry forums, conducted on-site outreach visits, and given lectures and presentations in academic and other fora. In 2018–19, ASNO supported public information and outreach activities through attendance and discussions held at the:

- Minerals Council of Australia
- The Australasian Institute of Mining and Metallurgy (AusIMM) Conference.

ASNO delivered modules on safeguards for the online Master of Nuclear Engineering course ENGG9744 Nuclear Safety, Security and Safeguards at the University of New South Wales (UNSW).

During 2015–2018, ASNO established a number of new 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 template permits and compliance codes publicly available online.[23]



ASNO Safeguards Officer preparing e-learning modules for the UNSW course Nuclear Safety, Security and Safeguards.

23 Available at https://dfat.gov.au/international-relations/security/asno/Pages/template-permits-and-compliance-codes.aspx.

SECTION 5

OUTPUT 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 was reappointed as the Director General ASNO on 6 December 2015 for a period of five years.

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 has a small core of staff whose day-to-day activities are overseen by the Director General. ASNO staff are employed under the *Public Service Act 1999* as a division within the Department of Foreign Affairs and Trade (DFAT). ASNO staff, other than the Director General, are also employed under the DFAT Enterprise Agreement. Further details can be found in Table 18 and the DFAT Annual Report 2018–19.

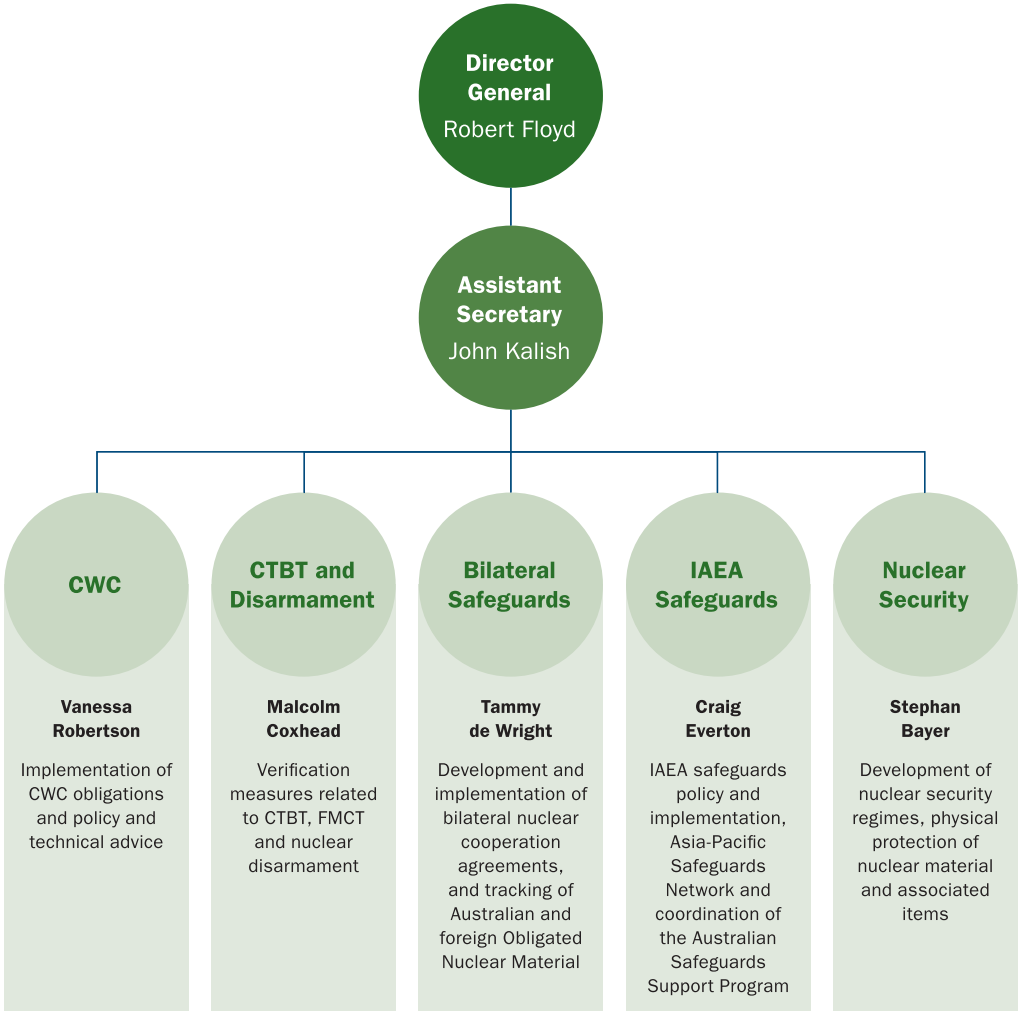
In 2018–19 ASNO had an allocated staff level of 18 FTE.

ASNO's organisational structure is closely aligned with the outputs and can be found in Figure 5.

Table 18: **ASNO Staff at 30 June 2019**

	MALE	FEMALE	TOTAL
SES B2	1	0	**1**
SES B1	1	0	**1**
Executive Level 2	3	2	**5**
Executive Level 1	2	3	**5**
APS Level 6	2	2	**4**
APS Level 5		2	**2**
APS Level 4			**0**
TOTAL	**9**	**9**	**18**

Figure 5: **ASNO's Organisational Structure at 30 June 2019**



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 19.

Table 19: **Training and Development Activities during 2018–19**

TRAINING AND DEVELOPMENT ACTIVITY	PERSON DAYS
Formal DFAT courses	22
Structured work unit and on-the-job training, including planning days	20
Seminars, workshops, conferences, overseas negotiations and IDCs	40
External formal courses	5
Academic study	0
Other (IAEA Consultancy)	0
TOTAL	**87**

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

Table 20: **ASNO Administrative Costs**

		2017–18	2018–19
Salaries		2 209 755	2 683 352
Running Costs	General	676 094	521 892
	Seismic monitoring[1]	566 513	564 247
	Sub-Total	1 242 607	1 086 139
TOTAL		**$3 452 362**	**$3 769 491**

1 Undertaken by Geoscience Australia.

REGULATORY REFORM

As a portfolio regulator with the Department of Foreign Affairs and Trade, in 2018–19 ASNO completed its fourth year of participation in the Government's Regulator Performance Framework. The Government developed the Framework to measure the performance of regulators in regard to reducing the cost to business. The goal of the program is to measure and report performance that will give business, the community and individuals confidence that regulators effectively and flexibly manage risk.

The Framework consists of six mandatory outcome-based key performance indicators (KPIs) covering the reduction in regulatory burden, communications, risk-based and proportionate approaches, efficient and coordinated monitoring, transparency, and continuous improvement. ASNO has devised a set of seven metrics against the six KPIs outlined in Table 21 below.

Table 21: **ASNO Regulatory Performance Framework Metrics 2018–19**

Timely processing of permit applications and approvals.
Regulations and permits 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.

ASNO has continued to collect against our metrics for the processing time for completed permit applications and approvals, as can be seen in Table 22. The timeframe benchmark for approvals corresponds to the number of days required by ASNO to process a permit application and before an activity can occur. These timeframes are required to ensure ASNO is able to meet its onward reporting obligations to the IAEA, OPCW or international counterparts. ASNO encourages permit holders to submit their applications as early as practical, in case any unforeseen complications occur. However, when needed, ASNO works with regulated entities and other federal regulators to expedite matters to facilitate their operations as much as possible, while still ensuring Australia meets its domestic and international obligations.

The diverse nature of the organisations applying for nuclear or chemical permits makes it difficult to compare approval times from one reporting period to the next, as some permit applications will require complex analysis. However, in general, processing times were comparable to the previous year.

Table 22: **Processing of permits and approvals July 2018 – June 2019**

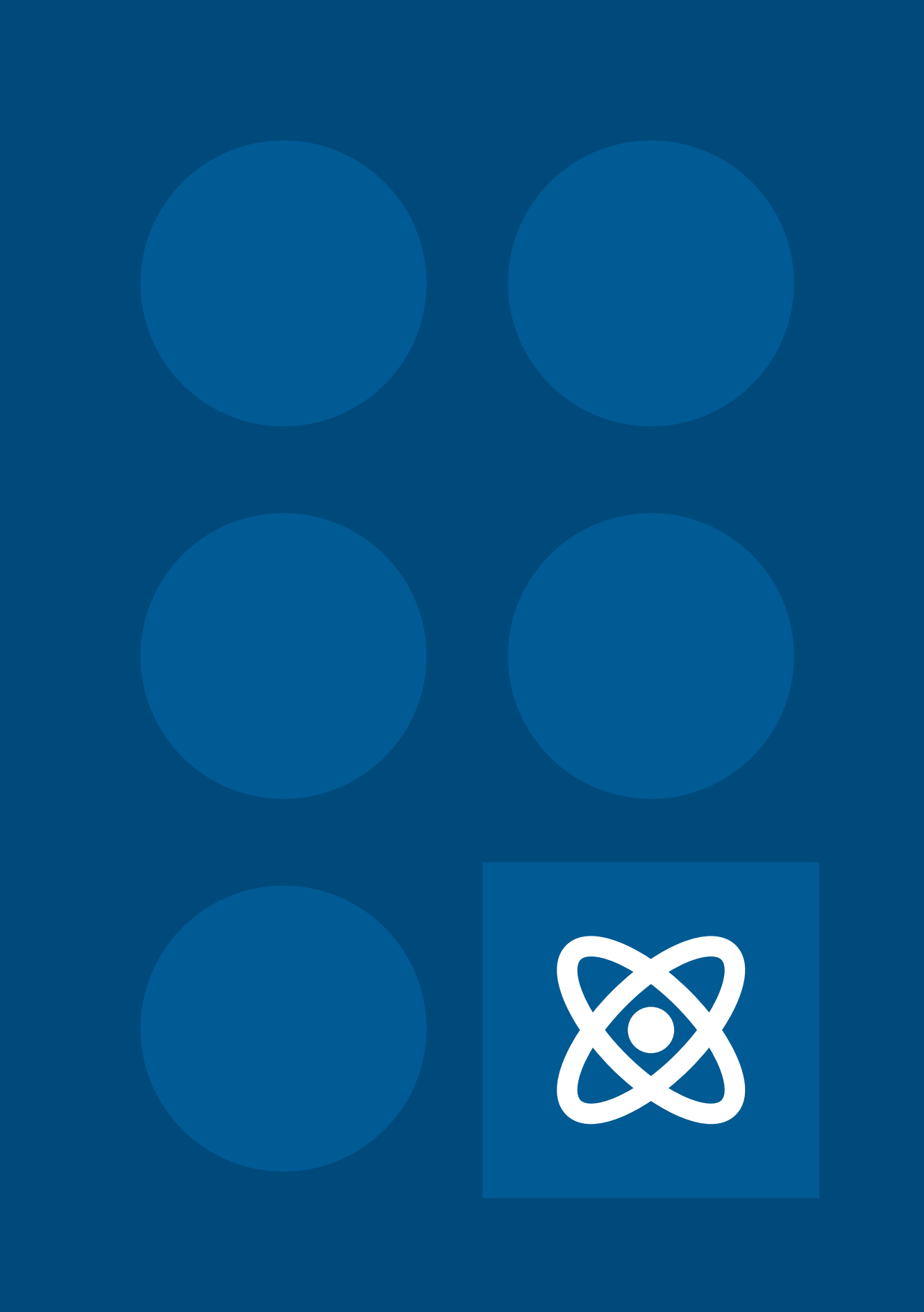
PROCESSING OF PERMITS AND APPROVALS JULY 2018 – JUNE 2019	
Number of nuclear permit applications processed[2]	31
Average number of calendar days	20.7 days
Per cent of permits issued within 21 days of final application	84%
Number of chemical import permit applications processed[3]	66
Average number of calendar days	5.3 days
Per cent of import permits issued within 7 days of final application	80%
Number of chemical facility permit applications processed[4]	2
Average number of calendar days	3 days
Per cent of facility permits issued within 21 days of final application	100%
Number of approved applications to transport UOC internationally	73
Average number of days	2.3
Per cent of approvals issued within 7 calendar days of final application	95%

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).

2 Includes granting new permits and permit variations. It does not include three permits that expired (and not renewed) and one permit that was revoked (without prejudice) during the reporting period.
3 Includes new, renewed and varied permits. In the 2017–18, this included 10 new and varied permits and only noted the renewal of about 50 permits.
4 This does not include regulated chemical facilities that do not need a facility permits but are required to notify ASNO of the production of certain chemicals. The OPCW may nominate to inspect such a facility.

Beverley and Four Mile uranium mines (Heathgate Resources)



SECTION 6

APPENDICES

APPENDIX A: AUSTRALIA'S NUCLEAR COOPERATION AGREEMENTS

Table 23: **Australia's Nuclear Cooperation Agreements at 30 June 2019**

COUNTRY	ENTRY INTO FORCE
Republic of Korea	2 May 1979
United Kingdom	24 July 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
United States	22 December 2010

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

COUNTRY	ENTRY INTO FORCE
Euratom[2]	1 January 2012
United Arab Emirates	14 April 2014
India	13 November 2015
Ukraine	15 June 2017

Note: The above list does not include Australia's NPT safeguards Agreement with the IAEA, 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 also 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 atomic energy agency of the European Union. The Euratom agreement covers all 28 member states of the European Union.

APPENDIX B: IAEA STATEMENTS OF CONCLUSIONS AND OTHER INSPECTION FINDINGS FOR AUSTRALIA IN 2018–19

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 three 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 the OPAL reactor (AS-F), ANSTO's R&D laboratories (AS-C), and ANSTO's storage areas (AS-D). PIVs for each MBA are scheduled together each year so the IAEA can complete all with one visit to Australia. In total these usually take five days to complete in conjunction with design information verification (DIV) (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. The first PIV for AS-I occurred in May 2019.
- **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):** inspection to verify the correctness and completeness of the design features of a facility relevant to the application of safeguards. The IAEA typically conducts a few DIVs together with 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: assuring the absence of undeclared nuclear material or activities in Australia (Article 4.a.i); resolving any questions or inconsistencies related to the correctness and completeness of Australia's declarations under the Additional Protocol (Article 4.a.ii); or, confirming the decommissioned status of a facility (Article 4.a.iii). The IAEA has

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.

conducted a total of 76 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, but given the considerable distances in Australia these 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 2018 (see Appendix C) for all States with safeguards agreements with the IAEA, including Australia; 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 2018. Australia was the first country to receive the 'broader conclusion' in 2000 and has received it every year since.

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).[7]
- **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.[8]
- 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
- **Article 10.c** of the Additional Protocol: Statement on the conclusions the IAEA has drawn from complementary access activities.

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.

8 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.

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 2018	ANSTO	"Based on the activities conducted and the information available to date in connection with such activities, the results of the DIV were satisfactory"	10 July 2018

Material balance area: AS-C (research and development laboratories)
Material balance period: 6 April 2017–1 May 2018

Inspection activity	Date(s) of inspection	Inspection location	Statement of results	Date statement provided
Design Information Verification and scheduled environmental sampling	3–5 October 2017	ANSTO	"Based on the activities conducted and the information available to date in connection with such activities, the results of the DIV were satisfactory"	19 February 2018
Physical Inventory Verification	2–3 May 2018	ANSTO	"Based on the activities conducted and the information available to date in connection with such activities, the results of this inspection were satisfactory"	15 August 2018
Design Information Verification	2–3 May 2018	ANSTO	"Based on the activities conducted and the information available to date in connection with such activities, the results of the DIV were satisfactory"	15 August 2018
91(b) Statement of Conclusions (27 February 2019)			"The IAEA has concluded from its verification activities carried out at AS-C during the material balance period from 6 April 2017 to 1 May 2018, 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-C (research and development laboratories)
Material balance period: 2 May 2018–7 May 2019

Inspection activity	Date(s) of inspection	Inspection location	Statement of results	Date statement provided
Physical Inventory Verification	8–9 May 2019	ANSTO	"Based on the activities conducted and the information available to date in connection with such activities, the results of this inspection were satisfactory"	18 July 2019
Design Information Verification	8–9 May 2019	ANSTO	"Based on the activities conducted and the information available to date in connection with such activities, the results of the DIV were satisfactory"	18 July 2019
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: 3 April 2017–3 May 2018

Inspection activity	Date(s) of inspection	Inspection location	Statement of results	Date statement provided
Physical Inventory Verification	4 May 2018	ANSTO	"Based on the activities conducted and the information available to date in connection with such activities, the results of this inspection were satisfactory"	1 August 2018
Design Information Verification	4 May 2018	ANSTO	"Based on the activities conducted and the information available to date in connection with such activities, the results of the DIV were satisfactory"	1 August 2018
91(b) Statement of Conclusions (1 February 2019)	"The IAEA has concluded from its verification activities carried out at AS-D during the material balance period from 3 April 2017 to 3 May 2018, 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: 4 May 2018–5 May 2019

Inspection activity	Date(s) of inspection	Inspection location	Statement of results	Date statement provided
Physical Inventory Verification	6 May 2019	ANSTO	"Based on the activities conducted and the information available to date in connection with such activities, the results of this inspection were satisfactory"	2 August 2018
Design Information Verification	6 May 2019	ANSTO	"Based on the activities conducted and the information available to date in connection with such activities, the results of the DIV were satisfactory"	2 August 2018
91(b) Statement of Conclusions		Not available at time of publication of this Annual Report		

Material balance area: AS-E and ASE1 (other locations)
Material balance period: 1 July 2013 – 30 June 2017

Inspection activity	Date(s) of inspection	Inspection location	Statement of results	Date statement provided
Physical Inventory Verification	26 April 2018	Monash University	"Based on the activities conducted and the information available to date in connection with such activities, the results from this inspection were satisfactory"	1 August 2018
91(b) Statement of Conclusions (27 February 2019)		"The IAEA has concluded from its verification activities carried out at AS-E during the material balance period from 1 July 2013 to 30 June 2017, 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. However, the State reports ICR 414, PIL 416–431, MBR 432 and ICR 434 were not dispatched to the Agency within the timing specified by the Facility Attachment." "The IAEA has concluded from its verification activities carried out at ASE1 during the material balance period from 1 July 2013 to 30 June 2017, 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: 4 April 2017–30 April 2018

Inspection activity	Date(s) of inspection	Inspection location	Statement of results	Date statement provided
Short Notice Random Inspection	12–13 September 2017	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 December 2017
Physical Inventory Verification	1 May 2018	ANSTO	"Based on the activities conducted and the information available to date in connection with such activities, the results of this inspection were satisfactory"	16 August 2018
Design Information Verification	1 May 2018	ANSTO	"Based on the activities conducted and the information available to date in connection with such activities, the results of the DIV were satisfactory"	16 August 2018
91(b) Statement of Conclusions (1 February 2019)			"The IAEA has concluded from its verification activities carried out at AS-F during the material balance period from 4 April 2017 to 30 April 2018, 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: 1 May 2018–6 May 2019

Inspection activity	Date(s) of inspection	Inspection location	Statement of results	Date statement provided
Short Notice Random Inspection	9–10 October 2018	ANSTO	"Based on the activities conducted and the information available to date in connection with such activities, the results from this inspection were satisfactory"	1 February 2019
Physical Inventory Verification	7 May 2019	ANSTO	"Based on the activities conducted and the information available to date in connection with such activities, the results of this inspection were satisfactory"	2 August 2018
Design Information Verification	7 May 2019	ANSTO	"Based on the activities conducted and the information available to date in connection with such activities, the results of the DIV were satisfactory"	2 August 2018
91(b) Statement of Conclusions		Not available at time of publication of this Annual Report		

Material balance area: AS-I (CSIRO)
Material balance period: 28 February 2018–30 June 2018

Inspection activity	Date(s) of inspection	Inspection location	Statement of results	Date statement provided
Physical Inventory Verification	3 May 2019	CSIRO – Black Mountain, ACT	91(a) Statement not available at time of publication of this Annual Report	
91(b) Statement of Conclusions		Not available at time of publication of this Annual Report		

Additional Protocol Assessment Period: 1 January 2018–31 December 2018

Date of Complementary Access (CA)	Location	10(a) Statement of activities	Date statement provided
27 April 2018	CSIRO – Clayton, VIC	"The IAEA was able to carry out all planned activities during the CA"	28 August 2018
9 October 2018	Lucas Heights Science and Technology Centre: Buildings 3 and 20B.	"The IAEA was able to carry out all planned activities during the CA"	10 January 2019
11 October 2018	Lucas Heights Science and Technology Centre: Buildings 54, 80 and 88.	"The IAEA was able to carry out all planned activities during the CA"	28 January 2019
10(c) Statement of Conclusions (20 March 2019)	"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: • PN210 – CSIRO Minerals • LHSTC – Lucas Heights Science and Technology Centre* Note that conclusions marked with a star (*) are pending the results and evaluation of environmental samples."		

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
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 2018 [i, ii]

In 2018, safeguards were applied for 182 States[iii, iv] with safeguards agreements in force with the Agency. The Secretariat's findings and conclusions for 2018 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 twenty-nine States had both comprehensive safeguards agreements and additional protocols in force[v]:
   a. For 70 of these States[iv], 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 45 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 2018, 11 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.
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.

i 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.

ii 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.

iii 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.

iv And Taiwan, China.

v Or an additional protocol being provisionally applied, pending its entry into force.

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 diversion 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.

This statement plus further details on safeguards implementation is available at: https://www.iaea.org/sites/default/files/19/06/statement-sir-2018.pdf. This statement is copied verbatim from the IAEA's publication, including footnotes.

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 http://www.dfat.gov.au/foi/ips.html.

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. These include:

Kalman Robertson, Nuclear Non-Proliferation and Safeguards, University of New South Wales School of Electrical Engineering and Telecommunications course on Nuclear Safety, Security and Safeguards, 12–13 July 2018 and 15 March 2019, Sydney, Australia.

Jenna Parker, Bilateral Safeguards and Australia's Uranium Export Policy, presentation for Australian National University course, Nuclear Fundamentals, 18 October 2018, Canberra, Australia.

Malcolm Coxhead, Perspectives on on-site inspection in different environments, CTBTO OSI Workshop–24, November 2018, Southampton, United Kingdom.

Noriko Sumino (JAEA), Kalman Robertson, APSN Surveys for the Coordination of Training Efforts in Asia: Results and Challenges, Symposium on International Safeguards, 6 November 2018, Vienna, Austria.

Jasmin Diab (UNSW), Rebecca Stohr, Using Machine Learning and Natural Language Processing to Enhance Uranium Mining and Milling Safeguards, Symposium on International Safeguards, 6 November 2018, Vienna, Austria.

Rebecca Stohr, Craig Everton, Kalman Robertson, Safeguards by Design for Storage and Disposal of Nuclear Waste, Symposium on International Safeguards, 6 November 2018, Vienna, Austria.

Craig Everton, Rebecca Stohr, Kalman Robertson, Numbat: Lessons Learnt from Australia's Database Development, Symposium on International Safeguards, 6–7 November 2018, Vienna, Austria.

Kalman Robertson et al, The IAEA Robotics Challenge – Demonstrating Robots for Safeguards Inspections, Symposium on International Safeguards, 7 November 2018, Vienna, Austria.

Lyndell Evans et al, LOF Management in Australia, Symposium on International Safeguards, 7 November 2018, Vienna, Austria.

Rob Floyd et al, Australia's Experience with Engaging Researchers outside the Traditional Safeguards Community, Symposium on International Safeguards, 7 November 2018 Vienna, Austria.

Craig Everton, Kalman Robertson, Safeguards in a Nutshell, Australian National University Department of Nuclear Physics course on Nuclear Science and Its Applications, 4 April 2019, Canberra, Australia.

Julieanne Dougherty, Capacity Building Programs with Other International and Regional Organisations, 10 April 2019, Kuala Lumpur, Malaysia.

Julieanne Dougherty, National Measures to Control Toxic Chemicals of Security Concern, 10 April 2019, Kuala Lumpur, Malaysia.

Julieanne Dougherty, Non-state actors and chemicals of security concern, 3 June 2019, Paris, France.

Vanessa Robertson, Engagement with the Australian Chemical Industry, 25 June 2019, Ulaanbaatar, Mongolia.

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 model text of the Additional Protocol is set out in IAEA document INFCIRC/540.
ANSTO	Australian Nuclear Science and Technology Organisation
APSN	Asia-Pacific Safeguards Network
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
ASSP	Australian Safeguards Support Program
Australian Obligated Nuclear Material (AONM)	Australian uranium and nuclear material derived therefrom, which is subject to obligations pursuant to Australia's bilateral safeguards agreements.
BWC	Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction. Also known as the Biological Weapons Convention.
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.
CNSACs	Central Nervous System-Acting chemicals
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 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).
Conversion	Purification of uranium ore concentrates or recycled nuclear material and conversion to a chemical form suitable for isotopic enrichment or fuel fabrication.
CPPNM	Convention on the Physical Protection of Nuclear Material
CTBT	Comprehensive Nuclear-Test-Ban Treaty
CTBTO	Comprehensive Nuclear-Test-Ban Treaty Organization. The Vienna-based international organisation established at entry into force of the CTBT to ensure the implementation of its provisions.

TERM	DESCRIPTION
CWC	Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction. Also known as the Chemical Weapons Convention.
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).
CWPF	Chemical Weapon Production Facility
Depleted Uranium (DU)	Uranium with a ^{235}U content less than that found in nature (e.g. as a result of uranium enrichment processes).
DFAT	Department of Foreign Affairs and Trade
Direct-Use Material	Nuclear material defined for safeguards purposes as being usable for nuclear explosives without transmutation or further enrichment, e.g. plutonium, 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.
DPRK	Democratic People's Republic of Korea, also known as North Korea
DST Group	Defence Science and Technology Group
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 LEU fuel the proportion of ^{235}U (the enrichment level) is typically increased to between 3% and 5%.
Euratom	Atomic Energy Agency 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 and the United Kingdom.

TERM	DESCRIPTION
Facility	(For CWC purposes) a plant, plant site or production/ processing unit. (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.
FFM	Fact-Finding Mission
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 by a neutron. In a fission reaction, a neutron collides with a fissile nuclide (e.g. ^{235}U) that then splits, releasing energy and further neutrons. Some of these neutrons may 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.
GA	Geoscience Australia
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.
HIFAR	High Flux Australian Reactor. 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 enriched to over 90% ^{235}U.

TERM	DESCRIPTION
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.
IAEA	International Atomic Energy Agency
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.
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 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. 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 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 giving the data about events are made 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.
IPPAS	IAEA's International Physical Protection Advisory Service
International Partnership of Nuclear Disarmament Verification (IPNVD)	IPNDV is an ongoing initiative 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.
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. As the number of protons is the same, isotopes are different forms of the same chemical element.
JIM	The OPCW-UN Joint Investigative Mechanism
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 (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.
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.

TERM	DESCRIPTION
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.
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.
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	Treaty on the Non-Proliferation of Nuclear Weapons
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.
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 build nuclear database used to fulfil reporting requirements under Australia's safeguards agreement 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*.

TERM	DESCRIPTION
Old Chemical Weapons (OCW)	Defined under the Chemical Weapons Convention as: chemical weapons produced before 1925; or 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.
OPCW	Organisation for the Prohibition of Chemical Weapons
Other Chemical Production Facility (OCPF)	Defined under the Chemical Weapons Convention as all plant sites that: produced by synthesis during the previous calendar year more than 200 tonnes of unscheduled discrete organic chemicals; or 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).
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.
PTS	Provisional Technical Secretariat for the CTBTO Preparatory Commission
^{239}Pu	An isotope of plutonium with atomic mass 239 (94 protons and 145 neutrons). 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 will 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.

TERM	DESCRIPTION
Reprocessing	Processing of spent nuclear fuel to separate uranium and plutonium from highly radioactive fission products.
Safeguards Inspector	For domestic purposes, 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 Agency inspections and complementary access in Australia.
Seismic	Referring to the movements of the ground that can be generated by earthquakes, explosions etc. The seismic element of the CTBT monitoring system 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.
Special Fissionable Material	^{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.
TAV	Technical Assistance Visit
TWG	Temporary Working Group of the OPCW's Scientific Advisory Board
^{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.
UNSCR	United Nations Security Council Resolution

TERM	DESCRIPTION
Uranium ore concentrate (UOC)	A commercial product of a uranium mill 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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