The Auditor-General
Auditor-General Report No.26 2021–22
Performance Audit

The Australian Nuclear Science and Technology Organisation's Management of Nuclear Medicine Assets

Australian Nuclear Science and Technology Organisation

Australian National Audit Office

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Senior Executive Director
Corporate Management Group
Australian National Audit Office
GPO Box 707
Canberra ACT 2601

Or via email:
communication@anao.gov.au.

Australian National Audit Office

Canberra ACT

10 May 2022

Dear Mr President
Dear Mr Speaker

In accordance with the authority contained in the *Auditor-General Act 1997*, I have undertaken an independent performance audit in the Australian Nuclear Science and Technology Organisation. The report is titled *The Australian Nuclear Science and Technology Organisation's Management of Nuclear Medicine Assets.* Pursuant to Senate Standing Order 166 relating to the presentation of documents when the Senate is not sitting, I present the report of this audit to the Parliament.

Following its presentation and receipt, the report will be placed on the Australian National Audit Office's website — http://www.anao.gov.au.

Yours sincerely

Grant Hehir
Auditor-General

The Honourable the President of the Senate
The Honourable the Speaker of the House of Representatives
Parliament House
Canberra ACT

AUDITING FOR AUSTRALIA

The Auditor-General is head of the Australian National Audit Office (ANAO). The ANAO assists the Auditor-General to carry out his duties under the *Auditor-General Act 1997* to undertake performance audits, financial statement audits and assurance reviews of Commonwealth public sector bodies and to provide independent reports and advice for the Parliament, the Australian Government and the community. The aim is to improve Commonwealth public sector administration and accountability.

For further information contact:
Australian National Audit Office
GPO Box 707
Canberra ACT 2601

Phone: (02) 6203 7300
Email: ag1@anao.gov.au

Auditor-General reports and information about the ANAO are available on our website:
http://www.anao.gov.au

Audit team

Christine Chalmers
Irena Korenevski
David van Schoten
Ben Thomson
Carolyn Truong
Yoann Colin
Alex Wilkinson

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Audit snapshot

Auditor-General Report No.26 2021–22

The Australian Nuclear Science and Technology Organisation's Management of Nuclear Medicine Assets

Why did we do this audit?

- The objective of the audit was to assess the effectiveness of the Australian Nuclear Science and Technology Organisation's (ANSTO's) management of assets involved in the manufacture, production and distribution of nuclear medicines.
- ANSTO supplies the Australian health sector with nuclear medicines. Effective planning, use and disposal of assets is necessary to achieving agreed program delivery outcomes.

What did we find?

- ANSTO's management of nuclear medicine assets is partly effective.
- ANSTO's asset management framework is largely fit for purpose.
- Planning and implementation of asset acquisition and disposal is partly effective.
- Maintenance practices for the nuclear medicine assets are developing.
- ANSTO's measurement and monitoring of asset performance is partly effective.

Key facts

- ANSTO supplies approximately 75 to 80 per cent of Australia's nuclear medicines.
- ANSTO is the sole provider in Australia of Technetium 99m (Tc-99m), a radiopharmaceutical used in around 80 per cent of all diagnostic procedures.
- Nuclear medicine production mainly relies on three ANSTO facilities that were built between 1959 and 2018.
- The government has committed over $500 million to ANSTO to 2024–25 to fund operations, maintenance, waste management and decommissioning.

What did we recommend?

- The Auditor-General made six recommendations to ANSTO, aimed at improving ANSTO's asset management framework, asset disposal planning and practices, maintenance planning, and asset performance framework and measures.
- ANSTO agreed to all six recommendations.

$1.3bn

The value of ANSTO's non-financial assets at 30 June 2021.

12,500

The number of Tc-99m patient doses distributed weekly to Australians according to ANSTO.

68%

Average achievement of ANSTO's radiopharmaceutical dose target between 2015–16 and 2020–21.

Summary and recommendations

Background

1. The Australian Nuclear Science and Technology Organisation (ANSTO) was established as a corporate Commonwealth entity under the *Australian Nuclear Science and Technology Organisation Act 1987* (the Act). Section 5 of the Act identifies ANSTO's purpose and functions to include undertaking research and development; making available on a commercial basis its expertise, equipment and facilities; producing and selling nuclear radiation goods and services; and conditioning, managing and storing radioactive materials and radioactive waste.

2. The ANSTO Board (the Board) is the accountable authority for ANSTO under the *Public Governance, Performance and Accountability Act 2013*. The Minister for Industry, Science and Technology (the Minister) provides the Board with direction through a Statement of Expectations. The Board's Statement of Intent outlines how ANSTO proposes to meet the Minister's expectations. The current statements of expectation and intent require ANSTO to, among other activities, 'advance Government policy priorities through supporting the health of Australians with nuclear medicines…[and] manage research infrastructure and national facilities.'

Rationale for undertaking the audit

3. ANSTO supplies the Australian health sector with the radiopharmaceuticals used to diagnose heart disease, cancer and skeletal injuries. Disruptions to ANSTO's manufacture, production or distribution of radiopharmaceuticals result in risks to worker safety, ANSTO's financial sustainability and the security of domestic nuclear medicine supply.

4. At 30 June 2021 ANSTO's non-financial assets were valued at $1.3 billion. Effective planning, acquisition, use, maintenance and disposal of non-financial assets is necessary to achieving agreed program delivery outcomes. The audit was identified as a Parliamentary priority in 2020–21. The audit will provide assurance that ANSTO is effectively managing the principal assets involved in nuclear medicine production in Australia.

Audit objective and criteria

5. The audit examined the effectiveness of ANSTO's management of assets involved in the manufacture, production and distribution of nuclear medicines.

6. To form a conclusion against the audit objective, the following high-level criteria were adopted.

- Does ANSTO have a fit for purpose asset management framework?
- Has ANSTO effectively acquired and disposed of the assets used in nuclear medicine production?
- Has ANSTO effectively maintained the assets used in nuclear medicine production?
- Does ANSTO effectively measure, report on and monitor its asset performance?

Conclusion

7. ANSTO's management of assets involved in the manufacture, production and distribution of nuclear medicines is partly effective.

8. The framework for asset management is largely fit for purpose. There is need for an improved enterprise-level strategic approach to asset management in planning, training and information management.

9. ANSTO's management of acquisition and disposal of key nuclear medicine assets has been partly effective. There have been delays, cost overruns and failure to meet some deliverables and targets in two major nuclear medicine asset acquisition and disposal projects, and there has been a lack of planning and decision-making in relation to a third obsolete asset. Changes are being made to ANSTO's capital budgeting and planning processes.

10. ANSTO's management of nuclear medicine asset maintenance is progressing through the development of maintenance strategies and plans and with an increasing focus on proactive maintenance. Nuclear medicine asset management plans are largely fit for purpose. Maintenance planning maturity varies by facility and is not consistently monitored. Maintenance is often not timely. Although regulatory inspections and reviews address maintenance to some extent and there are key performance indicators, internal oversight of maintenance effectiveness through management system and internal audits could be expanded.

11. ANSTO's measurement and monitoring of asset performance is partly effective. There could be a greater focus on the nuclear medicine function in public performance reporting, and a more coherent and comprehensive asset performance framework at the enterprise level. Reporting to internal and external stakeholders is continuing to develop.

Supporting findings

Asset management framework

12. There is a largely fit for purpose asset management policy. The enterprise-level strategic asset management plan is not fit for purpose. There is a strategic asset management plan in place, however it does not substantively explain ANSTO's long term, strategic and enterprise-level approach to managing its physical assets. (See paragraphs 2.4 to 2.10)

13. ANSTO leadership and workplace culture largely facilitate effective asset management. ANSTO leadership has demonstrated a commitment to strategic asset management principles and there have been activities related to the establishment of an asset management framework since 2014. Although roles and responsibilities are clearly defined at an individual asset level, there could be greater clarity of accountability for strategic asset management at the enterprise level. There is a program of mandatory and role-related training which touches on aspects of asset management. There is no training on asset management as a discipline. (See paragraphs 2.13 to 2.27)

14. There is a largely appropriate asset information framework. The asset management system, which is based on System Applications and Products (SAP), is largely fit for purpose and represents a single source of truth about asset performance. Use of the system is developing. The

financial asset register is fit for the purpose of financial reporting. Neither the financial nor the operational asset registers, which are derived from SAP, contain information that would assist with asset performance monitoring. While there are procedures and guidelines for information management, there is no information or data strategy that identifies what information is needed to manage ANSTO's assets. (See paragraphs 2.28 to 2.39)

Asset acquisition and disposal

15. Capital management planning for nuclear medicine assets is developing. During 2021–22, new governance arrangements for capital management planning were implemented. It is too early to assess the effectiveness of these changes. While a fit for purpose business case for replacing the ageing Building 23 was undertaken in the context of the revised capital planning arrangements, there were lengthy delays in ANSTO commencing the planning process. (See paragraphs 3.2 to 3.13)

16. Based on an analysis of a recent nuclear medicine asset acquisition project — the SyMo project — asset acquisition is partly effective. Achievement of the project objectives was impacted by limitations in early planning and design, lack of contractual clarity and relatively late activation of contractual recourse mechanisms for the primary construction contractor. Risks were first identified in 2011 and were actively managed between 2019 and 2021 (the period examined by the ANAO). ANSTO's 2021 implementation plan for the SyMo project is largely fit for purpose. (See paragraphs 3.14 to 3.38)

17. Based on an analysis of two obsolete assets — Building 54 and the High Flux Australian Reactor (HIFAR) — asset disposal is partly effective. There is limited planning, decision-making and activity in relation to Building 54. HIFAR disposal planning for the latest decommissioning phase is largely fit for purpose. Not all key deliverables were achieved as planned. The disposal of HIFAR has been delayed, in part due to external factors. Expenditure on HIFAR disposal to date is higher than varied budgets. While HIFAR disposal risks are identified, they are not actively managed or reported. (See paragraphs 3.39 to 3.64)

Asset maintenance

18. Asset management plans for individual assets and supporting documentation are largely fit for purpose. Asset management plans could more comprehensively consider decommissioning and risk. Maintenance procedural documentation for the Open Pool Australian Lightwater (OPAL) reactor, Building 23 and the ANSTO Nuclear Medicine Molybdenum-99 (ANM) facility is comprehensive and mainly up to date. There is strategic maintenance planning based on Reliability Centred Maintenance principles; however, planning is at different levels of maturity across ANSTO nuclear medicine assets. Half of the maintenance plans relating to Building 23, the highest risk asset, are unreviewed (the lowest level of maintenance plan maturity) and none are optimised (the highest level). (See paragraphs 4.5 to 4.20)

19. An enterprise-level position on the appropriate ratio of proactive to corrective maintenance for different assets has not been established. The ratio is not monitored. The proactive to corrective maintenance ratio is increasing. (See paragraphs 4.21 to 4.28)

20. Based on a sample of completed work orders, ANSTO does not consistently meet its timeliness targets for maintenance. Work orders — including higher criticality work orders — are not

always completed on time and assigned priority timeframes are not consistently met. Measuring maintenance timeliness is difficult using available information in the maintenance information system, SAP. (See paragraphs 4.29 to 4.34)

21. ANSTO obtains partial assurance over maintenance practices. There are performance indicators to monitor maintenance performance. The regulator, the Australian Radiation Protection and Nuclear Safety Agency, periodically reviews maintenance practices as part of safety inspections. ANSTO management system and internal audit coverage of asset maintenance has been limited in the seven years to 2020–21 and there has been little specific consideration of the nuclear medicine assets. (See paragraphs 4.35 to 4.46)

Asset performance

22. There is no enterprise-level performance measurement strategy that establishes the necessary asset performance indicators and the required level of asset performance. Specific procedures for performance measurement are largely managed within each group or division independently of the others. Detailed frameworks linking performance metrics with ANSTO objectives and providing some methodological information exist for the OPAL reactor. They do not exist for the other nuclear medicine facilities. (See paragraphs 5.2 to 5.6)

23. ANSTO's nuclear medicine performance indicators are largely fit for purpose. A selection of eight key asset performance measures that are publicly reported are largely adequate. Public performance reporting does not sufficiently address ANSTO's nuclear medicine function. Although internal asset performance measures are well balanced, there is a lack of transparent information about methodology and targets. (See paragraphs 5.9 to 5.21)

24. Monitoring of asset performance information is partly adequate. ANSTO's internal audit program — a key assurance function — does not reflect the importance of nuclear medicine operations and asset management. ANSTO's incident reporting system has limitations that impact its usefulness in diagnosing and tracking operational issues. The system's existing data is underutilised. Reporting of asset performance information is largely adequate. The ANSTO Board regularly considers nuclear medicine asset performance and risks. Standing item discussion may lack the appropriate detail to inform the Board of risk and performance issues associated with specific assets. Prior to 2019, the government was not kept sufficiently informed about asset issues and risks. ANSTO's reporting to government has since developed. (See paragraphs 5.22 to 5.44)

Recommendations

Recommendation no. 1
Paragraph 2.11

The Australian Nuclear Science and Technology Organisation replace the current strategic asset management plan with a substantive enterprise-level plan that is reflective of the Australian Nuclear Science and Technology Organisation's unique operating environment, is risk-based, incorporates asset performance expectations and results, and is regularly reviewed.

Australian Nuclear Science and Technology Organisation response: *Agreed.*

Recommendation no. 2 Paragraph 3.46

The Australian Nuclear Science and Technology Organisation develop an asset management or disposal plan for Building 54.

Australian Nuclear Science and Technology Organisation response: *Agreed.*

Recommendation no. 3 Paragraph 3.65

The Australian Nuclear Science and Technology Organisation establish governance and risk management arrangements for the disposal of the High Flux Australian Reactor that are aligned with its February 2021 decommissioning plan.

Australian Nuclear Science and Technology Organisation response: *Agreed.*

Recommendation no. 4 Paragraph 4.18

Given its importance to the secure domestic supply of nuclear medicines until at least 2031, the Australian Nuclear Science and Technology Organisation prioritise the development and finalisation of maintenance strategies and plans for Building 23.

Australian Nuclear Science and Technology Organisation response: *Agreed.*

Recommendation no. 5 Paragraph 5.7

The Australian Nuclear Science and Technology Organisation establish an enterprise-level asset performance measurement framework that identifies asset performance requirements, metrics and methodology — which may vary by facility/platform depending on the asset's characteristics.

Australian Nuclear Science and Technology Organisation response: *Agreed.*

Recommendation no. 6 Paragraph 5.16

The Australian Nuclear Science and Technology Organisation amend its public performance measures to reflect the importance of nuclear medicine to the achievement of the Australian Nuclear Science and Technology Organisation's purpose. Public performance measures should be aligned to the requirements of section 16EA of the Public Governance, Performance and Accountability Rule 2014 and the 'clear read' principle.

Australian Nuclear Science and Technology Organisation response: *Agreed.*

Summary of entity response

25. The Australian Nuclear Science and Technology Organisation's summary response is provided below and its full response is included in Appendix 1.

The Australian Nuclear Science and Technology Organisation (ANSTO) acknowledges the findings contained in the audit report on assessing the effectiveness of ANSTO's management of nuclear medicine assets. ANSTO agrees with the findings in the audit report.

This audit and its outcomes have provided ANSTO with an opportunity to continue its improvement of the management and maintenance of our significant capital portfolio. As the operator of Australia's only nuclear reactor and supporting infrastructure that manufactures 75-80 per cent of Australia's nuclear medicine ANSTO understands the importance of effective management of those assets.

As part of this commitment and established culture of continued improvement, ANSTO has commenced planning to address each recommendation. The implementation of the actions will be monitored by our Risk and Audit Committee.

Key messages from this audit for all Australian Government entities

26. Below is a summary of key messages, including instances of good practice, which have been identified in this audit and may be relevant for the operations of other Australian Government entities.

Program design and program implementation

- To appropriately manage physical assets throughout the asset lifecycle, entities should prepare long-term plans that consider whole-of-life costs and strategies, including asset disposal, and that are updated regularly to reflect changes in the operating environment.
- For long term, complex and high value asset acquisition and disposal projects, entities should establish appropriate governance structures for project decision-making and oversight, set realistic milestones and budgets that include appropriate contingencies, and build identified risks into implementation planning.

Contract management

- The achievement of asset project objectives is supported by establishing contracts that have clear milestones and deliverables, assigning appropriately trained and experienced contract management staff, monitoring contractor progress, and using contract recourse mechanisms to manage underperformance.

Performance and impact measurement

- Strategic physical asset management should include developing, measuring and monitoring asset performance indicators that are aligned to program objectives.

Audit findings

1. Background

Introduction

1.1 The Australian Nuclear Science and Technology Organisation (ANSTO) was established as a corporate Commonwealth entity under the *Australian Nuclear Science and Technology Organisation Act 1987* (the Act). Section 5 of the Act identifies ANSTO's purpose and functions to include undertaking research and development; making available on a commercial basis its expertise, equipment and facilities; producing and selling nuclear radiation goods and services; and conditioning, managing and storing radioactive materials and radioactive waste.

1.2 The ANSTO Board is the accountable authority under the *Public Governance, Performance and Accountability Act 2013*. The Minister for Industry, Science and Technology provides the Board with direction through a Statement of Expectations. The Board's Statement of Intent shows how ANSTO will meet the Minister's expectations. The current statements require ANSTO to 'advance Government policy priorities through supporting the health of Australians with nuclear medicines…[and] manage research infrastructure and national facilities.'[1] Nuclear medicines have been included in the Australian Government's list of critical technologies in the national interest.[2]

1.3 ANSTO operates across two campuses in New South Wales (NSW) and Victoria. Lucas Heights NSW is the administrative centre and houses nuclear medicine production and distribution facilities, operational and non-operational nuclear reactors and other facilities.[3] ANSTO comprises eight groups including the Nuclear Operations and Nuclear Medicine Group and the Nuclear Science and Technology Group. At 30 June 2021 ANSTO's average staffing level was 1352.

1.4 Some of ANSTO's activities are regulated by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA). The effectiveness of ARPANSA's regulation of Australian Government radiation and nuclear activities was considered in two Auditor-General reports.[4]

Radioisotope and nuclear medicine production

1.5 ANSTO supplies approximately 75 to 80 per cent of Australia's nuclear medicines. It is the sole provider in Australia of Technetium-99m (Tc-99m) and sells about 20 products to 145 domestic and international customers. In 2020–21 ANSTO received $34.7 million in revenue from health product sales, primarily Tc-99m generators. The two main products are described below.

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1 ANSTO, *Governance* [Internet], ANSTO, available from https://www.ansto.gov.au/about/governance [accessed 14 November 2021]. The Australian and New Zealand Society of Nuclear Medicine describes nuclear medicine as a branch of medical imaging that uses radiopharmaceuticals to generate images that are used to diagnose or treat human disorders; some radioisotopes may also be used to treat disease or pain. Radiopharmaceuticals combine radioactive material (radioisotopes) to medicines.

2 Department of the Prime Minister and Cabinet, *List of critical technologies in the national interest* [Internet], PM&C, 2021, available from https://www.pmc.gov.au/resource-centre/domestic-policy/list-critical-technologies-national-interest [accessed 28 February 2022].

3 ANSTO ceased operations of the National Research Cyclotron Facility at Camperdown NSW in 2021.

4 Auditor-General Report No.29 2013–14 *Regulation of Commonwealth Radiation and Nuclear Activities;* Auditor-General Report No.30 2004–05 *Regulation of Commonwealth Radiation and Nuclear Activities.*

- Molybdenum-99 (Mo-99) — Mo-99 is the most widely used radioisotope in diagnostic nuclear medicine. It is produced in several facilities around the world, including ANSTO. ANSTO Nuclear Medicine Pty Ltd is the most significant of ANSTO's three subsidiaries and is responsible for producing and distributing Mo-99.
- Tc-99m — Considered ANSTO's most significant medicine, Tc-99m is formed by the decay of Mo-99 in radionuclide generators.[5] Used mainly for imaging of organs and soft tissues, it is distributed to domestic nuclear medicine practitioners. Around 80 per cent of all diagnostic procedures use Tc-99m. ANSTO reports that about 12,500 patient doses of Tc-99m are distributed weekly. ANSTO Health is the commercial unit responsible for radiopharmaceuticals.

ANSTO's non-financial assets

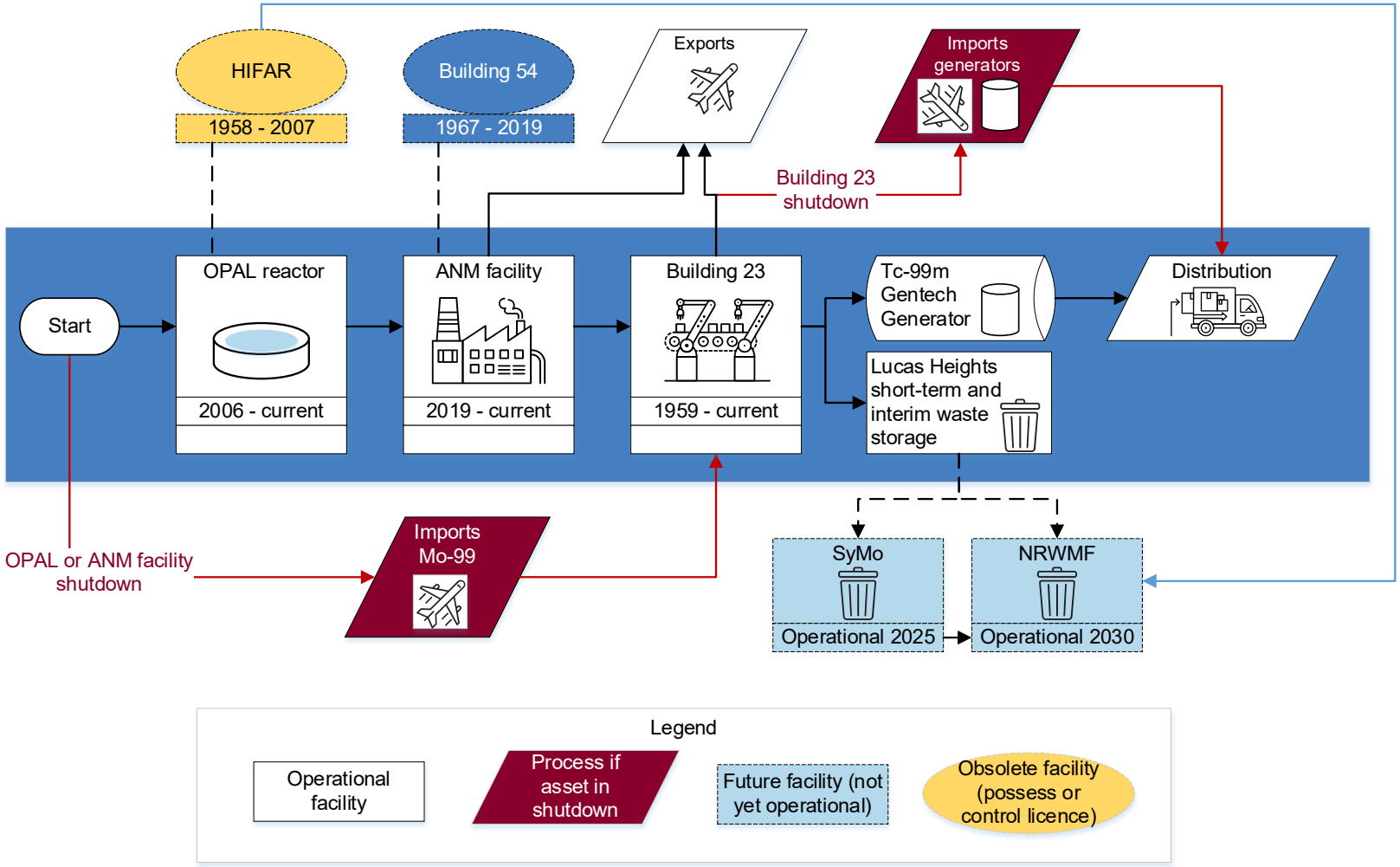
1.6 Non-financial assets — such as plant, equipment, infrastructure, land, buildings and inventory — are held to support program delivery. Non-financial assets are essential to ANSTO's purpose. At 30 June 2021 ANSTO assets were valued at $1.6 billion, of which non-financial assets comprised 85 per cent.

1.7 Australia is one of a small number of countries with capability across all stages of the value chain in nuclear medicine (refer Figure 1.1).[6]

5 A generator is a device that provides a local supply of a short-lived radioactive substance from the decay of a longer-lived parent radioisotope.

6 Other countries are Argentina, the Netherlands, Russia and South Africa. China also has the capability but currently imports Mo-99.

Figure 1.1: Australian Mo-99 and Tc-99m supply chain



Note: NRWMF refers to the National Radioactive Waste Management Facility, HIFAR refers to High Flux Australian Reactor, OPAL refers to the Open Pool Australian Lightwater reactor and ANM facility refers to ANSTO Nuclear Medicine Molybdenum-99 facility. A 'possess or control' licence is a type of facility licence issued by ARPANSA that is most commonly issued for a prolonged period (usually years) of safe enclosure between periods of routine operations or leading to decommissioning of a facility. It is usually characterised by a period of minimal activity.

Source: ANAO analysis of ANSTO documentation.

1.8 The key ANSTO assets currently or previously involved in radioisotope and nuclear medicine production are described below.

- Open Pool Australian Lightwater (OPAL) reactor — OPAL is a 20-megawatt multi-purpose nuclear reactor that uses low enriched uranium fuel to conduct a range of activities including the irradiation of target materials to produce radioisotopes; irradiation of silicon ingots for use in electronic semiconductor manufacture; and the support of research. At February 2022 OPAL was the world's newest multi-purpose reactor facility.
- High Flux Australian Reactor (HIFAR) — HIFAR was Australia's first nuclear reactor, commencing operation in 1958 and permanently shut down in 2007.
- Building 54 — Building 54 was built in 1967 and operated until 2019. From 1980, its role was to extract Mo-99 from fresh uranium fission products irradiated in HIFAR and OPAL. Some equipment relating to Mo-99 manufacturing reached the end of its design life in 2017. ANSTO advised the ANAO that design life likely could be extended with some engineering inputs.
- ANSTO Nuclear Medicine Molybdenum-99 (ANM) facility — In 2012 the Australian Government approved $169 million to fund the construction of a new Mo-99 radioisotope production facility and associated waste processing facility. The facility began operations in 2018–19, initially operating in tandem with and then fully replacing Building 54. The transition to the ANM facility for Mo-99 production was intended to double ANSTO's capacity to meet global medical market demand. The ANM facility is owned by ANSTO Nuclear Medicine Pty Ltd.
- Building 23 — Building 23 was constructed in 1959 for the purpose of radioactive product manufacture and was extended to suit isotope handling, and radiopharmaceutical and radiochemical production, in 1972. In relation to the Mo-99 and Tc-99m supply chain, after extraction and initial processing, bulk Mo-99 is transported to Building 23 for further processing, and production and distribution of Tc-99m generators.
- SyMo facility — Under construction at February 2022 and with a projected operational date of March 2025, SyMo is a purpose built facility to apply ANSTO proprietary 'Synroc' technology for immobilisation of waste from ANSTO's Mo-99 production processes in the ANM facility.[7]

1.9 Mo-99 is produced and Tc-99m generators are manufactured and distributed using a 'just in time' process due to the radioisotopes' short half-life.[8] Shutdowns in OPAL, the ANM facility or Building 23 may require imports of bulk Mo-99 or Tc-99m generators to meet domestic requirements for Tc-99m.

1.10 ANSTO's Nuclear Science and Technology (NST) Group manages research platforms including the Australian Centre for Neutron Scattering (ACNS), the Centre for Accelerator Science

7 Synroc is a waste encapsulation process that can treat a range of radioactive waste. The technology has been in development since 1978–79.

8 The radioactive decay process for a radioisotope is measured with a time period called a 'half-life'. A half-life is the interval of time it takes for half of the radioactive atoms of a specific radionuclide to decay. Mo-99 has a half-life of 66 hours and decays to Tc-99m. Tc-99m has a shorter half-life of six hours.

(CAS), the National Deuteration Facility (NDF) and the Australian Synchrotron.[9] ACNS, CAS and NDF are supported in part through grants administered by the Australian Department of Education, Skills and Employment under the National Collaborative Research Infrastructure for Australia Strategy (NCRIS).[10]

Incidents and reviews

1.11 Since 2017 there have been safety, mechanical or quality failures in Mo-99 production and Tc-99m generator manufacture. Safety incidents included a serious radiation contamination incident in Building 23 (August 2017), a finding of non-compliance with health procedures (March 2018), failure to obtain ARPANSA approval for a process change with safety implications (May 2018), a radiation contamination event in Building 23 (October 2018), a chemical spill in Building 54 (February 2019) and radiation contamination in the ANM facility (June 2019).[11] There were shutdowns in OPAL, Building 23 and the ANM facility due to mechanical faults, operational incidents and quality check failures in June 2018, June 2019, September 2019, October 2020, November 2020, March 2021 and August 2021.

1.12 Across all ANSTO facilities, Building 23 had the highest number of reported safety and operational incidents (1527) between 1 July 2013 and 31 December 2021 (Figure 1.2).[12]

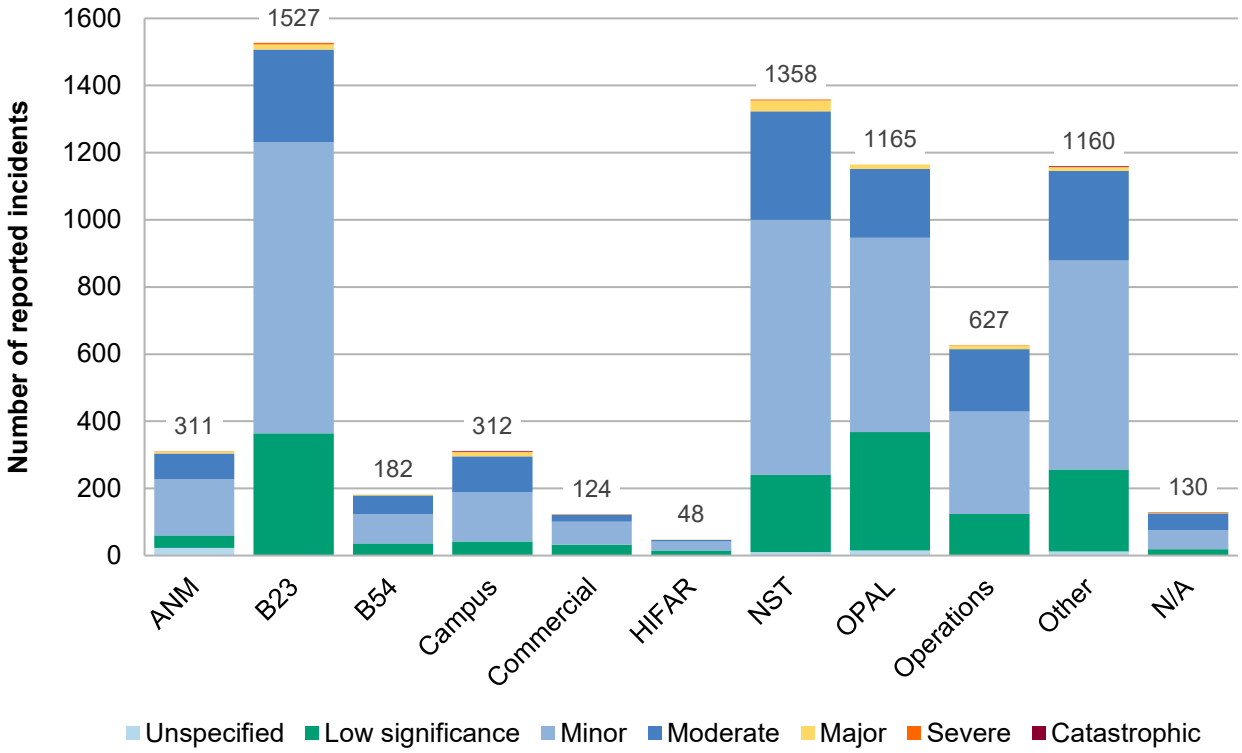
9 ACNS provides high-energy neutron beam instruments for the characterisation of a variety of materials. CAS provides ion beam analysis and accelerator mass spectrometry to identify and analyse the chemical make-up of samples for research in health, environment, energy and materials engineering. NDF supports research investigating the relationship between the structure of molecules and their function. Deuteration replaces the hydrogen atoms in a molecule with its heavier isotope, deuterium. The Synchrotron produces beams of light that are used to examine the molecular and atomic details of a range of materials. The Synchrotron was built by the Victorian Government in Clayton, Victoria in 2001. ANSTO began operating the facility in 2013.

10 The NCRIS program aims to give researchers access to national research infrastructure through supporting projects led by universities, publicly funded research organisations and private companies.

11 The August 2017 incident in Building 23 was classified as a 'Level 3' ('Serious') incident according to the International Atomic Energy Agency's (IAEA's) International Nuclear and Radiological seven-level event scale, which ranges from zero (no safety significance) to seven (major accident). This was the only Level 3 (or above) rated incident reported worldwide in 2017, and the only one ever reported at ANSTO. The June 2019 incident in the ANM facility was classified as 'Level 2' ('Incident') and the October 2018 incident in Building 23 was classified as 'Level 1' ('Anomaly'). ANSTO advised the ANAO that the other incidents listed in paragraph 1.11 did not meet the threshold for classification on the IAEA's scale.

12 ANSTO advised the ANAO that a good reporting culture would lead to higher incident reporting.

Figure 1.2: Number of reported safety or operational incidents by facility, 1 July 2013 to 31 December 2021

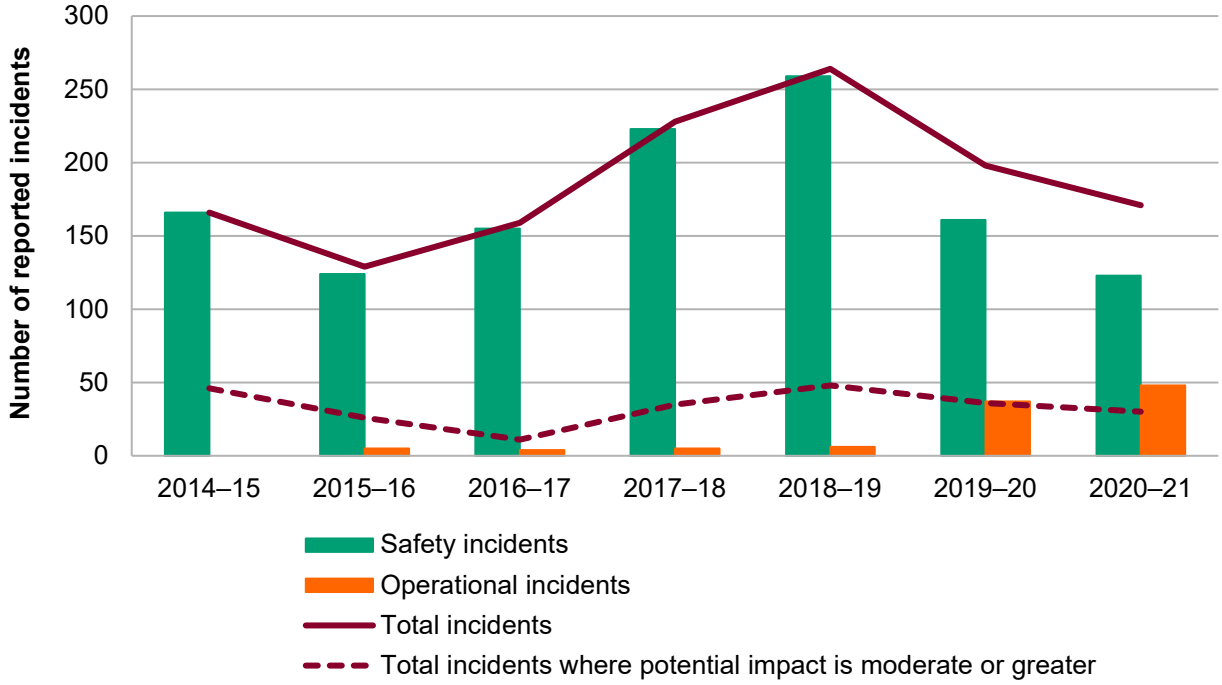


Note: ANSTO procedural documentation specifies three main types of safety incidents, which are each further defined: radiological, injury/illness and nuclear safety. An operational incident is defined in ANSTO procedural documentation as situations or occurrences relating to the operations, or plant and equipment, that do not have safety or environment implications. In practice, incidents were often simultaneously classified in the Governance, Risk, Compliance and Assurance system as safety and operational incidents. Some operational incidents have no safety implications. Incident ratings are determined by the triage officer, using ANSTO's risk analysis matrix. Typically, an incident rated as 'minor' or above requires an investigation that identifies the root cause. For safety incidents, a 'catastrophic' general incident would be one involving multiple fatalities or serious permanent injuries. A 'minor' general incident would be one requiring first aid or early intervention. ANSTO's risk analysis matrix does not include ratings definitions for operational incidents without a safety implication.

Source: ANAO analysis of ANSTO incident data.

1.13 Reported safety incidents in Building 23 peaked in 2018–19 (259 safety incidents), while reported operational incidents increased from 2016–17 (Figure 1.3).

Figure 1.3: Number of reported safety and operational incidents in Building 23, 2014–15 to 2020–21



Note: Data from 2013–14 not shown. Data between 1 July 2021 and 31 December 2021 not shown. Incidents can be simultaneously classified as safety and operational incidents. Some operational incidents have no safety implications.

Source: ANAO analysis of ANSTO incident data.

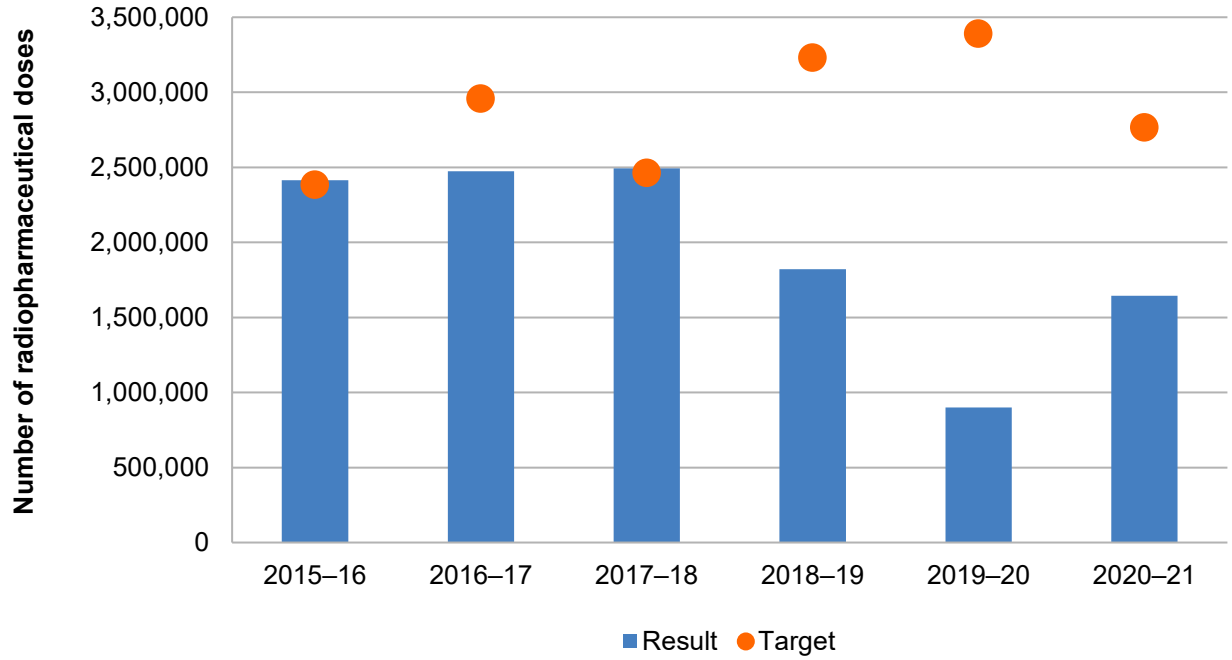
1.14 Operational failures in ANSTO nuclear medicine assets have consequences for human safety, ANSTO financial sustainability and the security of domestic nuclear medicine supply.

- In an analysis of safety incidents impacting workers conducted in 2021, ANSTO found that equipment was the top cause of safety incidents, including moderate to major impact incidents, far surpassing other root causes such as construction, information, people, design, training deficiency, management or external events.
- In June 2021 ANSTO estimated the average cost of unplanned outages to be approximately $1 million per week. This includes foregone export revenues and the cost of securing the supply of Mo-99 through imports, which the Australian Government has determined will not be passed on to patients through price increases. In 2019–20 ANSTO's own-source revenue was $87 million ($48 million less than budgeted) and in 2020–21 it was $111 million ($5 million less than budgeted).
- Although ANSTO works with international suppliers to secure supply as a back-up during supply disruptions, ANSTO has advised government that this model is 'not sustainable over the long term' due to the small number of suppliers globally, the high price of imported supply and logistical challenges associated with the short product shelf life. Impacts on patients from shortages include cancelled procedures, delays in diagnosis and treatment, and disruptions to research trials.

1.15 ANSTO achieved 56 per cent of its production target of radiopharmaceutical potential doses in 2018–19, 27 per cent in 2019–20 and 59 per cent in 2020–21 (Figure 1.4). ANSTO attributed

shortfalls to mechanical breakdowns and equipment defects in Building 23, a delay in the new ANM facility commencing operations and a contamination incident (2018–19); the coronavirus disease 2019 (COVID-19) pandemic's impact on production runs and exports (2019–20); and OPAL outages, limits placed on Building 23 capacity to better ensure safe supply, and international cargo restrictions during the pandemic (2020–21).

Figure 1.4: Achievement of pharmaceutical dose targets, 2015–16 to 2020–21



Source: ANAO analysis of ANSTO annual reports.

1.16 Three major external reviews of ANSTO have been undertaken since 2018.

- In October 2018 a review of ANSTO's approach to occupational radiation safety and operational procedures in nuclear medicine production was commissioned by ANSTO in response to a June 2018 direction from ARPANSA. The direction was in relation to four reportable incidents in Building 23 and a finding that ANSTO was in breach of subsection 30(2) of the *Australian Radiation Protection and Nuclear Safety Act 1998* (ARPANS Act).[13] The review considered ANSTO's approach to occupational radiation safety of processes and operational procedures at its nuclear medicine facility.
- In 2019 the Minister directed an independent review of ANSTO's financial sustainability and governance arrangements.[14] The review was conducted in three phases, with the first phase focusing on short term funding needs (which were addressed in the 2019–20 Budget), the second phase focusing on governance and risk management issues, and the

13 A reportable incident is one that must be reported to ARPANSA in accordance with paragraph 46(2)(c) of the Australian Radiation Protection and Nuclear Safety Regulations 1999 (the ARPANS Regulations). ARPANSA found ANSTO to have been in breach of subsection 30(2) of the ARPANS Act for failing to comply with regulations 46 (measures to prevent accidents) and 48 (dose limits) of the ARPANS Regulations.

14 The review was led by Mr David Tune AO PSM.

third phase focusing on longer term financial requirements (which were addressed in the 2019–20 Mid-Year Economic and Fiscal Outlook).

- In part to inform the government's consideration of a range of proposals in the 2021–22 Budget, the Department of Finance (Finance) led a scoping study of long-term governance and commercial arrangements for the supply and pricing of nuclear medicines. The study was overseen by a steering committee chaired by Finance and including personnel from the Department of Industry, Science, Energy and Resources (DISER), ANSTO and the Department of Health (Health).

1.17 In addition to the three major reviews, a 2020 nuclear medicine business case identified and assessed options for future nuclear medicine supply.

1.18 The reviews noted contextual and funding challenges, as well as concerns about ANSTO's governance, financial management and asset management (refer Appendix 3). Over 120 recommendations were made. In response, the government committed over $500 million to ANSTO to 2024–25, as well as providing a $56 million equity injection held in administrative quarantine, to fund operations, decommissioning, waste storage, spent fuel management, nuclear medicine production and maintenance.[15] In July 2021 the government approved $26 million for the first phase of an estimated $419 million project to replace Building 23 and $4 million to sustain the operations of Building 23.

Rationale for undertaking the audit

1.19 ANSTO supplies the Australian health sector with the radiopharmaceuticals used to diagnose heart disease, cancer and skeletal injuries. Disruptions to ANSTO's manufacture, production or distribution of radiopharmaceuticals result in risks to worker safety, ANSTO's financial sustainability and the security of domestic nuclear medicine supply.

1.20 At 30 June 2021 ANSTO's non-financial assets were valued at $1.3 billion. Effective planning, acquisition, use, maintenance and disposal of non-financial assets is necessary to achieving agreed program delivery outcomes. The audit was identified as a Parliamentary priority in 2020–21. The audit will provide assurance that ANSTO is effectively managing the principal assets involved in nuclear medicine production in Australia.

Audit approach

Audit objective, criteria and scope

1.21 The audit examined the effectiveness of ANSTO's management of assets involved in the manufacture, production and distribution of nuclear medicines.

1.22 To form a conclusion against the audit objective, the following high-level criteria were adopted.

- Does ANSTO have a fit for purpose asset management framework?

15 The equity injection can be released by Finance if required by ANSTO.

- Has ANSTO effectively acquired and disposed of the assets used in nuclear medicine production?
- Has ANSTO effectively maintained the assets used in nuclear medicine production?
- Does ANSTO effectively measure, report on and monitor its asset performance?

1.23 The audit scope included enterprise-wide asset management frameworks and, where relevant, consideration of other ANSTO assets and platforms. Nuclear safety and the management of radioactive waste were not a focus of the audit although they are discussed where they relate to the audit objective.

Audit methodology

1.24 The audit involved:

- reviewing ANSTO, Finance and DISER documentation;
- analysing safety and operational incident data;
- observing ANSTO Risk and Audit Committee and asset acquisition planning meetings;
- meetings with officers from relevant ANSTO business areas and members of the Executive and Board;
- meetings with officials from DISER, Health, Finance, and ARPANSA;
- a systems assurance review of the asset management information system;
- considering two public submissions from nuclear medicine professional bodies; and
- visiting the Lucas Heights campus of ANSTO.

1.25 The audit was conducted in accordance with ANAO Auditing Standards at a cost to the ANAO of approximately $650,000.

1.26 The team members for this audit were Christine Chalmers, Irena Korenevski, David van Schoten, Ben Thomson, Carolyn Truong, Yoann Colin and Alex Wilkinson.

2. Asset management framework

Areas examined

This chapter examines whether the Australian Nuclear Science and Technology Organisation (ANSTO) has established a fit for purpose asset management framework.

Conclusion

The framework for asset management is largely fit for purpose. There is need for an improved enterprise-level strategic approach to asset management in planning, training and information management.

Areas for improvement

The ANAO made one recommendation to improve the enterprise-level strategic asset management plan. The ANAO also suggested that ANSTO should review the asset management policy to assess the applicability of all principles; rationalise related documentation and ensure this is up to date; and clarify accountability for establishing and implementing a strategic asset management framework at the enterprise level.

2.1 An asset management policy records the principles by which the entity manages its assets.[16] The approach to implementing asset management principles should be documented in a strategic asset management plan, which is: informed by an assessment of risk[17]; defines the desired functional performance, level of service and condition of assets[18]; and details how an entity will use its assets in an efficient and effective manner over the asset or asset group's life cycle to support program delivery.[19] Leadership and culture can also influence the achievement of asset management objectives.[20]

2.2 The asset management framework includes consideration of how asset information will be managed. Information about physical assets should be used to inform decisions about how they are managed, maintained and replaced.[21]

2.3 The ANAO examined whether: there was a fit for purpose asset management policy and plan; leadership facilitated effective asset management; and there was an appropriate asset information system and register.

16 International Organization for Standardization, *ISO 55000:2014 Asset management – Overview, principles and terminology,* International Organization for Standardization, Switzerland, 2014, p. 8.

17 Department of Finance, *Resource Management Guide 500*: *Commonwealth Property Management Framework*, Finance, February 2020, p. 5.

18 Institute of Asset Management, *Asset Management - An Anatomy*, Version 3, IAM, 2015, p. 69. The Institute of Asset Management is a not-for-profit membership-based professional body for asset management professionals.

19 International Organization for Standardization, *ISO 55000:2014 Asset management – Overview, principles and terminology,* International Organization for Standardization, Switzerland, 2014.

20 ibid.

21 ibid.

Is there a fit for purpose asset management policy and plan?

There is a largely fit for purpose asset management policy. The enterprise-level strategic asset management plan is not fit for purpose. There is a strategic asset management plan in place, however it does not substantively explain ANSTO's long-term, strategic and enterprise-level approach to managing its physical assets.

Asset management policy

2.4 An ANSTO asset management policy was established in 2013 and last updated in 2019. The updated policy was endorsed by the Chief Executive Officer (CEO), authorised by the ANSTO Board (the Board) and made available to all staff on ANSTO's intranet.

2.5 The policy outlines seven broad principles (refer Box 1).

Box 1: ANSTO's asset management principles

Principle 1	Commitment to safety, international standards and best practice
Principle 2	Decisions based on data and information using robust, systematic, transparent, risk-informed systems and processes for acquiring, operating, maintaining, upgrading, replacing and disposing of our assets
Principle 3	Continuous improvement is achieved through regular review, benchmarking, risk assessment, performance measurement, reporting, analysis, corrective actions, and audits
Principle 4	Focus on delivering value and outcomes for our stakeholders through clearly defining and seeking to achieve the capability and required level of performance, reliability and service of our assets and [asset management] systems
Principle 5	Organisation-wide, standard and consistent Asset Management systems, processes and practices across all assets
Principle 6	Roles, responsibilities and accountabilities at all levels of the organisation are defined and understood
Principle 7	Integration with our operational framework including: ○ Workplace health and safety, and nuclear safety; ○ Taking all reasonable steps to meet site commitments; ○ Spatial planning and environmental management; ○ Governance, Risk, Compliance and Assurance; ○ Integrated business planning and continuous improvement; ○ Customer and service level requirements; and ○ Certified Business Management Systems.

2.6 The asset management policy could be improved in several ways.

- With regard to Principle 5, individual ANSTO asset owners apply different processes and there are multiple systems in practice. ANSTO should consider whether this principle should be applied as intended or adapted.
- The policy does not include a commitment to comply with legal and regulatory requirements and does not refer to a separate 'Compliance Policy'. ANSTO operates assets through licences issued by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA). There are other relevant policies including for financial, project and radioactive waste management. The asset management policy should consider or refer to other ANSTO policies where they relate to the management of non-financial assets.

Strategic asset management plan

2.7 ANSTO has had a strategic enterprise-level asset management plan since 2015. It was last revised in November 2019 and was due for review in June 2020. At November 2021 the review was not completed. The strategic asset management plan contains references to documents that are out-dated or obsolete, particularly in relation to risk management practices.

2.8 The ANAO considered ANSTO's enterprise-level strategic asset management plan against the asset management standards of the International Organization for Standardization (ISO).[22] ANSTO advised the ANAO that although it was not its intention at this time to gain certification, it was guided by the ideals and principles of ISO 55000.

2.9 While the strategic asset management plan restates ISO 55000 principles and provides direction on what should be contained in individual asset management plans, it does not substantively explain ANSTO's long-term, strategic and enterprise-level approach to managing its assets. It does not adequately: consider the context of the organisation and its assets; incorporate demand analysis; incorporate an analysis or assessment of enterprise risks as they relate to assets; consider the lifecycle stages of its specific asset base and the resulting interdependencies; establish an enterprise-level strategic approach to managing stakeholder needs; or aggregate individual assets' performance requirements into an enterprise-level consideration of required asset performance. There were instances of empty references between the enterprise-level strategic asset management plan and individual asset-level plans.

2.10 In meetings between the ANAO and key ANSTO decision-makers, decision-makers demonstrated a lack of familiarity with the enterprise-level strategic asset management plan.

22 International Organization for Standardization, *ISO 55000: 2014 Asset management – Overview, principles and terminology* and *55001:2014 Asset management systems: Requirements.* Both standards are referred to as ISO 55000 throughout the report.

Recommendation no. 1

2.11 The Australian Nuclear Science and Technology Organisation replace the current strategic asset management plan with a substantive enterprise-level plan that is reflective of the Australian Nuclear Science and Technology Organisation's unique operating environment, is risk-based, incorporates asset performance expectations and results, and is regularly reviewed.

Australian Nuclear Science and Technology Organisation response: *Agreed.*

2.12 *ANSTO has commenced developing its action plan in response to this recommendation. The implementation of the actions will be monitored by our Risk and Audit Committee*.

Does ANSTO leadership and workplace culture facilitate effective asset management?

ANSTO leadership and workplace culture largely facilitate effective asset management. ANSTO leadership has demonstrated a commitment to strategic asset management principles and there have been activities related to the establishment of an asset management framework since 2014. Although roles and responsibilities are clearly defined at an individual asset level, there could be greater clarity of accountability for strategic asset management at the enterprise level. There is a program of mandatory and role-related training which touches on aspects of asset management. There is no training on asset management as a discipline.

2.13 Management should communicate the importance of asset management and periodically review the asset management framework that is in place.[23] Senior managers with asset management responsibilities should have sufficient influence and authority[24] and there should be clear roles and accountability.[25] Officials undertaking the work should have the necessary competence and understanding of asset management processes.[26]

Management communication and review

2.14 ANSTO began considering the principles of ISO 55000 in 2014 when the standards were introduced. A 2014 ANSTO-commissioned review of the asset management framework — with a focus on central site services and the Open Pool Australian Lightwater (OPAL) reactor — was described by ANSTO as a 'benchmark' capability audit at a very early stage of its asset management framework development. The review noted shortcomings, particularly in relation to the design of the asset management system; resources and awareness; and monitoring and assurance.

2.15 ANSTO advised the ANAO that the findings of the 2014 review drove the development of 'baseline' asset management documentation comprising the asset management policy, the strategic asset management plan, roles and responsibilities guidance and individual asset

23 International Organization for Standardization, *ISO 55001:2014 Asset management – Management systems: Requirements*, International Organization for Standardization, Switzerland, 2014, p. 11.

24 Institute of Asset Management, *Asset Management - An Anatomy*, Version 3, IAM, 2015, pp. 12 and 64.

25 International Organization for Standardization, *ISO 55001:2014 Asset management – Management systems: Requirements*, International Organization for Standardization, Switzerland, 2014, p. 9.

26 ibid, p. 11.

management plans. Initiatives introduced in 2014 included the recording of maintenance in the asset management software system and the development of a maintenance strategy template to be used across ANSTO.

2.16 Since 2014, asset management priorities have been considered and disseminated through the corporate plan, an enterprise-level business plan, a risk appetite framework, some divisional planning and employee communications via ANSTO's intranet.

2.17 ANSTO advised the ANAO that since the 2014 review of the asset management framework there had been no subsequent 'strict' self-assessment, but that other types of assurance activities such as internal technical audits had been completed. There was an internal check against ISO 55000 principles in 2017, which noted that an asset management policy, strategic asset management plan and most individual asset management plans (16 of an intended 20) were in place. It would be timely for ANSTO to undertake a fresh review that includes the nuclear medicine assets against the ISO 55000 standards.

Roles and accountabilities

2.18 Effective asset management depends on a clear definition of roles and responsibilities. Asset roles and responsibilities are outlined in various enterprise-level documents. The documents contain references to obsolete governance and functional arrangements. ANSTO should ensure that these documents reflect current organisational arrangements.

2.19 Individual asset roles and responsibilities are also defined within the OPAL, ANSTO Nuclear Medicine Molybdenum-99 (ANM) facility and Building 23 asset management plans. There is an asset owner (who bears ultimate responsibility for the realisation of value from the asset), an asset manager (who has responsibility for asset management plans and maintenance strategies) and an asset service provider (who provides 'on the ground' implementation of asset management plans). Additional asset-level procedural documentation provides further detail on maintenance responsibilities. The review of asset management commissioned by ANSTO in 2014 concluded that the definition of roles and responsibilities provided 'sufficient detail to guide people in understanding their respective responsibilities'.

2.20 In 2002 an ANSTO-commissioned review of maintenance strategy and procedures had emphasised the importance of a centralised site services role that has a 'dynamic ongoing dialogue' with the corporate planning function. Site services are provided by the ANSTO Maintenance and Engineering Group (AME), which is managed by the Chief Engineer. AME functions include coordination and maintenance of ANSTO's campus infrastructure, primary asset service provision for most ANSTO assets and routine and breakdown maintenance support services to individual facilities and platforms.

2.21 From 2014 the development of a strategic enterprise-level asset management capability was initiated and led by several individuals within the Reactor Operations division and AME. AME assumed responsibility for the asset management policy and setting the direction for maintenance strategies. The 2014 review of ANSTO's asset management framework noted the 'spare time' and 'voluntary' nature of the effort by a small number of individuals to put in place an asset management framework for the entity. A small 'Maintenance Transformation' section, including a

'Reliability Centred Maintenance' lead (refer paragraph 4.9), was established in AME at the end of 2017.

2.22 Accountability for asset performance at the enterprise level is unclear.

- The nuclear medicine assets have specialised maintenance staff and work units. The level of involvement of AME varies by facility depending on local decisions by asset owners. In relation to strategic maintenance planning, a service level agreement briefly mentions AME's responsibility for 'consulting services', but these services are not further defined. Consistent with the accountability framework, there is no requirement for individual asset owners, who bear ultimate responsibility for a maintenance strategy, to seek or follow AME advice.
- ANSTO's delegation of authorities organises delegations into six broad categories (Board, Financial, Commercial, Administration, Human Resources, and Safety and Research Ethics) and provides detailed delegation authorities within each of these categories. Asset management does not figure clearly in the categorisation. A 'Delegations Manual' states that divisional general managers and the 'Leader – Site(s) Maintenance' are responsible for organisational management reporting to the CEO. The 'Leader – Site(s) Maintenance' role is obsolete.
- The strategic asset management plan does not identify accountability for enterprise-level asset management and other documentation is similarly focused on ownership and management at the individual asset level, describing the individual asset owner as having ultimate accountability for realising value from assets.

2.23 ANSTO advised the ANAO that a 'Lead, Asset Management and Controller' position would be established in early 2022.

Awareness and understanding

2.24 To perform their functions in relation to asset management, staff require access to up to date asset management guidance materials. An intranet page specified that each business unit was to maintain an asset management plan and provided a link to the asset management policy, the strategic asset management plan and a document describing asset roles and responsibilities.

2.25 To support asset management plans, there are many procedural guidance documents. A July 2021 internal review identified 6915 procedural documents, including 1700 controlled documents within the Reactor Operations division and 1200 controlled documents within the Nuclear Medicine division. A February 2021 paper to the Risk and Audit Committee of the Board noted duplicate and redundant records and a need to rationalise the information.

2.26 The 2014 review of ANSTO's asset management framework noted that there was lack of understanding among some of those assigned an asset management role about what this entailed. When the ANAO asked about training needs analysis, ANSTO supplied a training request form that seeks to identify skills gaps that are not met by existing training. ANSTO has mandatory training requirements with a focus on managing risk and including modules on quality, security, workplace health and safety, and incident reporting. There are also role-required training requirements. Technical training for maintenance planners and supervisors is managed by AME. At November 2021 ANSTO advised that there are plans to improve maintenance planner training.

2.27 Mandatory training modules address asset management indirectly. There was little evidence of training in relation to asset management as a discipline. A non-mandatory Asset Management Council 'asset management fundamentals' training program was offered to staff in 2014.[27] Intranet links to the training were no longer available at November 2021.

Is there an appropriate asset information framework?

There is a largely appropriate asset information framework. The asset management system, which is based on System Applications and Products (SAP), is largely fit for purpose and represents a single source of truth about asset performance. Use of the system is developing. The financial asset register is fit for the purpose of financial reporting. Neither the financial nor the operational asset registers, which are derived from SAP, contain information that would assist with asset performance monitoring. While there are procedures and guidelines for information management, there is no information or data strategy that identifies what information is needed to manage ANSTO's assets.

2.28 The ANAO examined whether ANSTO had an effective information or data strategy; a fit for purpose asset management information system; and an asset register that can be used for asset planning and decision-making.

Asset information or data strategy

2.29 An entity should determine its asset information requirements; considerations might include what asset information is needed, and how and when the information is to be collected, stored, analysed and assessed.[28] ANSTO has an 'Information Management Policy', which is primarily focused on information integrity and security. The policy is supported by a large volume of related policies, procedures and guidelines at both the enterprise and individual asset level.

2.30 Documented procedures state that every asset must be registered. There are procedures for maintaining the financial asset register.[29] Asset 'custodians' are responsible for ensuring that information contained in the financial asset register is up to date.[30] A series of related guidelines provides further detail on the appropriate registration of assets.

2.31 There are two asset classes for operational purposes: (1) standalone plant and equipment assets (including licensed facilities) and (2) site infrastructure assets. Individual asset management plans provide further direction on classification of assets into asset sub-classes, plant systems, subsystems, assemblies, sub-assemblies, components and parts. There is a protocol for classification for OPAL. An equivalent document did not exist for other assets.

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27 The Asset Management Council is a membership-based, not-for-profit organisation with the goal of providing information and guidance on asset management to create a deeper understanding of asset management and support organisations to improve business performance. Members include individuals, students and private and public sector bodies.

28 International Organization for Standardization, *ISO 55001:2014 Asset management – Management systems: Requirements*, International Organization for Standardization, Switzerland, 2014, pp. 11–12.

29 Assets are defined as any land, building, plant, equipment or fitting that is valued at $5000 or more.

30 Asset custodians are defined as the division or entity that has the responsibility for maintaining or operating the asset.

2.32 A paper presented to the Risk and Audit Committee in February 2021 noted that data quality was not adequately measured and recommended that 'a more centralised approach to data management should be established'. The paper proposed an investment of approximately $2.5 million for the initiative with a completion date of 2025–26. The 2021–22 internal audit plan listed 'data management' as a planned audit.

Asset information systems

2.33 Asset information systems are software applications to collect, store, process and analyse asset information. They should protect asset information from loss of confidentiality or integrity, and improper use.[31] ANSTO uses multiple systems to manage its assets, including the core system, SAP.[32] SAP is used by ANSTO for capital, maintenance, supply chain, logistics, procurement and financial management. The ANAO found that SAP usage was appropriately managed and controlled by individual asset owners.

2.34 Maintenance plans documented within SAP contain maintenance work orders and information about asset condition and impairment. At November 2021 there were about 4000 maintenance plans for the nuclear medicine facilities. Maintenance and configuration activities are largely documented on paper, with drawings and forms then scanned and available as attachments in the system. This process increases workload and limits system functionality. The use of spreadsheets and manual data entry for Building 23 maintenance activity recording increases the risk to data integrity. A 2021 ANSTO-commissioned review of the nuclear medicine supply chain found that there was a heavy reliance on manual spreadsheets in both Building 23 and the ANM facility and that SAP functionality was not sufficiently tailored.

2.35 The 2021 review found under-utilisation of SAP for Building 23 demand planning. The ANAO found that usage of the system for data-driven demand forecasting for spare parts could have been improved for all facilities. Procedures had been introduced at the ANM facility to improve demand forecasting with an anticipated completion date of 2022.

2.36 Following the 2014 review of asset management, there were several system improvement projects: most recently, a 'SAP simplification project' started in January 2020 and completed in December 2021. The simplification project addressed 98 'pain points' identified by users. At November 2021 there were plans to update the instructions for maintenance plans and defining functional asset locations. Another planned project with an anticipated completion date of December 2022 was to migrate into SAP the many paper-based forms and information held in multiple document management systems and to standardise the capture of asset metadata.

Asset registers

2.37 Asset information systems ideally store, or are integrated with, an asset register. An effective register keeps financial and non-financial information over each asset's life cycle for the purposes of planning; accounting and legislative compliance; and performance monitoring.

31 International Organization for Standardization, *ISO 55001:2014 Asset management – Management systems: Requirements*, International Organization for Standardization, Switzerland, 2014, p. 12.

32 SAP is a software system used for business processes.

2.38 ANSTO creates operational asset registers separately to the financial register. The OPAL, Building 23 and ANM facility operational asset registers are hierarchical numbered lists of assets and their components.[33] Neither the financial nor the operational registers contain information about asset condition or maintenance, and the operational registers contain no information about costs. ANSTO advised the ANAO that creating registers with more detail about asset condition from the information contained in SAP is manual and difficult.

2.39 The linkage of asset operational information to asset financial information is an important potential contribution of an asset management system. ANSTO's financial and operational asset registers are derived from a common system that includes functionality to potentially link equipment, maintenance activities and the financial asset record. ANSTO advised the ANAO that this functionality is not used. Moreover, linkage would be difficult to establish below the highest (facility) level due to the lack of a common unit of analysis.

33 OPAL and the ANM facility maintained a register of functional locations based on a system/dependency hierarchy. At November 2021 Building 23 was also planning to move away from the legacy use of physical (building and room) locations towards the assignment of functional locations by systems and dependencies.

3. Asset acquisition and disposal

Areas examined

This chapter examines whether the Australian Nuclear Science and Technology Organisation (ANSTO) has effectively managed nuclear medicine assets across the acquisition and disposal phases of the asset life cycle.

Conclusion

ANSTO's management of acquisition and disposal of key nuclear medicine assets has been partly effective. There have been delays, cost overruns and failure to meet some deliverables and targets in two major nuclear medicine asset acquisition and disposal projects, and there has been a lack of planning and decision-making in relation to a third obsolete asset. Changes are being made to ANSTO's capital budgeting and planning processes.

Areas for improvement

The ANAO made two recommendations relating to the development of an asset management or decommissioning plan for Building 54, and the governance of High Flux Australian Reactor (HIFAR) disposal. The ANAO also suggested ANSTO should consider developing a capital budgeting policy and conduct a lessons learned exercise around HIFAR disposal.

3.1 Accountable authorities and officials have a duty to promote the proper use and management of public resources.

> In relation to the Commonwealth Property Management Framework, proper use means efficient, effective, economical and ethical management of owned and leased Commonwealth property.[34]

The duty extends across the asset lifecycle, including asset planning, acquisition and disposal. The ANAO examined:

- ANSTO's capital management planning processes;
- the acquisition of the SyMo facility for the immobilisation of waste from the production of Molybdenum-99 (Mo-99); and
- the disposal of Building 54 and HIFAR.

Is capital management planning fit for purpose?

Capital management planning for nuclear medicine assets is developing. During 2021–22, new governance arrangements for capital management planning were implemented. It is too early to assess the effectiveness of these changes. While a fit for purpose business case for replacing the ageing Building 23 was undertaken in the context of the revised capital planning arrangements, there were lengthy delays in ANSTO commencing the planning process.

34 Department of Finance, *Resource Management Guide 500: Commonwealth Property Management Framework,* February 2020, Section 8.

Capital budgeting policy and governance arrangements

3.2 A capital budgeting policy establishes the requirements for the management and reporting of capital expenditure and planning.[35] ANSTO does not have a capital budgeting policy and should consider developing one.

3.3 In response to a 2019 independent review of ANSTO's financial sustainability and governance, in 2020 ANSTO commissioned or conducted several internal reviews into the management of capital projects and processes. The reviews identified areas for improvement, including in relation to outdated policies, lack of clarity around roles, no common prioritisation approach that was clearly aligned to strategic objectives, no single decision-maker for capital allocation decisions and lack of a centralised process for monitoring capital projects. In December 2020 ANSTO advised government that it would implement recommendations from the reviews by January 2021.

3.4 Changes to ANSTO's governance arrangements were made on 1 July 2021. The Capital Program Management Office and the Capital Committee replaced previous governance bodies. The Capital Committee, composed of members of ANSTO's management executive[36], would decide the prioritisation and allocation of capital funding to projects and the Capital Program Management Office would be responsible for ensuring consistent and effective management of capital prospects and projects. ANSTO identified the key anticipated benefits.

- Most capital funding proposals would need to pass through a prospect phase to determine whether they were worthwhile.
- The Capital Program Management Office would support the Capital Committee in its determination of investment priorities and provide specialist expertise in large-scale project delivery.
- Approvals for funding or project proposals that could not be funded within a portfolio's budget would be centralised in the Capital Committee, providing greater visibility, accountability and consistency around capital funding decisions.

3.5 Benefits of the new governance arrangements were being measured and tracked through a portfolio scorecard presented at monthly Capital Committee meetings, presentation of a 'Capital Paper' to the ANSTO Board (the Board), and a 'Project Health Summary Report' from November 2021.

Capital plans

3.6 A capital management plan sets out long-term funding strategies for asset acquisitions. It guides the prioritisation of scarce resources and is a key mechanism by which management practically implements the entity's strategic goals for the asset portfolio. A capital expenditure (CAPEX) forecast report served as ANSTO's enterprise-level long-term capital management plan. The report set out actual and forecasted capital expenditure over a five-year period across each

35 Department of Finance, *Resource Management Guide 500: Commonwealth Property Management Framework,* February 2020, Section 24.

36 Including the Chief Executive Officer, Chief Operating Officer and Chief Financial Officer.

of the portfolios, approved and unapproved investment proposals, and funding sources.[37] Under the new governance structure, the Capital Committee would approve the five-year capital plan annually.

3.7 There was a hierarchical approach to capital project prioritisation, with prioritisation occurring at the asset, portfolio and enterprise level. A capital project prioritisation framework (with rankings based on five criteria: safety; compliance and security; strategic alignment; project risk; and the priorities of the Minister, Board or executive management) was developed in May 2021 for enterprise-level prioritisation. The intention was to achieve alignment between organisational objectives, risk and capital investment. At December 2021 the framework had not been implemented and the process for prioritising capital projects at the portfolio and enterprise levels had not been formally documented. ANSTO advised the ANAO that the framework would be built into a new project management tool in 2022.

Building 23 replacement

3.8 Asset acquisition planning should involve the development of business cases to assess alternatives, including non-asset solutions.[38] The 2019 independent review of ANSTO's financial sustainability and governance arrangements recommended that new ANSTO projects or initiatives requiring a significant commitment of capital funding be subject to detailed business case processes. The ANAO examined a recent business case for the replacement of the ageing Building 23.

3.9 In August 2019 the Board requested a preliminary business case be prepared for the replacement of Building 23 following a recommendation from the 2019 independent review that the Board formally oversee the development of a business case.

37 ANSTO advised the ANAO that from 1 July 2021 there were four portfolios, comprising Infrastructure Lifecycle Management, Nuclear Operations and Nuclear Medicine, Information Technology, and National Science and Technology.

38 A non-asset solution is a method for addressing services demand that does not add to existing asset capacity.

Figure 3.1: Building 23

Source: ANSTO.

3.10 The business case made two recommendations relating to Building 23: build a replacement Technetium-99 manufacturing facility and maintain Building 23 in the interim period.[39] The business case was approved by the Board in June 2020.

3.11 The business case provided a clear rationale for the investment; analysis of alternatives including non-asset solutions (importing nuclear medicines or refurbishing the facility); and design requirements for planned operational usage and physical capacity. It assessed 13 operational and commercial risks associated with the project, and specified whole-of-life costs for the recommended option, including $64 million for decommissioning.

3.12 The first meeting of a Project Control Group was held on 6 September 2021 after the Australian Government agreed to provide initial funding (refer paragraph 1.18). In December 2021 ANSTO commissioned JacobsWyper and Predict Limited, which had prepared the April 2020 business case for the Building 23 replacement facility, to update it.[40]

3.13 Although the business case comprehensively covered commercial and operational issues, there were lengthy delays in the commencement of planning for a replacement building. Multiple reviews since at least 2009, including by the Therapeutic Goods Administration, identified issues with Building 23's design, internal layout, and lack of automation and ageing equipment; and

39 The business case also recommended that radiopharmaceutical pricing be corrected.

40 JacobsWyper is an architectural, planning and interior design firm.

recommended its replacement.[41] Building 23 had exceeded its standard useful life by 11 years before the business case was finalised in 2020.[42] The 2020 business case noted that 'there is an urgent need for a decision on the future of nuclear medicine manufacturing in Australia'. The risks to domestic nuclear medicine supply are increased by the need to rely on an ageing facility until at least 2031.

Is nuclear medicine asset acquisition effective?

Based on an analysis of a recent nuclear medicine asset acquisition project — the SyMo project — asset acquisition is partly effective. Achievement of the project objectives was impacted by limitations in early planning and design, lack of contractual clarity and relatively late activation of contractual recourse mechanisms for the primary construction contractor. Risks were first identified in 2011 and were actively managed between 2019 and 2021 (the period examined by the ANAO). ANSTO's 2021 implementation plan for the SyMo project is largely fit for purpose.

3.14 The 2019 review of ANSTO's financial sustainability and governance arrangements found that delays and cost overruns experienced in the governance and delivery of the ANSTO Nuclear Medicine Molybdenum-99 (ANM) facility project to replace the ageing Building 54 had eroded the confidence of stakeholders in the ability of ANSTO to deliver projects in accordance with business cases.[43] The review stated that the Board, as the ANSTO accountable authority, would need to ensure that capital program oversight and governance remained high priority issues. As an example of recent nuclear medicine asset acquisition, the ANAO examined the SyMo project.

SyMo implementation planning

3.15 ANSTO first developed a business case to assess options for processing liquid waste in May 2008. In 2009 ANSTO approved a capital investment case of $400,000 to commence works on SyMo. The aim was to design and construct a first-of-a-kind waste treatment facility based on ANSTO's proprietary 'Synroc' technology. In 2011–12 the ANM program was formed to oversee both the SyMo project and the acquisition of the new Molybdenum-99 (Mo-99) manufacturing facility (the ANM facility). A new business case for the combined project — the ANSTO Molybdenum 3000 Synroc project — was prepared in November 2011.

3.16 Between June 2009 and early 2015 the SyMo project was progressed with the intention of refurbishing an existing building into a facility that would treat intermediate level liquid waste from Building 54 and legacy acidic waste from other buildings and containers. Between 2010 and August 2021 there were 13 implementation plans (Table 3.1).

41 The Therapeutic Goods Administration is Australia's regulatory authority for therapeutic goods.

42 Useful life is the period over which an asset is expected to be available for use by an entity. Standard useful life assigns a uniform useful life within a particular asset class, which avoids the need to assign a useful life to each individual asset. Building 23 was constructed in 1959 and a standard useful life of 50 years was applied. At 30 June 2021 Building 23 was valued at $2.5 million; the valuers recommended that its standard useful life be extended for four more years.

43 There was a $98 million (113 per cent) budget overrun in the build of the ANM facility.

Table 3.1: Budget and milestones from selected SyMo implementation plans

	November 2010 plan	July 2015 plan	August 2021 plan
Plan number[a]	1	5	13
Budget	$38m	$59m	$140m[b]
Completion of plant installation and pre-commissioning activities	Not applicable[c]	December 2018	May 2022
Completion of cold commissioning[d]	July 2012/December 2013[e]	March 2019	February 2023
Completion of hot commissioning[f]	December 2013	July 2019	June 2024
Closure	March 2014	September 2019	March 2025

Note a: This table presents three versions of the implementation plan: at the outset of the project, following project scope changes in 2015 and the latest version of the plan as at February 2022.

Note b: The August 2021 plan provided a budget of $130.2 million for the construction of the facility. ANSTO identified an additional $10 million for operational readiness. The project objective identified in the August 2021 implementation plan was consistent with the 2015 implementation plan but expanded capacity from around 5000 to 6250 litres per year.

Note c: There was no clear comparable milestone date in the November 2010 plan due to the project scope changes (refer paragraph 3.17).

Note d: Commissioning involves testing the operations of a facility to demonstrate that it meets the design, performance and safety requirements. Cold commissioning is testing operations prior to introducing radioactive materials.

Note e: Cold commissioning is listed against two different milestone dates.

Note f: Hot commissioning involves using radioactive material during testing the operations of a facility.

Source: ANAO analysis of ANSTO documentation.

3.17 The project scope was adjusted in late 2011 to include the processing of intermediate level liquid waste from the new ANM facility, which had been approved for construction in September 2012. The scope underwent further change from late 2014 following delays and performance issues. The July 2015 plan reflected the new project scope.

3.18 Between 2012 and 2021, ANSTO commissioned or conducted reviews that identified deficiencies in early implementation planning. These included lack of mitigation strategies for the risk of cost and schedule overruns; lack of real time assessments of physical progress; insufficient detail in project schedules; failure to obtain stakeholder and expert input in planning; and deficiencies in procurement. A 2021 review found that the decisions made between 2009 and 2012 were not adequately risk-based and that the initial budget and schedule did not reflect SyMo's developmental nature as a first-of-a-kind facility. The review noted that a greater focus on the design technology readiness of the Synroc technology would have prevented the need to rework 95 per cent of the original concept and preliminary design.

3.19 The ANAO found that the August 2021 implementation plan was largely comprehensive. It included clear objectives; contextual considerations; roles and responsibilities; governance arrangements; risk management processes; and budget, key deliverables and milestones. There was a $16.5 million continency budget allowing for inherent uncertainty and COVID-19 impacts, project delays, additional process validation requirements and costs, and first-of-a-kind factors.

3.20 Several aspects of the plan could have been further developed. These included clearer thresholds for when approvals for decisions were required from the Board and Chief Executive

Officer; and more consideration of the engagement of experts in relation to cold commissioning, integration engineering and waste characterisation — factors which had been identified as technical challenges and integral to project success.

3.21 The estimated value of the procurements ranged from $35 million to $71 million between 2010 and 2021. ANSTO estimated $44 million for procurement at March 2021, which was 31 per cent of the total project cost at the time ($140 million). As a proportion of the total project cost, this was lower than at earlier stages when it reached 93 per cent of the total project cost. ANSTO advised the ANAO that previous procurement estimates envisioned delivery using three major contractors managed by a small in-house team. This was later changed to a significant in-house design component to ensure retention of ANSTO's intellectual property. In addition, further in-house resources were required to manage several large and difficult contracts.

3.22 ANSTO revised the SyMo procurement plan nine times between June 2010 and March 2021. Initial plans for a selective tender approach were amended in August 2010 to a 'project alliance' model with preferred technology partners.[44] In the period 2012 to 2015 ANSTO decided to use more competitive procurement methods.[45] The March 2021 plan listed procurement methods as expressions of interest, select tender and panel arrangements.

SyMo project implementation

3.23 The SyMo project completion date shifted from March 2014 to March 2025 (Table 3.1). At December 2021 a delay to the practical completion of construction was described by ANSTO as likely to impact the achievement of the March 2025 project closure milestone. Planned completion of plant installation and pre-commissioning activities by May 2022 and other major milestones such as cold commissioning, hot commissioning, and Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) approvals were considered 'under threat'. At January 2022 ANSTO attributed SyMo project delays to COVID-19 restrictions and contractor performance.

3.24 The project budget increased from $37.6 million in 2010 to $140.2 million in 2020. In 2020 and 2021 ANSTO advised the government that 'to meet the additional funding requirements of the Synroc project some asset renewal has been delayed'. The 2019 independent review of ANSTO's financial sustainability and governance arrangements noted that the cost overruns exacerbated ANSTO's poor financial position. At January 2022 actual costs were $98.9 million and ANSTO estimated that the total cost would be $140.2 million, assuming the full contingency budget would be required.[46]

3.25 In examining project implementation, the ANAO focused on the most material contract — with Icon Construction (Icon) — valued at $30.1 million in 2018 (Table 3.2). An amended AS4000-1997 construction contract (May 2018) and an amendment deed (September 2021)

44 An alliance contract involves an agency working with private sector parties to deliver the major capital asset, where all parties share the project risk management and outcomes. In the procurement plan, ANSTO identified that the benefits of the alliance approach were ongoing collaboration on future Synroc projects, protection of intellectual property and a closer working relationship on a first-of-a-kind project.

45 ANSTO has been a prescribed corporate Commonwealth entity in relation to procurement under the Public Governance, Performance and Accountability Rule 2014 since the Rule commenced in September 2014.

46 ANSTO indicated to the ANAO that it may request further contingency funds due to practical completion delay.

comprised the framework for the work.[47] SyMo contract management arrangements improved after a 2017 internal audit found that ANSTO had not developed formal contract management or contract risk plans, and that not all contracts were subject to performance review processes. The AS4000-1997 contract template included arrangements for contract governance, performance management and contract administration.

3.26 The 2018 Icon budget increased by almost 20 per cent as at the September 2021 amendment deed. At February 2022 the amended budget was on track to be achieved. Original and amended timeframes were not achieved. At February 2022 outstanding deliverables comprised completion of remaining works, rectification of defects and provision of documentation.

Table 3.2: Progress against Icon budget and milestones

	Contract May 2018[a]	Amendment deed September 2021	Outcome at February 2022
Budget[b]	Contract price $30,061,515	Contract price $35,825,070[c]	Invoiced $35,067,230
Practical completion[d]	4 February 2020	1 October 2021[e]	2 December 2021[f]
Post-completion works	N/A[g]	12 November 2021	In progress

Note a: ANSTO initially established a contract with Cockram Construction Australia Pty Ltd (Cockram). Cockram became Icon in January 2019.

Note b: All amounts GST inclusive.

Note c: The contract price in the amendment deed reflected the agreed variations and adjudication determination (refer paragraph 3.27).

Note d: Practical completion is the key milestone under the contract. At practical completion, works are complete and documentation and other information for the use, operation and maintenance of the site have been supplied by the contractor.

Note e: The amendment deed shifted some of the work that was originally required for practical completion into post-completion works and established that ANSTO could reclassify works when required.

Note f: Although Icon did not complete the entirety of the works required for practical completion, ANSTO issued Icon with a certificate of practical completion on 2 December 2021 because a portion of works were reclassified from practical completion to post-completion works. The reason was to allow handover of the site.

Note g: The contract did not have a post-completion works milestone.

Source: ANAO analysis of ANSTO documentation.

3.27 The increase in contract value and delays to practical completion reflected 122 supplier requests for extensions of time, 299 contract variations and an adjudication determination.[48] Reasons cited for extensions of time included incomplete design and other design issues; changes to construction works; unfavourable weather conditions; and the COVID-19 pandemic.

3.28 ANSTO had engaged GHD Pty Ltd (GHD) in 2013 to undertake detailed design and provide design assistance during the construction phase, which formed the basis of the construction tender process in July 2017. In late 2018 the Steering Committee received a report that GHD's building design required modification and an additional $1.2 million was approved to incorporate design

47 Standards Australia Limited, AS 4000-1997, General conditions of contract [available from https://infostore.saiglobal.com/en-au/standards/as-4000-1997-reference-use-only--1131979_saig_as_as_275491/] is a widely used form of head contract for construction projects in Australia.

48 The adjudication determination awarded Icon a payment of $2,447,050 (including GST and interest). ANSTO's legal costs in relation to the Icon contract were $585,000 at November 2021.

changes into the Icon construction contract. In late 2019 ANSTO attributed delays in the construction program to design errors, rework and constructability issues.

3.29 ANSTO and Icon did not agree on the extent of Icon's role in design. In March 2020 Icon indicated that it interpreted its role to be 'construct only', with minimal design obligations. ANSTO's position was that the contract established some specific design and coordination responsibilities.

3.30 In 2021 ANSTO identified lessons learnt from the SyMo project, including that:

- facility and process designs should be fully completed and certified prior to the commencement of tendering;
- complex projects should appoint a design manager; and
- 'construct-only' contracts should be used only for fully detailed designs.

3.31 The Icon contract established recourse mechanisms for failure to meet contractual obligations, including: defective work rectification; liquidated damages for delays to practical completion; a security clause in the form of a bank guarantee; breach notices; withholding of payment; and contract termination. The September 2021 amendment deed removed the continuing application of liquidated damages and established that Icon was no longer entitled to additional payments, extensions of time or delay costs.

3.32 ANSTO did not use contract recourse mechanisms until 2021. Initially there were attempts to resolve issues through meetings and discussions with Icon and GHD. From January 2021 ANSTO commenced applying the liquidated damages clause to reduce payments to Icon. Four breach notices were issued to Icon between October and December 2021 in relation to quality, safety concerns, potential equipment damage, defects, documentation, and failure to complete the entirety of works for practical and post-completion by the deadlines. Icon disputed ANSTO's breach notices and in turn issued a breach notice to ANSTO in November 2021, which ANSTO disputed. The Icon breach notice claimed that ANSTO had taken unlawful possession of parts of the works, failed to certify practical completion, failed to cooperate, and delayed parts of the works. In November 2021, ANSTO applied the security clause to offset ANSTO's loss. At March 2022, correspondence between ANSTO and Icon on legal matters was ongoing.

3.33 ANSTO advised the ANAO that there were no safety infringements or equipment damages requiring a breach notice until late 2021. Further, defects identified throughout the construction works were notified to Icon and 'usually attended to by Icon', negating the need to issue a breach notice until December 2021. ANSTO advised that it did not issue breach notices for late completion until Icon failed to complete works by the required dates in the amendment deed. In relation to quality and documentation issues, the lack of intermediary contractual milestones preceding practical completion may have contributed to the late activation of breach notices.

Management and reporting of SyMo acquisition risk

3.34 Key oversight arrangements for SyMo included the ANSTO Board for strategic oversight; a Steering Committee for monitoring SyMo project performance, providing direction and high-level issues resolution; and a Project Coordination Group to manage delivery of the project. Internal ANSTO staff fulfilled the role of the contract 'superintendent' responsible for managing the amended AS4000-1997 contract. Due to staff shortages in 2019–20, ANSTO temporarily assigned

both contract management (superintendent) and project management responsibilities to one staff member. The workload in the dual role was found to be unmanageable and the roles were separated by June 2020.

3.35 From 2011 project risks were registered in spreadsheets, reports and the Governance, Risk, Compliance and Assurance system (refer paragraph 5.27). In July 2020 the Steering Committee was told that risk workshops had been held and a comprehensive update had been made to the risk register. The August 2021 implementation plan included a process for risk management, as had previous plans. During audit fieldwork, the ANAO observed that ANSTO made updates to the primary SyMo risk register (containing 275 risks at January 2022).

3.36 Between January 2019 and December 2021, the Steering Committee met monthly and discussed risks at each meeting, including in relation to the Icon contract and delays to practical completion. Action items from the meetings included risk treatments. The Steering Committee received reporting from other working groups, such as the Synroc Technology Steering Group, on components of the SyMo project and associated risks.

3.37 The Project Coordination Group generally met monthly between January 2019 and December 2021 to discuss progress with input from working groups; there were discussions about risks, updates to the risk register for new and existing risks, and decisions to escalate risks through the project governance levels. In December 2021 it was noted by the Project Coordination Group that the risk register was not being reviewed on a monthly basis by all the team leads.

3.38 Between June 2019 and December 2021 the Board received high-level progress updates and risk reporting on the SyMo project. The level of detail presented to the Board varied.

Is nuclear medicine asset disposal effective?

Based on an analysis of two obsolete assets — Building 54 and the High Flux Australian Reactor — asset disposal is partly effective. There is limited planning, decision-making and activity in relation to Building 54. HIFAR disposal planning for the latest decommissioning phase is largely fit for purpose. Not all key deliverables were achieved as planned. The disposal of HIFAR has been delayed, in part due to external factors. Expenditure on HIFAR disposal to date is higher than varied budgets. While HIFAR disposal risks are identified, they are not actively managed or reported.

3.39 Disposal of physical assets is necessary when those assets reach the end of operational life, or are determined to be not fit for purpose, surplus to requirement, under-utilised, unserviceable, or non-compliant with legislation or regulation. Disposal options include decommissioning, refurbishment, demolition, and repurposing. Better practice involves the disposal of assets as soon as practicable after their useful life has ended. Where this cannot occur, the asset owner should assess the risks and establish plans and arrangements that will ensure safety.

3.40 The 2019 review of ANSTO's financial sustainability and governance arrangements identified the need for ANSTO to address ageing infrastructure, unfunded nuclear waste and decommissioning obligations (refer Appendix 3). The government allocated $77 million to ANSTO over four years in the 2020–21 Budget (including approximately $19 million per year, ongoing,

indexed) to support the decommissioning of assets, and the management of legacy radioactive waste and spent fuel.

3.41 The ANAO examined ANSTO's disposal planning and implementation for two non-operational nuclear medicine facilities: Building 54 (Mo-99 manufacture ceased in 2019) and HIFAR (taken out of operation in 2007).

Building 54

3.42 ANSTO commenced planning a replacement facility for Building 54 in 2012 through the preparation of a business case for the planned ANM facility. At this time, Building 54 was expected to cease operations in June 2017 and that it would be used as a back-up facility for the ANM facility and then 'closed and written-off'. In 2016 ANSTO commissioned an external review of Building 54 to assist with planning for the decommissioning process. The review made seven recommendations, which ANSTO accepted, including that ANSTO develop a decommissioning plan for Building 54. ANSTO did not implement the recommendations of the 2016 review, conduct any costings or evaluations of disposal alternatives or develop a disposal plan.

3.43 ANSTO advised the ANAO that from May 2017 to June 2021 it was considering options for alternate methods of iodine-131 production, which included the potential use of Building 54 for the process.[49] In July 2021 ANSTO advised the ANAO that it had not decided whether Building 54 would be decommissioned or repurposed. In email correspondence from July 2021 options such as re-purposing to a waste storage facility, upgrading to an intermediate level radioactive waste conditioning facility or applying for a decommissioning licence were discussed.

3.44 In July 2021 ANSTO decided to transfer the ARPANSA licence for Building 54 from ANSTO Health to the Waste Management Services division. ANSTO advised this would likely occur in mid-2022 after completion of inventories, risk assessments and updates to regulatory documentation. Building 54 has been managed under a 'delay and decay' strategy to reduce radiological hazards while ANSTO has been considering Building 54's future.[50]

3.45 The failure to promptly plan for the disposal of Building 54 is inconsistent with ANSTO's corporate objectives as expressed in corporate plans, the strategic asset management plan, the asset management policy and other procedures, International Atomic Energy Agency guidance and the recommendations of the 2019 review of ANSTO's financial sustainability and governance arrangements. Maintenance costs for Building 54 were $526,469 in 2020–21.[51]

49 Iodine-131 is used to image the thyroid; treat thyroid cancer and hyperthyroidism; and diagnose abnormal liver function, renal blood flow and urinary tract obstruction.

50 Common decommissioning strategies include immediate dismantling, where decommissioning activities begin shortly after permanent shutdown of a facility, or deferred dismantling, where all or part of a facility containing radioactive material is either processed or placed in safe storage, and the facility is maintained until it is subsequently decontaminated or dismantled. 'Delay and decay' involves holding the waste in storage until the desired reduction in activity has occurred through radioactive decay of the radionuclides contained in the waste. By waiting for sufficient radioactive decay, volumes of waste may be reduced and decommissioning may be carried out safely without resorting to remote handling practices.

51 Maintenance expenditure figures for 2020–21 were different when drawn from operational and financial information systems. The ANAO used operational figures because these incorporated work order and labour costs for proactive and corrective maintenance.

Recommendation no. 2

3.46 The Australian Nuclear Science and Technology Organisation develop an asset management or disposal plan for Building 54.

Australian Nuclear Science and Technology Organisation response: *Agreed.*

3.47 *ANSTO has commenced developing its action plan in response to this recommendation. The implementation of the actions will be monitored by our Risk and Audit Committee*.

High Flux Australian Reactor

3.48 The Australian Government announced a proposal for a replacement research reactor in September 1997; at this time, HIFAR was about 40 years old and expected to reach the end of its operational life in 2005. HIFAR was permanently shut down in January 2007.

Figure 3.2: The High Flux Australian Reactor

Source: ANSTO.

3.49 ANSTO commenced planning for the disposal of HIFAR in 1992. Disposal alternatives were evaluated by considering the International Atomic Energy Agency's defined stages for decommissioning reactors; other countries' strategies; future use of the Lucas Heights NSW site; volumes of waste that would be generated; safety risks; regulatory aspects; rate of radioactive decay; and the future availability of a national radioactive waste management facility, among other factors. Disposal option costs were considered. Disposal options evaluated between 1992 and 2015

included: immediate dismantlement and restoration of the site; a care and maintenance program of between 10 and 120 years' duration; and burial or entombment of reactor remains.

3.50 ANSTO ultimately selected a 'deferred dismantling' decommissioning strategy. Initial 2008 disposal planning established four phases: closure (2007 to 2011), safe enclosure (2011 to 2017), decommissioning (2017 to 2020), and final site clean-up and handover (2020). Following delays to the implementation of closure and safe enclosure activities, ANSTO adjusted the planned timeframes for each phase (Table 3.3).

Table 3.3: HIFAR deferred dismantling decommissioning strategy and outcomes

Phase	Stage	Primary activities	Original planned timeframes[a]	Revised planned timeframes[b]	Actual timeframes[c]	Original budget	Varied budget	Actual cost
Closure	1	Shutdown of the reactor and removal of fuel and other materials	2007 to 2011	2007 to 2012[d]	2007 to ongoing	$7.8m	$6.9m	$9.1m to 2012[e]
	2	Preliminary dismantling of non-radioactive redundant circuits and equipment						
	3	Refurbishment of key systems						
Safe Enclosure		Waiting period of care and maintenance, whilst radioactive inventory decays	2011 to 2017[f]	2012 to 2019[f]	2012 to ongoing[g]	$300,000 - $600,000 annually[h]		$293,605 in 2020–21
		Radiological characterisation work to identify radioactive inventory and further consideration of decommissioning planning	2011 to 2017[f]	2013 to 2020[i]	2013 to 2020	$9.7m	$7.9m[j]	$7.9m
Decom-mission-ing	A	Decommissioning and dismantling of peripheral plant and equipment	2017 to 2020	2020 to 2025	2020 to ongoing	$13.9m[k]	N/A	$2.6m at January 2022
	B	Decommissioning and dismantling of the reactor block and internal components		2025 to 2031	Not yet commenced			
Final site clean-up and site handover		Clean-up of the site and release from regulatory control	2020	2031	Not yet commenced			

Note a: At September 2008.

Note b: Revised planned timeframes according to implementation plans for each phase and including subsequent variations to timeframes.

Note c: At February 2022.

Note d: The planned completion date for the closure phase was initially March 2011 and was varied twice. The June 2012 completion date was approved in May 2011.

Note e: This figure does not include closure projects after 2012.

Note f: While ANSTO identified planned timeframes for safe enclosure, it also described safe enclosure to have an approximate 10-year waiting period and that exact timing was dependent on the availability of the National Radioactive Waste Management Facility.

Note g: ANSTO's care and maintenance activities continue as required on an ongoing basis under an ARPANSA Possess or Control licence.

Note h: The budget for care and maintenance was approximately $600,000 per year from 2012–13 to 2014–15. The budget was reduced to approximately $300,000 per year in later years.

Note i: The planned completion date was varied once from February 2019 to December 2020; this variation was approved in August 2019.

Note j: The budget was reduced by $2.2 million in 2016–17 because ANSTO redistributed funds to the shipment and processing of HIFAR's legacy waste. In 2019, when ANSTO indicated that characterisation works would be suspended due to the funding reduction, the budget was increased to $8.2 million to ensure that characterisation activities continued. In October 2020 the funding was reduced by $345,000.

Note k: The overall budget for the decommissioning phase, including both stages, was estimated to be $73.8 million in 2017.

Source: ANAO analysis of HIFAR disposal planning documentation.

HIFAR disposal — Closure phase

3.51 ANSTO was unable to provide a final implementation plan for the closure phase as a whole or for the first shutdown stage. For the second and third stages (preliminary dismantling and refurbishment), a plan was included in a September 2008 report to the Board. The preliminary dismantling stage involved 28 projects to dismantle and remove redundant plant and systems that were not significantly contaminated and there were 10 refurbishment projects.

3.52 In the report, the Board was presented with two options for preliminary dismantling and refurbishment. The preferred option involved an estimated cost of $7.9 million, while the other option of $6.7 million involved fewer activities that would not 'remove all the risks'. The approved budget was $7.8 million in 2010 and was reduced to $6.9 million by 2011. In February 2022 ANSTO advised the ANAO that the total cost of the closure phase to 2012 was $9.1 million. ANSTO was unable to provide actual expenditure on closure projects after 2012.

3.53 While ANSTO considered that closure works were 'practically complete' by May 2012, three of nine preliminary dismantling and refurbishment milestones were not completed. ANSTO continued to work on unfinished closure works during the safe enclosure phase. ANSTO advised the ANAO that 21 closure projects were not yet complete at September 2021.

3.54 In project status reports and in discussions with the ANAO, ANSTO identified the following primary reasons for delayed and incomplete closure works: a delay in progressing the Possess or Control licence that would allow ANSTO to conduct the closure phase works; ANSTO resourcing issues; and insufficient funding to complete closure projects due to a $900,000 reduction in budget. The funds were redistributed to other ANSTO projects based on monthly underspends for closure works.

HIFAR disposal — Safe enclosure phase

3.55 The safe enclosure phase involved a period of care and maintenance while radioactive inventory decay occurred and radiological characterisation work to identify radioactive inventory was undertaken.[52] Characterisation activities were closed in October 2020, later than initially planned but within the varied timeframes.

3.56 The first implementation plan for safe enclosure activities was approved by the Chief Engineer in January 2014. A 2015 plan established a budget of $9.7 million for characterisation including contingency. Characterisation was completed at a total cost of $7.9 million.

3.57 Four of the six key objectives and milestones for the characterisation stage were achieved. Two achieved objectives were delayed by about two years. The scope of reactor block characterisation was reduced. One of three planned deliverables was completed.

3.58 ANSTO indicated that the delays and incomplete milestones during the safe enclosure phase were due to: resourcing issues; reductions in funding; concerns raised by the ANSTO Heritage Committee about the removal of items during de-cluttering; and uncertainty around when a national radioactive waste management facility would become available to receive

52 Radiological characterisation involves collecting information and data on the physical, chemical and radiological conditions of the reactor.

waste generated from HIFAR decommissioning activities. In November 2019 ANSTO advised the government that, as for other ageing, damaged and non-compliant assets, the decommissioning of HIFAR was affected by delays in establishment of the national waste facility. Delays incurred costs to maintain HIFAR, which contains radioactive and contaminated material, in a safe state. Maintenance costs for HIFAR were $293,605 in 2020–21.

HIFAR disposal — Decommissioning phase

3.59 ANSTO developed a project management plan for stage A of the decommissioning phase that was approved by the Chief Engineer in February 2021. At April 2022, ANSTO advised the ANAO that a decommissioning licence application, including a supplementary decommissioning plan, was under internal review and due to be submitted to ARPANSA in May 2022. The stage A project management plan and the supplementary decommissioning plan outlined the rationale for the chosen deferred dismantling strategy. The two HIFAR decommissioning plans were largely comprehensive, including arrangements for risk identification and management.

3.60 ANSTO had commenced decommissioning activities in July 2020. At January 2022 decommissioning was in progress but early milestones had not been achieved. At January 2022 ANSTO noted that there had been an approximate one-year delay to project completion and forecasted a completion date of December 2025. ANSTO has indicated that there have been internal resourcing constraints during decommissioning activities.

Management of HIFAR disposal risk

3.61 The February 2021 decommissioning phase plan had arrangements for risk management, including that project risks would be tracked in the Governance, Risk, Compliance and Assurance system and the project manager would maintain a risk register and mitigation strategies. The plan also indicated that risks and issues would be monitored, reviewed and acted on during project governance meetings.

3.62 ANSTO established risk registers from 2010 for the various phases. General HIFAR facility risks were also recorded in the Governance, Risk, Compliance and Assurance system. The decommissioning phase project risk register identified 29 risks, each of which had a description, consequence, inherent risk rating, risk mitigation strategies and residual risk rating. Four risks did not have a risk owner. By mid-2021 internal reporting noted that the risk register was ‘falling behind’ and needed to be updated. At January 2022 the risk register was last reviewed in July 2021. Records of 2021 team meetings did not show regular review of the risk register.

3.63 ANSTO advised the ANAO that formal project governance meetings had not been held although there had been ‘informal meetings’ with internal stakeholders. Between August 2020 and October 2021 reporting to the Board stated that decommissioning was on track in terms of budget, schedule, scope, risks and issues, and resourcing. There was no specific risk reporting to the Board.

3.64 One of the risks identified by ANSTO in HIFAR disposal planning was the loss of knowledge and expertise through staff attrition over the long duration of decommissioning. ANSTO should capitalise on the expertise of ANSTO officials who were present during the

closure and safe enclosure phases and undertake a lessons learned exercise to inform future OPAL disposal planning.

Recommendation no. 3

3.65 The Australian Nuclear Science and Technology Organisation establish governance and risk management arrangements for the disposal of the High Flux Australian Reactor that are aligned with its February 2021 decommissioning plan.

Australian Nuclear Science and Technology Organisation response: *Agreed.*

3.66 *ANSTO has commenced developing its action plan in response to this recommendation. The implementation of the actions will be monitored by our Risk and Audit Committee*.

4. Asset maintenance

Areas examined

This chapter examines whether the Australian Nuclear Science and Technology Organisation (ANSTO) has effectively managed the maintenance of nuclear medicine assets.

Conclusion

ANSTO's management of nuclear medicine asset maintenance is progressing through the development of maintenance strategies and plans and with an increasing focus on proactive maintenance. Nuclear medicine asset management plans are largely fit for purpose. Maintenance planning maturity varies by facility and is not consistently monitored. Maintenance is often not timely. Although regulatory inspections and reviews address maintenance to some extent and there are key performance indicators, internal oversight of maintenance effectiveness through management system and internal audits could be expanded.

Areas for improvement

The ANAO made one recommendation to prioritise the development of maintenance strategies and plans for Building 23. The ANAO also suggested that decommissioning and risk could be better addressed in individual asset management plans; ANSTO should consider establishing metrics and benchmarks to monitor the proactive:corrective maintenance ratio and maintenance plan maturity; and the number of maintenance performance indicators for Building 23 should be commensurate with the other nuclear medicine facilities and the risk it presents.

4.1 Poor asset maintenance can lead to a shorter than envisioned useful life; a decrease in functionality and utilisation; a threat to human safety; or a legislative breach. Applying effective maintenance strategies was identified by ANSTO as one mitigation for the 'severe', 'almost certain' risk of radiopharmaceutical production being adversely affected by operational interruptions.

4.2 The Australian Government was advised in 2019 that due in part to insufficient depreciation funding and ANSTO's practice of re-allocating depreciation funding to cover operational funding shortfalls, in recent years the maintenance and upgrade of critical assets had deteriorated. In the 2019–20 Budget the government committed $13.9 million for maintenance work in nuclear medicine facilities and $18 million to maintain ANSTO's asset base over three years. In the 2021–22 Budget the government committed $94 million over four years to maintain Building 23 and $57 million over four years to support maintenance and renewal of infrastructure and equipment.

4.3 ANSTO's 'Multi-purpose Reactor 2055 Long Term Plan' identifies the elements of a maintenance management program that support asset availability and reliability. In addition to effective management of contracted maintenance, these comprise:

- effective maintenance planning;
- proactive (predictive and preventative) maintenance that aims to reduce failure;
- corrective maintenance that responds in a timely and considered way to failures; and
- maintenance assessments.[53]

53 Contracted out maintenance services were infrequent for maintenance conducted at the asset level and so were excluded from the audit scope.

4.4 The ANAO examined practices across these four elements, with a focus on the operational nuclear medicine facilities — the Open Pool Australian Lightwater (OPAL) reactor; the ANSTO Nuclear Medicine Molybdenum-99 (ANM) facility and Building 23.

Is nuclear medicine asset maintenance planning fit for purpose?

Asset management plans for individual assets and supporting documentation are largely fit for purpose. Asset management plans could more comprehensively consider decommissioning and risk. Maintenance procedural documentation for OPAL, Building 23 and the ANM facility is comprehensive and mainly up to date. There is strategic maintenance planning based on Reliability Centred Maintenance principles; however, planning is at different levels of maturity across ANSTO nuclear medicine assets. Half of the maintenance plans relating to Building 23, the highest risk asset, are unreviewed (the lowest level of maintenance plan maturity) and none are optimised (the highest level).

Asset management plans

4.5 Asset management plans give practical direction to day-to-day management of assets, including operations and maintenance. The enterprise-level strategic asset management plan required all ANSTO assets or specific groups of assets to establish an asset management plan. ANSTO asset management plans are meant to be active for a rolling five-year period, updated annually, recommended by the appropriate portfolio review committee (PRC) and endorsed by the Engineering Council and Investment Review Committee (IRC).[54]

- Records indicate that at October 2020 there were 24 asset management plans across ANSTO, including for each nuclear medicine facility except Building 54.
- The content of the OPAL, ANM facility, Building 23 and High Flux Australian Reactor (HIFAR) plans was aligned to the requirements of the asset management policy and plan template. There were variations in the level of detail between the asset management plans.
- Review and endorsement requirements were not consistently adhered to. Asset management plans were last endorsed by the Engineering Council in April 2021 but the OPAL, ANM facility, Building 23 and HIFAR asset management plans did not evidence PRC recommendation or IRC endorsement.
- The ANM facility asset management plan was updated annually. The HIFAR and OPAL asset management plans specified a review date that was not annual. This was not consistent with the requirement for an annual review. It was not possible for the ANAO to confirm that the Building 23 asset management plan was reviewed annually as it was undated with no review date specified.
- The Engineering Council Charter did not mention the endorsement requirement and should be updated.

54 The IRC was replaced by the Capital Committee in July 2021 as part of governance changes. At November 2021 endorsement requirements had not been updated.

4.6 Asset management plans reference a suite of other guidance and procedures, which in turn reference more detailed documents. The ANAO assessed the asset management plans and associated planning documentation against ANSTO policies and guidelines; International Organization for Standardization (ISO) asset management standards 55000 and 55001; and other asset management best practice principles.[55] The asset management plans were largely fit for purpose. There were gaps in relation to decommissioning and consideration of risk.

4.7 For each facility, Table 4.1 presents an assessment of risk planning in asset management plans or related risk documentation. Overall, the ANAO found there was inconsistent and duplicative recording of risks for the nuclear medicine assets. The ANAO also reviewed the Nuclear Science and Technology Group's research platform asset management plans and noted inconsistencies across platforms as to how risk was assessed and referred to.

Table 4.1: Consideration of risk in asset management plans

Risk considerations	OPAL	Building 23	ANM facility	HIFAR	Building 54
Risks were identified	●	●	●	●	●
Identified risks were assessed	◕	●	◑	●	●
Controls were specified	◕	◕	◔	●	◕
Mitigations specified[a]	◕	◑	◔	○	N/A[b]

Legend: ● Criteria met; ◕ Largely met; ◑ Half met; ◔ Partly met; ○ Not met; N/A — Not Applicable

Note a: For risks exceeding the risk appetite. The ANAO considered risks with a residual risk rating of 'high' or 'very high' in accordance with the ANSTO general risk appetite statement. The ANAO did not further classify risks as safety-related; safety-related risks have a lower risk appetite meaning that the judgements applied by the ANAO may overstate compliance.

Note b: No Building 54 identified risks were rated 'high' or 'very high'.

Source: ANAO analysis of asset management plans and risk documentation.

Maintenance planning

4.8 Operational and maintenance procedural documentation was held within multiple electronic document records management systems.

- The ANAO drew a stratified random sample of 76 operational (from a population of 738) and 68 maintenance (from a population of 700) documents to assess whether procedural documentation was up to date. All documents were appropriately updated except in OPAL (where seven per cent of maintenance documents were not up to date) and Building 54 (where 37 per cent were not up to date).
- The ANAO assessed the comprehensiveness of relevant maintenance procedural documentation against ISO 55000 standards and better practice guidance. The high-level

55 International Organization for Standardization, *ISO 55000: 2014 Asset management – Overview, principles and terminology*, and *55001:2014 Asset management systems: Requirements.* The ANAO considered documentation that supported information detailed in the asset management plans, such as Safety Analysis Reports, contingency and business recovery plans, risk registers, risk assessments and business plans.

review found that documentation was comprehensive in all examined areas except deferred maintenance, which was explicitly considered for OPAL only.

4.9 Maintenance strategies are used to control and mitigate the risk of critical failures occurring. A maintenance strategy template based on Reliability Centred Maintenance principles was introduced at the entity level in 2014.[56] OPAL, Building 23 and HIFAR asset management plans stated that maintenance strategies were to be based on Reliability Centred Maintenance principles. While the ANM facility asset management plan did not indicate whether strategies should be based on Reliability Centred Maintenance principles, the template was used. Plant maintenance procedures required a maintenance strategy template to be completed for any equipment requiring maintenance.

4.10 At December 2021, maintenance strategies totalled:

- sixty-two for OPAL;
- twenty-two for the ANM facility;
- one for HIFAR; and
- one for Building 54.

4.11 In addition there were 73 maintenance strategies administered by ANSTO Maintenance and Engineering Group (AME), for provision of support services to OPAL, the ANM facility, Building 23, HIFAR and Building 54. AME maintenance strategies cover systems such as gas detection systems, lifting devices, compressed air systems, cleaning, grounds maintenance, elevator lifts and pest control.

4.12 ANSTO advised the ANAO that there were 16 non-AME strategies for Building 23. The ANAO was unable to confirm the existence of the Building 23 strategies as internal documentation was unclear and some strategies were in draft form.

4.13 The 'optimisation' of maintenance strategies and plans began in late 2014. There is no consistent enterprise-wide definition for strategy 'optimisation' (refer Figure 4.1 and paragraph 4.20). ANSTO advised the ANAO that an optimised strategy may suggest that all sub-ordinate maintenance plans were optimised, no further development work was required or the strategy was signed off by the asset manager. Maintenance strategies for each nuclear medicine facility were at different stages of maturity. A December 2019 report to the Risk and Audit Committee stated that while OPAL strategies had been based on Reliability Centred Maintenance principles for over a decade, Building 23 and ANM facility strategies were at 'baseline maturity'.

4.14 Maintenance strategies were linked to more detailed maintenance plans. Unlike strategies, plans were established in the asset information system, System Applications and Products (SAP). At November 2021 there were 3712 maintenance plans in SAP relating to OPAL, Building 23, the ANM facility, HIFAR, Building 54 and AME. An AME maintenance plan could apply simultaneously to multiple facilities.

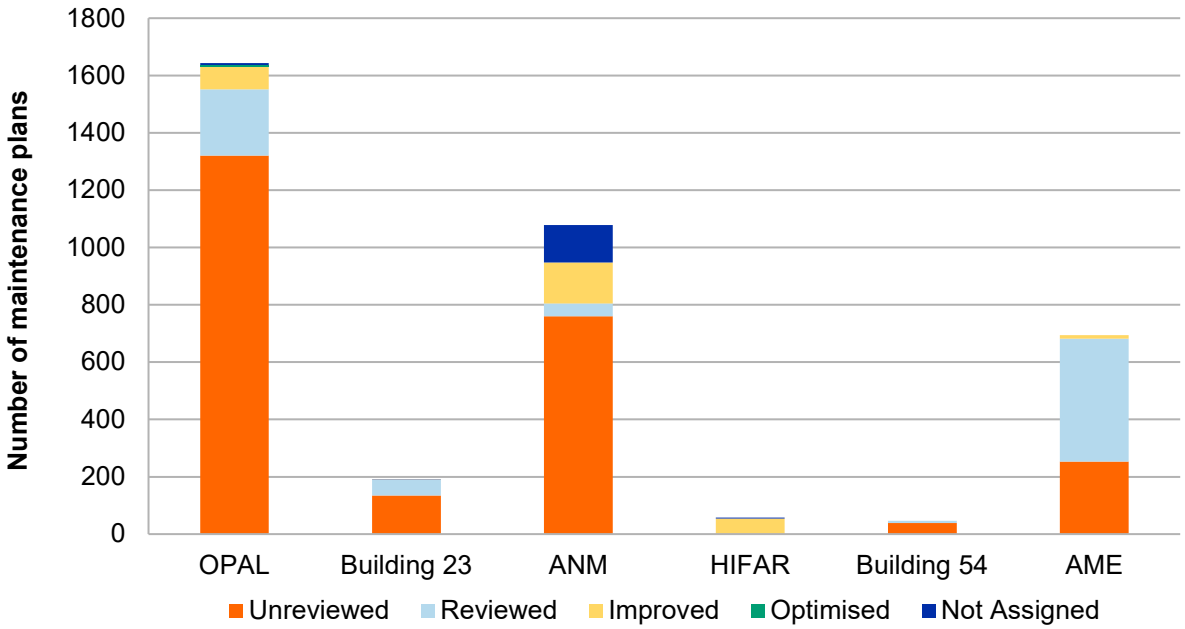
56 The Reliability Centred Maintenance framework is premised on the systematic identification and analysis of failure modes and mitigations with the aim of ensuring that the risk and cost of failures are considered in decision-making.

4.15 While ANSTO has not established a target or timeline for completion of maintenance strategies and plans, the objective is optimisation. Maintenance plans were at different stages of maturity (Figure 4.1). Of the 3712 plans, 2509 were classified as unreviewed, 767 reviewed, 288 improved, 141 were not assigned, and seven optimised.

4.16 One of three recommendations from the business case for the replacement of Building 23 (refer paragraphs 3.8 to 3.13) was that Building 23 would need to be kept operational until at least 2031, when the replacement facility was built and could be used for nuclear medicine production. In the 2020–21 Budget, the government committed $45.7 million over four years to maintain Building 23 in recognition of its critical role in the secure supply of nuclear medicine. In the 2021–22 Budget, the government built on this commitment by allocating an additional $56.9 million over four years to undertake additional maintenance and renewal of ANSTO infrastructure and equipment.

4.17 In June 2021 the government was advised that detailed asset management planning was being undertaken to identify maintenance priorities for Building 23. Of 192 Building 23-specific maintenance plans, 135 were unreviewed, 54 were reviewed, two were improved, and one was not assigned. None were optimised. Of the 446 AME maintenance plans that applied to Building 23, 178 were unreviewed, 267 were reviewed, one was improved, and none were optimised. In summary, of 638 relevant maintenance plans, three were improved.

Figure 4.1: Status of maintenance plans by nuclear medicine facility, November 2021



Note: AME definitions: Unreviewed — Older plan in the system, not reviewed, and not referenced in a maintenance strategy. Reviewed — Plan is reviewed, assigned a strategy reference, and a maintenance strategy is attached to service for objects. Improved — As above for reviewed plus additional documents are attached, such as standard operating procedures, relevant service manuals, drawings, and supplier details and contacts. Optimised — A strategy that contains all information that is required cognisant of the level of detailed required for the specific plan and signed off. ANSTO advised the ANAO that Building 23 had fewer maintenance plans than OPAL and the ANM facility because it was not using the relevant SAP module nor the maintenance strategy concept when the system and concept were first introduced. ANSTO Health was retrospectively creating Building 23 maintenance strategies for active maintenance plans already in the system. Further, Building 23 had a relatively higher number of maintenance plans managed by AME.

Source: ANAO analysis of ANSTO SAP data at 19 November 2021.

Recommendation no. 4

4.18 Given its importance to the secure domestic supply of nuclear medicines until at least 2031, the Australian Nuclear Science and Technology Organisation prioritise the development and finalisation of maintenance strategies and plans for Building 23.

Australian Nuclear Science and Technology Organisation response: *Agreed.*

4.19 *ANSTO has commenced developing its action plan in response to this recommendation. The implementation of the actions will be monitored by our Risk and Audit Committee*.

4.20 Reporting on maintenance plan maturity is not consistent across ANSTO. OPAL management advised the ANAO that it does not apply the AME definition of 'unreviewed', 'reviewed', 'improved', and 'optimised' to report on maintenance plan maturity and uses a different methodology. At September 2021 it reported that 80 per cent of OPAL maintenance plans listed in maintenance strategies were complete. To ensure plan maturity can be effectively monitored, ANSTO should adopt a consistent approach to assessing maturity that is accepted and used by all asset owners.

Does ANSTO conduct proactive maintenance?

An enterprise-level position on the appropriate ratio of proactive to corrective maintenance for different assets has not been established. The ratio is not monitored. The proactive to corrective maintenance ratio is increasing.

4.21 Corrective maintenance is maintenance that is carried out after failure is detected and is aimed at restoring an asset to a condition in which it can perform its intended function. Examples of corrective maintenance include repairs or responding to errors, alarms, leaks and faults. A deliberate corrective maintenance strategy is referred to by ANSTO as 'run to failure'. The ANSTO Risk and Audit Committee was advised in February 2021 that a run to failure maintenance strategy is only suitable for low risk assets.

Case study 1. Corrective maintenance: Conveyer belt failure in Building 23

In June 2018 a conveyor belt in Building 23 failed due to a mechanical failure in a low value, simple component that had been operating without incident for about 20 years. The incident halted production and led to a three-month interruption to ANSTO production of Technetium-99m generators. Urgent repairs were undertaken. Eight days after the incident, a limited supply of generators was secured through import to address domestic demand. Rectification of the mechanical problem took longer than anticipated leading to reliance on a costly international logistics process, and postponements and cancellations of medical procedures. The estimated net cost to ANSTO was about $15 million.

4.22 Proactive maintenance includes condition monitoring (tasks that analyse asset condition data to detect and predict failures) and fixed-time preventive maintenance (periodic tasks that address failure modes and aim to renew equipment to lessen the likelihood of failure). In its response to the 2020–21 Budget announcement of additional funding to ANSTO, ANSTO noted that the funding would be used to support, in part, the proactive maintenance of ageing infrastructure.

Case study 2. Proactive maintenance: Electrical supply and resilience project

Following costly shutdowns in OPAL reactor operations due to electrical supply issues, ANSTO commissioned external reviews in 2015 and 2018 to analyse the causes and identify potential solutions. Problems relating to the reliability of the electrical feed to ANSTO, obsolete switchgear, inadequate earthing and other infrastructure weaknesses were identified among other causes. A project was established to better protect assets and enhance their resistance and recovery from power dips. In addition to better communications with stakeholders, improvements were made to physical assets (including fume cupboards and control systems, fire alarm panels, buildings, a diesel generation plant and ventilation systems). ANSTO analysis showed that the number of unplanned OPAL outages decreased from an annual average of 3.2 between 2006–07 and 2016–17 (when improvements were made) to fewer than one. ANSTO estimated $4.6 million in savings between 2017 and 2021.

4.23 ANSTO maintenance strategies and plans reference corrective and proactive tasks. Corrective work orders are generated from requests (referred to as notifications), which are raised in SAP. Maintenance plans automatically generate proactive work orders (Appendix 4). The work orders describe the work to be performed, scope and frequency.

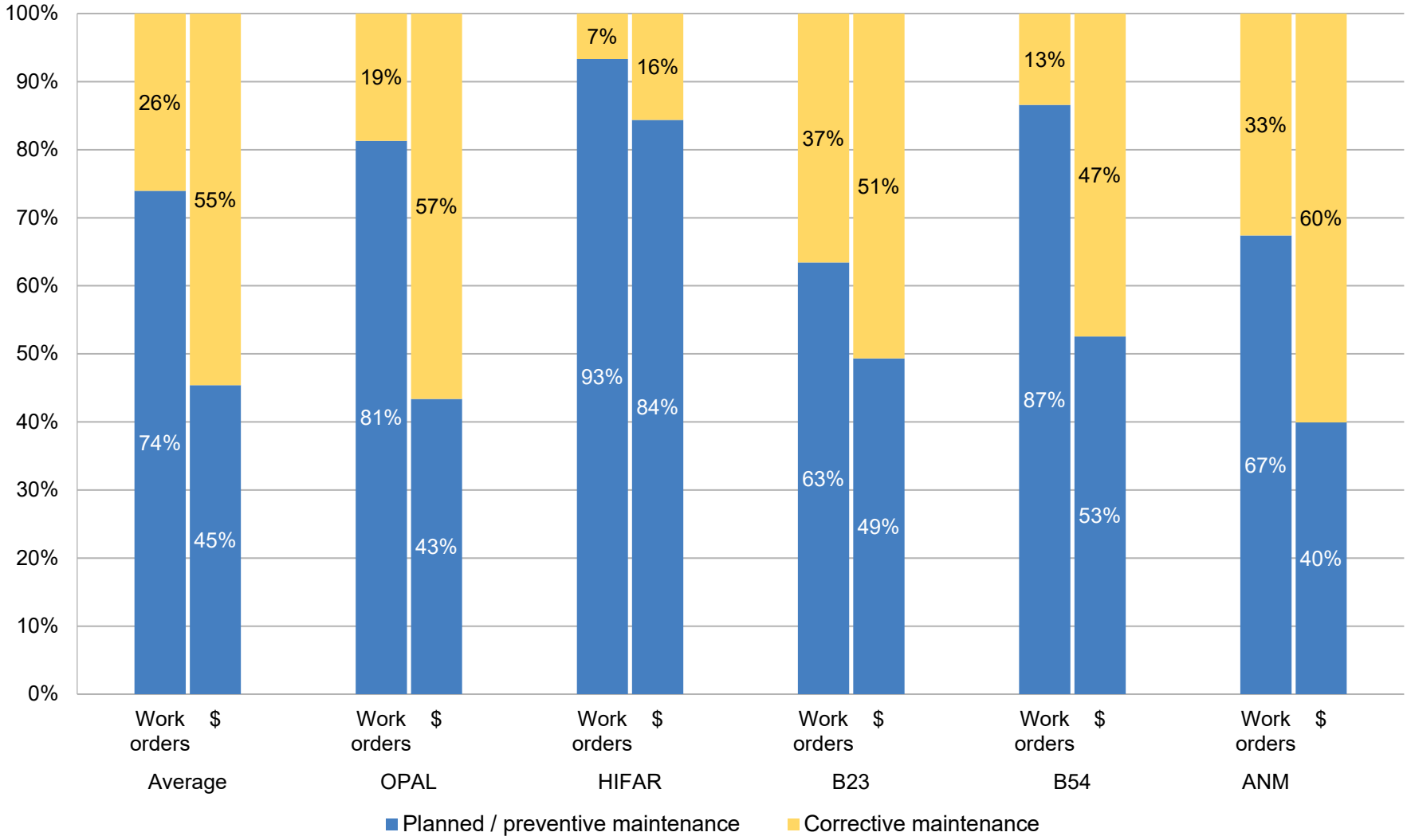
4.24 A 2016 internal audit report on maintenance practices found that in 2014–15 about 6400 work orders were generated by AME, of which 36 per cent were related to 'planned' works and 64 per cent to 'unplanned' requests for maintenance or repair. ANAO analysis identified that, in 2020–21, around 8900 maintenance work orders representing about $6.3 million in expenditure were generated for the nuclear medicine assets and reactors. Overall, 74 per cent of work orders were for proactive maintenance (ranging from 63 per cent for Building 23 to 93 per cent for HIFAR).

4.25 The ratio of proactive to corrective maintenance is typically assessed on a cost rather than work order basis. A 2002 ANSTO-commissioned review of the site services maintenance strategy found that the maintenance cost ratio was 35 per cent planned to 65 per cent reactive, compared to a better practice benchmark of 60:40.[57]

4.26 In 2020–21, on a cost basis, proactive maintenance represented 45 per cent of costs and corrective maintenance 55 per cent for the five assets combined (Figure 4.2). This was closer to but still below the 60:40 ratio identified as desirable and achievable in 2002. The ratio for the dormant nuclear medicine assets (HIFAR and Building 54) was 84:16 and 53:47, respectively, and stood at between 40:60 and 50:50 for the operational facilities. ANSTO advised the ANAO that 51 per cent corrective maintenance costs for Building 23 is commensurate with a facility built in 1959, and that 60 per cent corrective maintenance costs for the ANM facility is to be expected in a facility built in 2019 (because of unknown factors in early operation).

57 Although the industry best practice benchmark was considered to be 80 (preventive):20 (reactive), the reviewers suggested that an 80 per cent planned target 'could be optimistic given the age of ANSTO's buildings' and viewed 60 per cent as more achievable.

Figure 4.2: Proactive versus corrective maintenance, 2020–21



Note: Some business areas allocate internal maintenance labour costs directly to a cost centre rather than through a work order; where this occurred labour costs were allocated by ANSTO to preventive/corrective on a pro-rata basis. The ANAO did not validate work order expenditure.

Source: ANAO analysis of data prepared by ANSTO from SAP.

4.27 There is no enterprise-wide guidance as to relative emphasis for different assets or asset types. ANAO meetings with ANSTO nuclear medicine asset owners, senior executive and Board members demonstrated that while there was general agreement that the appropriate strategy will depend on the asset and its risk profile, positions and views varied as to the appropriateness of a run to failure strategy for Building 23 and there was no established position.

4.28 ANSTO advised the ANAO that the proactive to corrective maintenance ratio is not monitored or benchmarked as the focus has traditionally been instead on regulatory compliance (higher 'criticality' is assigned to maintenance work needed to comply with regulations and statutory authorities; refer paragraph 4.32). ANSTO should consider establishing metrics and benchmarks to monitor the proactive:corrective ratio over time and across facilities.

Is maintenance timely?

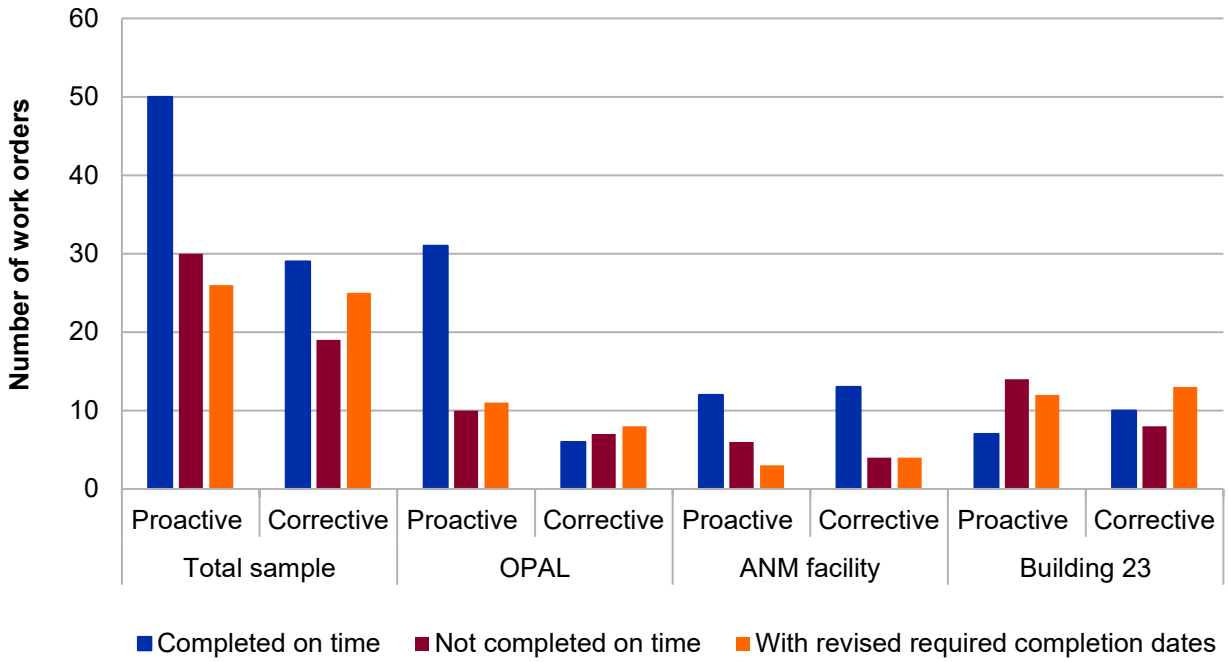
Based on a sample of completed work orders, ANSTO does not consistently meet its timeliness targets for maintenance. Work orders — including higher criticality work orders — are not always completed on time and assigned priority timeframes are not consistently met. Measuring maintenance timeliness is difficult using available information in the maintenance information system, SAP.

4.29 The priority status and required completion dates for proactive work orders are pre-populated based on the associated maintenance plan. A maintenance planner manually enters a priority, start date and completion date for corrective maintenance work orders during triage.

4.30 The ANAO examined the timeliness of execution of proactive and corrective work orders created between 1 January 2021 and 30 November 2021 based on a stratified random sample of 175 work orders (from a population of 11,008).

4.31 Analysis of timeliness was complicated by: key dates in the workflow not being visible within SAP or monitored; differences between facilities in procedures; and the common practice of revising required start and completion dates within SAP to align with available resources and scheduling. The ANAO compared the required completion date to the work completed date (Figure 4.3).

Figure 4.3: Timeliness of sampled completed proactive and corrective maintenance work orders, January to December 2021



Note: Only work orders completed at 31 December 2021 were included in the analysis. Work orders due to be completed by 31 December 2021 but not completed were excluded. The data in the figure above will therefore overstate timeliness.

Source: ANAO analysis of work order data in SAP.

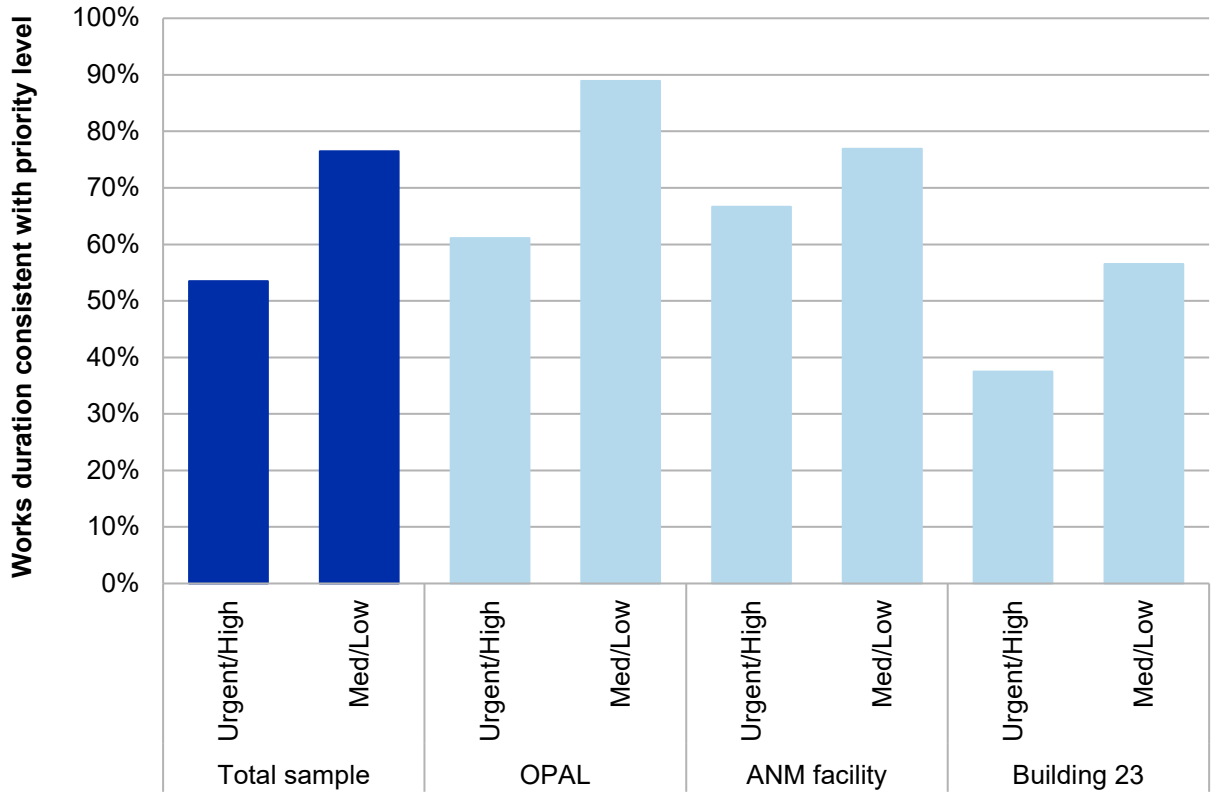
4.32 Criticality is assigned to work orders using a five-point scale in SAP with the highest criticality levels of 1 and 2 assigned to maintenance work needed to comply with regulations and statutory authorities. For proactive maintenance, sampled completed maintenance work orders assigned a criticality rating of 1 or 2 were completed by the required completion date 94 per cent of the time for OPAL; 63 per cent for the ANM facility; and 23 per cent for Building 23. For corrective maintenance, sampled completed criticality 1 and 2 work orders were completed by the due date 50 per cent of the time for OPAL; 80 per cent for the ANM facility; and 57 per cent for Building 23.

4.33 A 2016 internal audit of maintenance services found that, based on a sample of work orders issued to contractors by AME, the work specified in several work orders had been completed 'long after the required completion date', ranging from one month to 18 months late. The internal audit noted that while there may be legitimate reasons for delay, it was an unmet expectation that reasons for delay would be explained in supporting documentation. The ANAO also found that in most cases, while there was a high-level explanation in SAP about the completed work, there was a lack of detailed commentary with supporting documentation attached. As was found in the 2016 internal audit, narration had limited information about reasons for delays.

4.34 Proactive and corrective work orders should be completed within a standard timeframe based on assigned priority level. The ANAO tested whether the duration of works for the sampled completed work orders was in accordance with the assigned priority timeframe (Figure 4.4). Proactive and corrective work orders were not consistently completed in a timeframe required

by the priority level, particularly for urgent/high priority works and for Building 23. This was the case even when based on a duration calculation where the start point was defined by the maintenance planner rather than when the need was identified.

Figure 4.4: Percentage of sampled proactive and corrective work orders completed in accordance with priority, January to December 2021



Note: Priority timeframes are within one day for 'urgent' work, within one week for 'high priority' work, within one month for 'medium priority' work and within two months for 'low priority' work.

Source: ANAO analysis of work order data in SAP.

Does ANSTO obtain assurance over maintenance practices?

ANSTO obtains partial assurance over maintenance practices. There are performance indicators to monitor maintenance performance. The regulator, the Australian Radiation Protection and Nuclear Safety Agency, periodically reviews maintenance practices as part of safety inspections. ANSTO management system and internal audit coverage of asset maintenance has been limited in the seven years to 2020–21 and there has been little specific consideration of the nuclear medicine assets.

Management system and internal audit coverage

4.35 Technical audits (known as management system audits) and internal audits are conducted by ANSTO as the second and third lines of defence in its 'five lines of defence' assurance model

(refer paragraph 5.26).[58] The ANAO examined the degree to which management system and internal audits considered maintenance from 2015–16 (refer Table 4.2).

4.36 Management system audits have provided some assurance regarding maintenance management. Between 2015–16 and 2021–22, there were 24 management audits that substantively addressed maintenance in the audit name, objective, scope, criteria or reason. On average, each audit was estimated to involve 27 investigation hours. The completed management system audits have made a number of useful observations regarding the application of proactive maintenance, the development of maintenance strategies, the management of maintenance work orders, the recording of operational incidents and training for maintenance planners.

4.37 Internal audit coverage of asset maintenance has been limited and there was no coverage after 2016–17.

4.38 Specific coverage of the nuclear medicine production assets by management system and internal audits also has been limited.

4.39 In an assurance mapping exercise in 2018–19 conducted by the internal audit function (refer paragraph 5.23), assurance with respect to site management and maintenance services was described as 'to be mapped' and noted that 'only limited details concerning … assurance arrangements' for this function were available in the business management system.

58 The other lines of defence are (1) supervisory monitoring and line management review; (4) external audit, certifying bodies and regulators; and (5) the Risk and Audit Committee. The second line of defence is described as: '(2) internal specialist functions including risk management, work health and safety, and management system audits'.

Table 4.2: Management system and internal audit coverage of maintenance, 2015–16 to 2021–22

	Extent of coverage	Focus of coverage	Overall conclusion	Areas for improvement
Internal audits	• 61 planned internal audits • 2 related to asset management; none since 2016–17	• 2015–16 — works planning, contractor engagement and management by AME • 2016–17 — contractor supervision with a focus on safety	The 2015–16 audit found there were opportunities to improve; however, on the whole the internal control arrangements were satisfactory	13 recommendations, including to monitor timeliness of work orders; update and clarify operating instructions; and improve the contractor payment process
Management system audits	• 459 planned between 2016–17 and 2021–22 • 80 involved central site services • 28 substantively addressed maintenance in the audit name, objective, scope, criteria or reason • 24 of 28 were completed, underway or programmed to occur • On average, each involved an estimated 27 hours of work, or about 125 hours total coverage per year	• Maintenance procedures or processes (7) • Projects (7) • Contractor reviews (5) • Maintenance strategies and plans (2) • Work order management by AME (2)[a] • 2021–22 audit on condition monitoring postponed • Very few maintenance-related management system audits specifically for nuclear medicine assets	The ANAO examined 10 audit reports involving maintenance strategies, plans, orders or procedures[b] Management systems, internal control and/or compliance were:[c] • ‘satisfactory’ (2) • ‘improvement required’ (3) • ‘corrective actions required’ (3) • no overall conclusion (2) • no instances of an overall ‘unsatisfactory’ finding	Selected recommendations: • HIFAR — update procedures • OPAL — improvements to maintenance strategies • Waste Management Services — improve SAP documentation and maintenance incident reporting • AME — updates to the facilities management manual, guidance for maintenance triage, and improvements to work order record-keeping for Building 23

Note a: One was unspecified.

Note b: Two of 11 management system audit reports relating to these topics covered the same audit.

Note c: ‘Satisfactory’ (The management system(s) together with internal control and compliance arrangements examined are satisfactory, and provide ‘reasonable assurance’ as to the achievement of business objectives and management of defined processes in accordance with the standard and regulatory requirements).

‘Improvement required’ (Some specific weaknesses in the internal control environment have been identified that are mostly regarded as being of ‘low’ significance. On the whole, the management systems together with internal control and compliance arrangements examined are satisfactory).

‘Corrective actions required’ (Numerous ‘moderate’ and/or ‘high’ significance weaknesses in the internal control and/or compliance environments).

‘Unsatisfactory’ (The extent, nature and severity of internal control weaknesses and non-compliance concerns identified indicates that the existing internal control environment is not adequate, appropriate or effective. Management must give urgent attention to addressing issues identified).

Source: ANAO analysis of internal audit and management system programs and completed reports.

Maintenance performance indicators

4.40 Maintenance-focused management system audits made several findings regarding potential improvements to the maintenance key performance indicators, including more of them and greater specificity. The 2015–16 internal audit of maintenance services recommended that AME report, on a monthly basis, corrective work orders that had exceeded the required completion date and that an existing report on maintenance backlog be extended to include timeliness statistics and trends.

4.41 Of almost 400 internal and external asset performance measures examined by the ANAO (refer paragraph 5.18), 31 related directly to maintenance. All major facilities and platforms had at least one maintenance performance indicator. There was one common measure for the four platforms within the Nuclear Science and Technology (NST) Group, four for AME, seven for the Nuclear Medicine division (of which seven applied to the ANM facility and three to Building 23) and 16 for OPAL.

4.42 There is a lack of consistency across the different facilities in the number and nature of maintenance metrics. Maintenance performance indicators covered the completion of critical maintenance by scheduled dates (NST; AME; OPAL); the closure/completion of work orders (AME; OPAL); the conduct of maintenance review meetings (AME); the optimisation of maintenance strategies (OPAL); maintenance backlog (OPAL; Nuclear Medicine); and production delays due to breakdowns (Nuclear Medicine).

4.43 Given the risk it presents and the additional funding, ANSTO should consider whether there is sufficient performance indicator coverage of Building 23 maintenance.

4.44 The single publicly reported measure is 'on time completion of critical site compliance maintenance'. A target of 95 per cent was established. This key performance indicator, which relates to the performance of AME, was introduced in the 2021–22 Corporate Plan. Other measures are internal measures, with some reported to divisional or work group management. Some measures are not reported at all, raising questions about their function and utility.

Regulation

4.45 Periodic Safety and Security Reviews (PSSRs) assess a facility's overall safety and security performance. As a condition of its operating licence, an OPAL PSSR must be submitted to the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) at 10-yearly intervals, most recently in November 2021. The November 2021 draft OPAL PSSR made some observations in relation to maintenance. At January 2022 planning for the first Building 23 PSSR was underway. The first ANM facility PSSR will be due in 2026.

4.46 ARPANSA conducts inspections on a rolling two-year basis covering a number of performance criteria. The ANAO reviewed 39 publicly available ARPANSA inspection reports for ANSTO nuclear medicine assets relating to the period 1 January 2015 to 31 December 2021.[59] Thirteen inspections covered maintenance either solely or in combination with other criteria. Seven of the 13 reported at least one finding in relation to maintenance; six had no findings. There were a total of 11 negative findings, as well as some good practices identified in OPAL.

59 One report was not made public for security reasons. This report related to a facility that was not relevant to the audit.

5. Asset performance

Areas examined
The ANAO examined whether the Australian Nuclear Science and Technology Organisation (ANSTO) effectively measures, monitors and reports on its asset performance.

Conclusion
ANSTO's measurement and monitoring of asset performance is partly effective. There could be a greater focus on the nuclear medicine function in public performance reporting, and a more coherent and comprehensive asset performance framework at the enterprise level. Reporting to internal and external stakeholders is continuing to develop.

Areas for improvement
The ANAO made two recommendations aimed at developing an entity-level asset performance framework and improving the completeness and rigour of public performance measures. The ANAO also suggested that ANSTO should develop outcome/impact measures for the nuclear medicine assets and develop an 'operational dashboard' for incident data that is similar to the ANSTO 'safety dashboard'.

5.1 Effective performance reporting and monitoring arrangements are a key aspect of good governance, public sector accountability and asset management.[60] An asset management framework should establish the performance requirements of assets to obtain assurance that assets are fulfilling their required purpose. The ANAO considered whether: there is an enterprise-wide asset performance measurement strategy; asset performance indicators are fit for purpose; and asset performance information is adequately monitored and reported.

Does ANSTO have a fit for purpose asset performance measurement strategy?

There is no enterprise-level performance measurement strategy that establishes the necessary asset performance indicators and the required level of asset performance. Specific procedures for performance measurement are largely managed within each group or division independently of the others. Detailed frameworks linking performance metrics with ANSTO objectives and providing some methodological information exist for the Open Pool Australian Lightwater (OPAL) reactor. They do not exist for the other nuclear medicine facilities.

5.2 High level strategic documents (such as ANSTO's Quality Policy, Risk Appetite Framework, Operational Framework, Business Plan 2016–20 and Corporate Plan 2021–22) outline ANSTO's broad approach to measuring performance.[61] The asset management policy includes a commitment to base decisions on data; continually improve through benchmarking and performance measurement; and establish a required level of performance. The

60 Department of Finance, *Resource Management Guide No.131*: *Developing good performance information*, May 2020, and International Organization for Standardization, *ISO 55000:2014 Asset management – Overview, principles and terminology,* International Organization for Standardization, Switzerland, 2014.

61 The ANSTO Business Plan 2016–20 was prepared at the direction of the Chief Executive Officer in 2016 and expired in 2020. ANSTO advised the ANAO that there was no intention to reissue the document.

2019 enterprise-level strategic asset management plan established an intention to measure, assess and report on the performance and health of assets. It noted as a 'strategic action' the intention to establish an asset performance framework. At February 2022 this had not been completed.

5.3 In October 2021 the Chief Executive Officer issued 25 'executive' key performance indicators (KPIs). The KPIs built on measures developed at the group, division or asset level and were supported by documentation of metric definitions, targets, tolerances, owners and reporting frequency. The purpose was described by ANSTO as providing an enterprise-wide approach to performance measurement that was aligned to the corporate strategy. The set of executive KPIs provides a high level performance picture, and includes one operational measure for the two nuclear medicine facilities (Delivery in Full on Time; refer paragraph 5.10), as well as a maintenance compliance measure which applies to all group executives.

5.4 The strategic asset management plan stated that performance indicators were to be provided in individual asset management plans. Individual asset owners were responsible for designing, measuring, and monitoring performance measures through a 'bottom-up' model.

5.5 The OPAL, Building 23 and ANSTO Nuclear Medicine Molydenum-99 (ANM) facility asset management plans include KPIs that are mapped against service requirements. KPI sets range from 29 performances areas (some containing multiple performance indicators) for OPAL, to two performance indicators (reliability of supply and net profit) for the ANM facility and Building 23. The 2022–26 Building 23 asset management plan expanded the list of measures and noted their development as an action to be completed.

5.6 Asset management plans did not provide specific direction on performance measurement, analysis or reporting, such as the rationale for the choice of measures, methodology or reporting mechanisms. Separate to the asset management plans, some procedures and instructions for asset performance measurement existed for the Reactor Operations division and the Nuclear Science and Technology (NST) Group. There were no equivalent procedures and instructions for Building 23 and the ANM facility. At the level of individual nuclear medicine assets, assigned roles and responsibilities for performance measurement were clearly identified for all facilities.

Recommendation no. 5

5.7 The Australian Nuclear Science and Technology Organisation establish an enterprise-level asset performance measurement framework that identifies asset performance requirements, metrics and methodology — which may vary by facility/platform depending on the asset's characteristics.

Australian Nuclear Science and Technology Organisation response: *Agreed.*

5.8 *ANSTO has commenced developing its action plan in response to this recommendation. The implementation of the actions will be monitored by our Risk and Audit Committee*.

Are ANSTO's asset performance indicators fit for purpose?

ANSTO's nuclear medicine performance indicators are largely fit for purpose. A selection of eight key asset performance measures that are publicly reported are largely adequate. Public performance reporting does not sufficiently address ANSTO's nuclear medicine function. Although internal asset performance measures are well balanced, there is a lack of transparent information about methodology and targets.

Public performance measures

5.9 The Commonwealth Performance Framework requires entities to develop Portfolio Budget Statements (PBS) and corporate plans that include performance measures, and annual performance statements in annual reports.[62] Section 16EA of the Public Governance, Performance and Accountability Rule 2014 (PGPA Rule) requires an entity's performance measures, in the context of the entity's purposes or key activities, to: relate directly to one or more of those purposes or key activities; use sources of information and methodologies that are reliable and verifiable; provide an unbiased basis for the measurement and assessment of the entity's performance; where reasonably practicable, comprise a mix of qualitative and quantitative measures; include measures of the entity's outputs, efficiency and effectiveness if those things are appropriate measures of the entity's performance; and provide a basis for an assessment of the entity's performance over time. Under subsection 16E(2) item 5 of the PGPA Rule, an entity's corporate plan should specify targets for each of those performance measures for which it is reasonably practicable to set a target.

5.10 There were 32 performance measures in the ANSTO 2021–22 PBS and/or Corporate Plan, of which 27 were assessed by the ANAO to be asset-related (Appendix 5). The measures capture the work of OPAL, Building 23, the ANM facility and the NST research platforms.[63] Asset availability and Delivery in Full on Time (DIFOT) are key measures.

- Asset availability — A September 2021 paper to the Risk and Audit Committee of the ANSTO Board (the Board) noted that 'The most significant issues related to customer complaints arise when OPAL, ANM or [Building 23] experience a temporary unplanned interruption to supply.'
- DIFOT — The September 2021 paper noted that complaints about delivery in full and on time were one of two most common customer complaints across the nuclear medicine portfolio.

Relatedness and measurability

5.11 Although the ANAO did not do a full assessment of ANSTO's public performance measures against PGPA Rule 16EA, it assessed whether eight asset availability and DIFOT measures were related, measurable and targeted (Table 5.1).

- Related — The availability and DIFOT measures were linked to ANSTO's key activities, but there were issues with understandability. The Corporate Plan 2021–22 did not contain sufficient information about what is being measured. The understandability of four availability

62 Entities are required to keep records supporting their performance measurement, including records of the types of performance measures used, data sources, collection methods, procedures and data calculations.

63 The Australian Centre for Neutron Scattering (ACNS), the Centre for Accelerator Science (CAS), the National Deuteration Facility (NDF) and the Australian Synchrotron (Synchrotron).

measures is also reduced because they are labelled as utilisation measures and are measuring availability. ANSTO has other measures that capture utilisation.[64]

- Measurable — There was a lack of clear, detailed methodological information for the DIFOT and availability measures in both public and internal documentation. The lack of methodological transparency increases the risk of bias in performance results.
- Targeted — All measures had largely adequate targets. One asset availability and all three DIFOT measures had inconsistent targets across public and internal documentation. The OPAL availability measure had a financial year target and a calculation methodology by calendar year.

64 Examples of other utilisation measures include: Mo-99 utilisation (ANM facility), capacity utilisation (ANM facility), instrument utilisation (ACNS), and facility utilisation (Synchrotron, ACNS, CAS and NDF).

Table 5.1: Assessment of asset availability and DIFOT public performance measures

Category	Performance measure	Internal specification	Asset	Related[a]	Measurable[b]	Targeted[c]
Asset availability	Days at power	Number of operating days per year	OPAL	◆	▲	◆
	% utilisation	Delivered number of hours available out of scheduled number of hours	Australian Synchrotron	◆	▲	◆
	% utilisation	The number of actual operating days out of the scheduled operating time	Australian Centre for Neutron Scattering	◆	▲	◆
	% utilisation	Number of actual operating days out of the scheduled operating time	Centre for Accelerator Science	◆	▲	◆
	% utilisation	Percentage of NDF production capacity utilised by the approved user demand	National Deuteration Facility	◆	▲	◆
Delivery in Full on Time (DIFOT)	ANM (Mo-99) DIFOT[d]	Delivered in Full on Time	ANM facility	◆	▲	◆
	NTD Silicon DIFOT[e]	Delivered in Full on Time	OPAL	◆	▲	◆
	Nuclear Medicine Production Facility DIFOT	Delivered in Full on Time	Building 23	◆	▲	◆

Legend: ◆ Fully and/or mostly meets the requirements; ▲ Partly meets the requirements; ■ Does not meet the requirements.

Note a: Related refers to the requirement of subsection 16EA(a) of the PGPA Rule, as amended. In applying the 'related' criterion, the ANAO assessed whether the entity's performance measures: related directly to one or more of the entity's purposes or key activities; provided a clear link between purposes, key activities and performance measures; and were expressed in a consistent way.

Note b: Measurable refers to the requirement of subsection 16EA (b)(c)(f) of the PGPA Rule. In applying the 'measurable' criterion, the ANAO assessed whether the entity's performance measures were reliable and verifiable: used sources of information and methodologies that are reliable and verifiable; provided an unbiased basis for the measurement and assessment of the entity's performance; and provided a basis for an assessment of the entity's performance over time.

Note c: Targeted refers to the requirement of subsection 16E(2) table item 5(b) of the PGPA Rule. In applying the 'targeted' criterion, the ANAO assessed whether the entity's performance measures had targets that were specific, measurable, and time-bound, and whether the target was challenging but achievable.

Note d: Mo-99 (Molybdenum-99) is a radioisotope used in diagnostic nuclear medicine.

Note e: Silicon irradiation is conducted in OPAL for use in high power electronic devices. 'NTD' refers to neutron transmutation doped silicon. The NTD process takes place when undoped (high purity) silicon is irradiated.

Source: ANAO analysis based on PGPA Rule and Department of Finance, *Resource Management Guide No.131: Developing good performance information*, May 2020.

Measuring nuclear medicine asset performance

5.12 Supporting the health of Australians through nuclear medicine was emphasised in the Minister of Industry, Science and Technology's (the Minister's) Statement of Expectations for ANSTO. The Board decided in November 2020 that commercial activities, including the provision of nuclear medicine, was one of three core ANSTO functions.[65] In its August 2020 Statement of Intent in response to the Minister's Statement of Expectations, ANSTO indicated that it intended to refine metrics that meaningfully capture the scope of ANSTO's work.[66]

5.13 The ANAO did not assess the completeness of public measures against PGPA Rule 16EA. However, the ANAO considered whether the public performance measures provided a clear indication of nuclear medicine asset performance. The 2021–22 PBS contained one measure relating to the performance of the nuclear medicine production assets (pharmaceutical doses delivered). Other measures related to OPAL or NST Group assets. In the 2021–22 Corporate Plan two of 31 measures explicitly addressed nuclear medicine asset performance.[67] The radiopharmaceutical dose measure from previous corporate plans and the 2021–22 PBS was not included in the 2021–22 Corporate Plan (Appendix 5).

5.14 Annual performance statements in annual reports should be linked to performance measures identified in PBS and corporate plans and presented consistently within a reporting cycle. This is known as the 'clear read' principle.[68] There was a clear read in 2019–20. In 2020–21 there were several instances where a clear read was not achieved, including the removal of the pharmaceutical dose measure from the 2021–22 Corporate Plan (refer Figure 1.4).

5.15 ANSTO used case studies as public performance measures.[69] ANSTO did not rely solely, or mainly, on case studies to measure performance. The case studies used were not measurable performance indicators because there was no transparent methodology and criteria for their selection and assessment and the target was inappropriate.[70]

65 The other two core functions were research and research infrastructure; and trusted expert advice.

66 ANSTO, *Governance* [Internet], ANSTO, available from https://www.ansto.gov.au/about/governance [accessed 14 November 2021].

67 The two 2021–22 Corporate Plan nuclear medicine measures were ANM facility and Building 23 DIFOT.

68 Department of Finance, *Guide to Preparing the 2020-21 Portfolio Budget Statements*, August 2020, page 15.

69 The PGPA Rule allows the use of case studies, but not as a stand-alone measurement.

70 Auditor-General Report No.17 2018–19 *Implementation of the Annual Performance Statements Requirements 2017–18* and Auditor-General Report No.23 2021–22 *Audits of the Annual Performance Statements of Australian Government Entities — Pilot Program 2020–21.*

Recommendation no. 6

5.16 The Australian Nuclear Science and Technology Organisation amend its public performance measures to reflect the importance of nuclear medicine to the achievement of the Australian Nuclear Science and Technology Organisation's purpose. Public performance measures should be aligned to the requirements of section 16EA of the Public Governance, Performance and Accountability Rule 2014 and the 'clear read' principle.

Australian Nuclear Science and Technology Organisation response: *Agreed.*

5.17 *ANSTO has commenced developing its action plan in response to this recommendation. The implementation of the actions will be monitored by our Risk and Audit Committee*.

Internal performance measures

5.18 In addition to the public performance measures, ANSTO has a large suite of asset performance measures that are used internally for strategic, tactical or management purposes.[71] Performance measures were discussed in at least 42 internal planning documents and outlined in at least 20 standard internal dashboards or management reports in addition to publicly available documents. The ANAO compiled a list of 377 asset performance indicators across the Nuclear Operations and Nuclear Medicine and NST Groups. These are a subset of ANSTO's internal and external performance measures.[72] The ANAO classified asset performance measures into six categories (Appendix 6) and the category of operational performance indicators into six sub-types: asset utilisation/outputs (76), asset condition/availability (62), maintenance (31), customer (31), impact (24) and capital projects (2).[73]

5.19 High level ANSTO performance measurement guidance required that there should be leading and lagging measures; and qualitative and impact measures (refer paragraph 5.2). Where there was sufficient information for the ANAO to classify the indicators, the ANAO found there was a mix of accountability, strategic, tactical and management performance indicators[74]; qualitative and quantitative indicators; leading and lagging indicators; and that they were well distributed across the facilities and platforms. On the basis of a broad definition of efficiency, 17 per cent were classified as efficiency measures.[75] The measures were mainly process

71 Public sector performance information can be categorised by how it communicates accountability, strategic, tactical, or management information (ANAO analysis of Department of Finance, *Resource Management Guide No.131*: *Developing good performance information*, May 2020. See also Auditor-General Report No.33 2017–18 *Implementation of the Annual Performance Statements Requirements 2016–17*, p. 20).

72 This total excluded performance indicators that were not specifically related to asset performance, such as some financial and human resources performance indicators. Waste management measures were excluded. Additional KPIs specified in service level agreements with internal and external customers were excluded.

73 Two were not classifiable by the ANAO due to a lack of information.

74 The ANAO assigned a category to each KPI depending on what level of strategic planning or reporting document the KPI appeared in.

75 The ANAO broadly classified any measure relating to the relationship of inputs to outputs, return on investment, profitability, conformance to budget and timeliness of activities as an efficiency measure.

effectiveness and output measures.[76] There were few outcome effectiveness measures measuring impact; these were exclusively for NST research platforms. ANSTO should consider developing outcome measures for nuclear medicine assets, including patient impacts.

5.20 The ANAO assessed the quality of the asset KPIs identified in Appendix 6.

- About half of the strategic and tactical KPIs had an explicit link to an ANSTO strategic objective or risk in planning or reporting documentation. The 'NST Research Infrastructure Metrics Framework' was a good example of explicit linkage.
- There was no explanation of the relevant metric 23 per cent of the time; for example, whether it was intended to be a count, percentage/ratio or other unit of measurement. Very few of the KPIs were presented in sufficient detail in these documents to understand the calculation method.
- The data source for the KPI was recorded 20 per cent of the time.
- A target was established for 67 per cent of the performance indicators. The remainder either had no target (30 per cent) or it was stated that a target was under development. There were some inconsistencies in specified targets.

5.21 There was no one source of information that transparently explained data calculations, either at the entity or asset level. The lack of a 'single source of truth' increases the risk that performance results will be based on inconsistent criteria. In addition to the eight public measures, the ANAO identified internal DIFOT and asset availability KPIs. Although these external and internal DIFOT and asset availability measures were measuring common concepts, there were inconsistent calculation methods.

Does ANSTO adequately monitor and report on asset performance information?

Monitoring of asset performance information is partly adequate. ANSTO's internal audit program — a key assurance function — does not reflect the importance of nuclear medicine operations and asset management. ANSTO's incident reporting system has limitations that impact its usefulness in diagnosing and tracking operational issues. The system's existing data is underutilised. Reporting of asset performance information is largely adequate. The ANSTO Board regularly considers nuclear medicine asset performance and risks. Standing item discussion may lack the appropriate detail to inform the Board of risk and performance issues associated with specific assets. Prior to 2019, the government was not kept sufficiently informed about asset issues and risks. ANSTO's reporting to government has since developed.

76 Process effectiveness measures included safety, asset reliability/availability, other measures relating to processes and systems, and any measure that was not classified as another type. Output measures included asset utilisation; manufacturing outputs; revenue; number of projects, proposals, users, visitors, experiments and similar; and DIFOT measures.

Monitoring of asset performance

Internal and management system audits

5.22 The ANAO found that the focus on nuclear medicine asset management by the internal audit function could have been greater.

- Of 61 planned internal audits in the seven years to 2020–21, two had a specific focus on asset management and maintenance, with the last completed in 2017. ANSTO advised the ANAO that in addition to these two focused audits, other audits have addressed elements of asset management (for example, asset management was considered as part of fraud risk assessments in 2018 and 2020). The 2021–22 internal audit program listed 'strategic asset management plan and framework' as a potential review theme in future years.
- Twelve of 61 planned internal audits, and nine of 44 realised audits, related to the nuclear medicine business. Seven of the nine were completed between 2014–15 and 2016–17, with two delivered in subsequent years. In 2015 an internal audit scoping study of ANSTO Health stated that there were inherent challenges to conducting internal audit of nuclear medicine due to its technical and regulatory complexity. A nuclear medicine supply chain review was commissioned at the request of the Board in 2021–22.

5.23 In an assurance mapping exercise in 2018–19, internal audit aimed to identify gaps in assurance coverage and eliminate duplication in assurance activities. The mapping exercise identified 'strategic asset lifecycle management' as an assurance focus area; identified asset owners, asset managers and system engineers/strategists as the main assurance providers rather than internal audit; and concluded that 'additional assurance measures are suggested'. The exercise noted that 'assurance and review' actions listed in the strategic asset management plan had yet to be implemented.

5.24 Technical audits (known as management system audits) are the responsibility of the Regulatory and Governance area within the Chief Operating Office Group and are programmed, managed and undertaken by the specific business areas.[77] There was no clear prioritisation framework for management system audits. Of 459 planned management system audits between 2015–16 and 2021–22, 108 covered NST research platforms (especially the Australian Synchrotron), 81 covered OPAL and 64 covered operational nuclear medicine production assets. Thirty-one were meant to examine the SyMo project or the underlying technology, Synroc. A planned 2017–18 audit of Building 23 processes was cancelled. There was an increase in the proportion of planned audits focused on nuclear medicine production assets between 2016–17 (seven per cent) and 2021–22 (34 per cent).

5.25 In 2021 ANSTO requested a review of its internal audit function, which was performed by the Institute of Internal Auditors Australia (IAA).[78] The review found the internal audit function to

77 Management system audits ranged in planned duration of between two and 250 hours, with a median duration of 30 hours. Foci comprised quality management (63 per cent), process improvement (60 per cent), legal or regulatory compliance (54 per cent), safety management (54 per cent) or environmental management (35 per cent).

78 Internal Auditors Australia is a professional association for internal auditors. Its activities include setting international standards for the profession, and providing internal auditing certifications, research and education.

'generally conform' (the highest possible rating) with Internal Audit Standards, with a 'managed' maturity level; that it could be more strategic; and that there was an opportunity to enhance audit planning.[79] The reviewers recommended: offering a wider range of internal audit services; a clearer rationale of how internal audit engagements are selected; including focus on both core business and corporate support activities; and showing audit topic alignment to strategic objectives and risks. The review noted that projects often present the largest risks and recommended assurance activities over ongoing projects. The ANSTO Risk and Audit Committee considered the IAA review findings and recommendations in September and November 2021. In April 2022 ANSTO advised the ANAO that it was addressing the findings of the IAA review and would adjust the internal audit function in 2022–23.

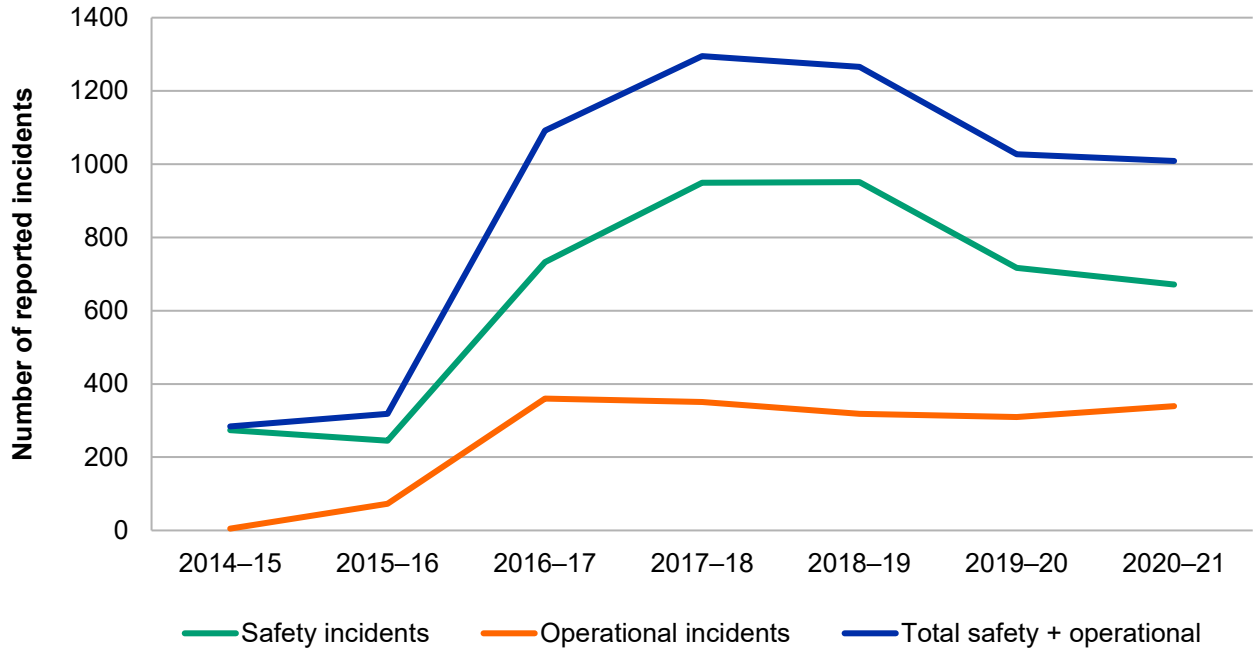
5.26 In ANSTO's 'five lines of defence' assurance model (refer paragraph 4.35), management system and internal audit are two assurance activities along with activities associated with line management, external audit and regulation. The IAA review found that there was limited integration in planning across all lines of assurance and that internal audit had 'limited oversight' of other assurance activities. It recommended that all assurance activities across ANSTO be identified and assessed for effectiveness, potential duplication and consistency; and be visible to the ANSTO Risk and Audit Committee and executive management.

Incidents

5.27 The Governance, Risk, Compliance and Assurance (GRC) system has been a key mechanism since 2014 for ongoing monitoring of operational, safety, security, quality and environmental issues. Incidents can be reported via the GRC system by any staff member and staff are advised to 'report early, report often'. Comprehensive documentation exists to support the logging, triage and investigation of incidents. Summary reports by cluster are available to all staff on the intranet. Between 2013–14 and 31 December 2021, 6944 safety and operational incidents were logged through the GRC system (refer Figure 5.1).

79 Possible ratings were Initial, Defined, Implemented, Managed or Optimising, with 'Initial' the lowest level of conformance, maturity and value add, and 'Optimising' the highest.

Figure 5.1: Number of reported safety and operational incidents, 2014–15 to 2020–21



Note: Data for 2013-14 and between 1 July 2021 and 31 December 2021 not shown. Operational incident reporting commenced in 2015–16. Other types of incidents are not shown. Incidents can be simultaneously classified as safety and operational incidents; the sum of safety and operational incidents will exceed the total.

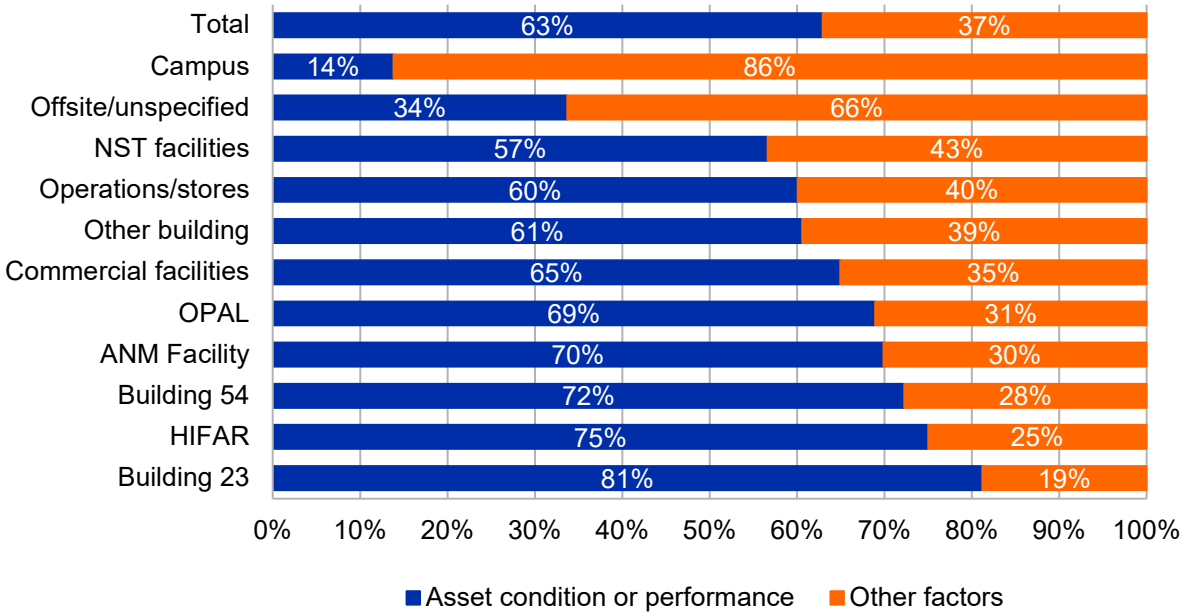
Source: ANAO analysis of GRC system incident data.

5.28 The GRC system has limitations, particularly for operational incidents. These relate to an inability to link operational incidents to specific assets or equipment; uneven use and application of the system across ANSTO; and gaps in the recording of key information. A 2018 Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) report to Parliament following a serious safety incident in Building 23 stated that lessons learnt from incidents were not being applied.[80] A 2018 external safety review commissioned by ANSTO at the direction of ARPANSA (Appendix 3) recommended that ANSTO place more emphasis on disseminating the lessons contained in the incident database.

5.29 Of 4223 safety incidents reported between 2014–15 and 31 December 2021, where 'breakdown agency' (cause) was recorded, 63 per cent could be attributed to asset condition or performance, particularly in Building 23 (Figure 5.2). Between 2016–17 and 2020–21, safety incidents attributed to asset condition increased from 58 to 66 per cent.

80 Australian Radiation Protection and Nuclear Safety Agency, *Radiation exposure of a worker at ANSTO Health, Lucas Heights on 22 August 2017*, ARPANSA, 26 February 2018, p. 7.

Figure 5.2 Cause of safety incidents by major asset, to 31 December 2021



Note: Factors classified by the ANAO under 'asset condition or performance' included: asbestos; buildings and other structures; communications equipment; compressors and pumps; computers and keyboards; cranes; doors and windows; fume cupboards; gas cylinders; gas mains, pipes, valves, and other gas reticulation equipment; laboratory equipment; lead and lead compounds; lighting equipment; manual lifting equipment; unspecified equipment; chemical products; pressure-based equipment; radiation hot cells; radioactive materials; refrigeration plant and cryogenic material; and water mains, pipes, valves, hydrants, taps, and other water reticulation equipment.

'Other factors' refers to causes of safety incidents such as: beverages; biological agents; vehicles and pushbikes; clothing and footwear; condition of the affected person and human agency; crates and cartons; crockery, glassware and food utensils; dust; fatigue; fencing; fire, flame and smoke; ground surfaces; hot water; hypodermic syringes; insects, birds, reptiles and other animals; sports equipment; stationery and paper products; systems of work; vegetation; and weather and water.

Source: ANAO analysis of GRC system incident data.

5.30 A regular 'Safety Report' to the ANSTO Board includes analysis of safety incidents and a 'safety dashboard'. There is substantial analysis of safety data, and limited examples of how GRC system data had been used to diagnose systemic causes of operational incidents. ANSTO should consider developing a more detailed 'operational dashboard' that builds on the potential of GRC system data by linking operational failures, and safety incidents that result from an asset condition root cause, to specific facilities, assets and equipment (where possible).

Reporting of asset performance to the Board

5.31 A February 2021 review of the Board requested by the Board Chair made nine recommendations, including improvements to the quality of Board papers and presentations, and more interaction between the Board and executive management. In June 2021 the government was advised that one area for improvement in the wake of a 2019 independent review of ANSTO's financial sustainability and governance arrangements was the Board's monitoring of risks.

5.32 In its 2020 annual ANSTO Financial Sustainability Report to the Minister (refer paragraph 5.41), ANSTO stated that the most significant recent change in ANSTO's governance approach was the level of engagement between the Board and executive management. Described improvements included better

Board packs; dashboards of key metrics; and fortnightly and as required updates. The Minister was advised that there was increased time for discussion in Board meetings and updates to the delegations of authority to enhance Board visibility of operational and performance matters. The ANAO did not observe fortnightly updates between 1 January and 31 December 2021.

5.33 DIFOT and other KPIs associated with capacity, utilisation and yield are regularly reported to the Board via an operations report that is included in Board packs. Discussion of 'top risks' is a regular agenda item in Risk and Audit Committee meetings. The Board regularly receives the 'safety dashboard'.

5.34 ANAO performed a high-level analysis of 38 Board and Risk and Audit Committee meeting papers between January 2020 and December 2021, focusing on OPAL, Building 23, the ANM facility, Building 54, the High Flux Australian Reactor (HIFAR) and SyMo.[81] Board papers included specific mention of asset performance, and Risk and Audit Committee papers included mention of asset risks, for most meetings.

5.35 Although there was regular consideration of asset risks in Board and Risk and Audit Committee papers, top risks were expressed at a high level that lacked substantive detail both in terms of the nature of the risk and the mitigations employed. For example, among the 'key responses' to the top risk that 'radiopharmaceutical production [is] adversely affected' was 'improving reliability and maintenance strategy through identification of risks associated with our assets and applying effective operational, maintenance and/or capital mitigations.' This unspecific mitigation, which was unchanged throughout 2021, was described as having an 'existing' implementation status with no specific due date.

5.36 A November 2021 ANSTO-commissioned review of ANSTO's risk management framework noted that some of the lengthy contextual background information provided in the 'top risks' section of Board packs 'may overshadow the important risks that matter'. The review recommended removing or summarising the contextual information, and revisiting the top risks to provide more coverage to help the Board perform its oversight function. In April 2022 ANSTO advised the ANAO that work to update the documentation and risk management process was in progress and due to be completed by June 2023.

Reporting of asset performance to external stakeholders

5.37 Under section 19 of the *Public Governance, Performance and Accountability Act 2013*, the accountable authority of a Commonwealth entity must keep the responsible Minister informed of the activities of, and any significant decisions and issues affecting, an entity or its subsidiaries.

5.38 ANSTO advised the ANAO that that there was no regular process for communicating with the Minister prior to the release of the 2019 independent review of ANSTO's financial sustainability and governance arrangements, although there was regular communication during OPAL construction (1997 to 2007). ANSTO's advice to government about Building 23 was limited prior to 2019. Appearances before Parliamentary Committees in 2015 and 2018 were not forthcoming about the status of the projects that were known to executive management to be delayed and over budget.

5.39 In November 2019, the government was advised by ANSTO that Building 23 — among other ageing and damaged assets — was non-compliant with modern standards and that five nuclear

81 ANSTO Nuclear Medicine Pty Ltd has its own Board and conducts separate meetings. This analysis excludes ANM Board and Risk and Audit Committee meetings, which are focused on the ANM facility.

medicines were not being produced because of age-related defects. ANSTO also advised that HIFAR decommissioning was delayed and that this was resulting in ongoing costs to maintain the facility, which contained radioactive and contaminated material, in a safe state; and that the non-operational Building 54 had lead and extensive radioactive contamination.

5.40 Following the 2019 review, ANSTO committed to providing the Minister with a quarterly status report on recommendation implementation. The tenth report covered the period to September 2021. The 10 recommendations from phases two and three of the 2019 review of ANSTO's financial sustainability and governance arrangements (that the ANAO classified as directly related to asset management) were all described as completed (Appendix 3).

5.41 ANSTO also committed to an annual report (the ANSTO Financial Sustainability Report) to the Minister on core and non-core activities and some matters addressed in the Statement of Intent. A report was provided in December 2020 and December 2021. The December 2020 report advised the Minister that 'the major risks to nuclear medicine production are those associated with the ageing Building 23, which is reaching the end of its useful life'. ANSTO advised the ANAO that additional ministerial communications would occur as required depending on need and when there was any major incident or requirement.

5.42 An August 2021 government engagement plan instituted for the Building 23 replacement project indicated that regular written reports to the Minister would be established in addition to regular stakeholder meetings with the Department of Industry, Science, Energy and Resources (DISER), the Department of Health, and central agencies. ANSTO advised the ANAO that while it had not provided bi-monthly briefs to the Minister as outlined in the non-binding government engagement plan, it had provided project updates through other means, such as a December 2021 letter to the Minister about the ANSTO Financial Sustainability Report.

5.43 A recommendation from the 2019 review of ANSTO's financial sustainability and governance arrangements was that communications between ANSTO and DISER be strengthened to give effect to the intent of the Statement of Expectations. ANSTO classified this recommendation as closed in June 2020, stating that fortnightly engagements had been formalised between DISER and ANSTO at a working level. DISER was represented in an observer capacity at some ANSTO Board meetings from August 2019 and at all monthly Project Control Group meetings for the Building 23 replacement project between September and December 2021.

5.44 ANSTO advised the government in August 2021 that it worked closely with DISER and the Departments of Finance and Health in the implementation of 2019 review recommendations. An external advisory group to the Building 23 replacement project was established which includes representation in an observer capacity from DISER, the Department of Finance and the Department of Health. The first meeting of the external advisory group was held on 8 April 2022.

Grant Hehir
Auditor-General

Canberra ACT
10 May 2022

Appendices

Appendix 1 Entity responses

19 April 2022

Mr Grant Hehir
Auditor General
Australian National Audit Office
19 National Circuit
BARTON ACT 2600

Dear Mr Hehir

Australian National Audit Office (ANAO) Section 19 Proposed Report - The Australian Nuclear Science and Technology Organisation's Management of Nuclear Medicine Assets

Thank you for your email of 18 March 2022 and the opportunity to respond to the ANAO's proposed report on The Australian Nuclear Science and Technology Organisation's (ANSTO's) Management of Nuclear Medicine Assets.

ANSTO welcomes the independent assessment of our management of nuclear medicine assets and agrees with each of the six recommendations presented in the report. Through the operation of the OPAL multipurpose nuclear reactor and its nuclear medicine infrastructure, ANSTO supports the Australian medical community to improve the health outcomes for all Australians. With the support of our Department and funding from the Government, ANSTO has been working to improve the safe and reliable operation of its assets and the governance over their maintenance and operation. As part of this commitment and our established culture of continued improvement, ANSTO has commenced planning to action each recommendation. The implementation of the actions will be monitored by our Risk and Audit Committee.

Attached to this letter are ANSTO's response to the Proposed Recommendations (Annex A) and ANSTO's Summary Response (Annex B). These constitute ANSTO's formal response to the Section 19 Proposed Report.

I would commend the work undertaken by your team, under the leadership of Christine Chalmers, in the completion of this audit. The professional and considered manner in which the audit was conducted has resulted in a report and recommendations that will strengthen the management, not only of ANSTO's nuclear medicine assets, but also of the whole of ANSTO's asset portfolio now and into the future.

Yours sincerely

Hon Annabelle Bennett AC SC

New Illawarra Road, Lucas Heights (Locked Bag 2001, Kirrawee DC 2232) **ABN** 47 956 969 590 **T** +61 2 9717 3111
www.ansto.gov.au

Icon SI (Aust) Pty Ltd
—
Level 2
179 New South Head Road
Edgecliff NSW 2027

26th April 2022

By email

Ms Christine Chalmers
Executive Director and Audit Manager
Australian National Audit Office
38 Sydney Avenue
Forrest ACT 2603

Dear Ms Chalmers

The Australian Nuclear Science and Technology Organisation (ANSTO)
ANSTO's Management of Nuclear Medicine Assets – SyMo Facility (Project)
Reply to proposed report pursuant to section 19 of the *Auditor-General Act 1997*

Thank you for the opportunity to provide comments.

1. General

1.1 Icon SI (Aust) Pty Ltd (**Icon**) was the contractor engaged to construct the Project at Lucas Heights for ANSTO.

1.2 Icon received a redacted copy of subsections 3.23 to 3.33 within the Asset acquisitions and disposal section of the proposed report (**Proposed Report**).

1.3 Set out below are comments by Icon on (grouped by the main categories of issue(s) raised in the Proposed Report):

(a) design responsibility (**section 2**);

(b) reasons for delay (**section 3**); and

(c) recourse mechanisms (**section 4**).

2. Design responsibility

3.29 ANSTO and Icon did not agree on the extent of Icon's role in design. In March 2020 Icon indicated that it interpreted its role to be 'construct only', with minimal design obligations. ANSTO's position was that the contract established some specific design and coordination responsibilities.

2.1 In Icon's view this was the fundamental issue on the Project. The extent of Icon's design responsibility should have been readily understood by ANSTO.

2.2 The industry-standard form contract under which Icon was engaged in mid-2018 (identified at paragraph 3.25) was an amended form of AS 4000-1997 (**General Conditions**).

2.3 AS 4000-1997 is a 'construct only' contract.

E infonsw@icon.co
W icon.co
P +61 2 8456 6500
ABN 66 617 747 458

Icon SI (Aust) Pty Ltd
—
Level 2
179 New South Head Road
Edgecliff NSW 2027

2.4 Under the 'construct only' procurement method the principal (in this instance ANSTO) engages consultants to prepare and develop the design and specifications for the project, through to completion or a ready to build form, and then the contractor is engaged to build ("construct only").

2.5 The Australian Standard form used when a project is procured on a design and construct basis is the AS 4902-2000 general conditions for design and construct. Under a "D&C" the design and specifications given to the contractor when it is engaged are incomplete. The contractor completes the design itself before beginning construction.

2.6 The key provisions found in the AS 4902-2000 D&C contract which distinguish it from the AS 4000-1997 construct only contract are the following:

(a) warranties in the following terms:

(i) a warranty that the contractor has reviewed any preliminary design provided to it and that it is suitable and adequate for the purpose stated in the principal's project requirements (PPR);

(ii) a warranty that the contractor will carry out and complete its design obligations to accord with the PPR; and

(iii) a warranty that the contractor will ensure the Works when completed would be fit for their stated purpose;

(b) a requirement that the contractor accepts the novation of certain design consultants; and

(c) a requirement that the contractor obtain and maintain professional indemnity insurance.

2.7 None of the above provisions were included in the General Conditions under which Icon was engaged.

2.8 Further Icon did not engage any design consultants on the project.

2.9 'GHD' was employed by ANSTO.

2.10 It is Icon's submission that:

(a) Icon had no design responsibility;

(b) ANSTO choose the wrong procurement method and contract form if it wished to place any design obligation on Icon; and

E infonsw@icon.co P +61 2 8456 6500
W icon.co ABN 66 617 747 458

Icon SI (Aust) Pty Ltd
—
Level 2
179 New South Head Road
Edgecliff NSW 2027

(c) Icon was engaged prematurely, that is before the design, drawings and ANSTO's contract documentation generally for the Project were complete to a stage where they were ready for construction.

3. Reasons for delay

3.27 The increase in contract value and delays to practical completion reflected 122 supplier requests for extensions of time, 299 contract variations and an adjudication determination. Reasons cited for extensions of time included incomplete design and other design issues; changes to construction works; unfavourable weather conditions; and the COVID-19 pandemic.

3.28 ANSTO had engaged GHD Pty Ltd (GHD) in 2013 to undertake detailed design and provide design assistance during the construction phase, which formed the basis of the construction tender process in July 2017. In late 2018 the Steering Committee received a report that GHD's building design required modification and an additional $1.2 million was approved to incorporate design changes into the Icon construction contract. In late 2019 ANSTO attributed delays in the construction program to design errors, rework and constructability issues.

3.1 Icon submits the main reasons for the Project delay were:

(a) design errors, rework and constructability issues (as noted by ANSTO at subsection 3.28 of the Proposed Report (extracted above));

(b) other design issues (such as simple incomplete design and a lack of design coordination);

(c) changes to the construction works resulting in the approximately 299 contract variations identified at subsection 3.27 of the Proposed Report;

(d) unfavourable weather conditions;

(e) COVID-19; and

(f) (in addition and generally) the lack of specificity in scope documents.

3.2 The above reasons (in particular those in relation to design) had a compounding effect. Icon explains the issues in relation to design and documents further below (unfavourable weather and COVID-19 are self-explanatory).

3.3 Demonstrable of the incomplete design (and design errors and/or clashes) was the number of RFIs (requests for information) issued by Icon. Some 2190 RFIs were issued seeking clarification on ANSTO requirements due to the absence of detail in contract documentation and/or conflicting detail in and between the documentation. These design errors and clashes were required to be resolved in order for Icon to carry out its works and the time taken in doing so delayed the Project.

3.4 In relation to the lack of design coordination there were numerous instances where revisions of drawings (marked-up only by hand) were issued to Icon without any updates to the other drawings on the Project. Icon raised this unacceptable practice as early as June 2019. The

E infonsw@icon.co P +61 2 8456 6500
W icon.co ABN 66 617 747 458

Icon SI (Aust) Pty Ltd
—
Level 2
179 New South Head Road
Edgecliff NSW 2027

situation did improve in December 2019 after the increased involvement of GHD, but it was short-lived, ANSTO reverted back to the practice in and from March 2020.

3.5 A general reason for delay was the lack of specificity in the scope documents. Icon sets out two examples to illustrate this reason:

(a) notwithstanding that the AS 4000-1997 is a construct only contract, ANSTO relies on "coordination" obligations in the scope documents to allege that Icon has design coordination obligations. Icon's view is that the coordination obligations relate to the coordination of construction works (i.e. shop drawings) as expected in a construct only contract (not the coordination of the design which remained with ANSTO); and

(b) the scope documents set out general requirements to be performed during the pre-commissioning stage (including the development of pre-commissioning procedure templates by ANSTO's design consultant (GHD) that commenced in July 2019). However in February 2021 (after 19 months) Icon was provided with the pre-commissioning procedure templates that had 'over and above' requirements as compared to the general requirements in the scope documents (and required additional testings that had previously already been carried out).

3.6 One factor that could have assisted in preventing the above issues in Icon's view was an external contract administrator. It is unusual for a project the size of the SyMo Project to be administered (the Superintending role) by employees of the principal (in this instance ANSTO).

3.7 Icon submits both ANSTO and Icon would have been greatly assisted if an independent professional project manager had been interposed between the parties to administer the contract generally and specifically in relation to 'scope/design' issues.

4. Recourse mechanisms

3.31 The Icon contract established recourse mechanisms for failure to meet contractual obligations, including: defective work rectification; liquidated damages for delays to practical completion; a security clause in the form of a bank guarantee; breach notices; withholding of payment; and contract termination. The September 2021 amendment deed removed the continuing application of liquidated damages and established that Icon was no longer entitled to additional payments, extensions of time or delay costs…

3.32 ANSTO did not use contract recourse mechanisms until 2021. Initially there were attempts to resolve issues through meetings and discussions with Icon and [redacted]. From January 2021 ANSTO commenced applying the liquidated damages clause to reduce payments to Icon. Four breach notices were issued to Icon between October and December 2021 in relation to quality, safety, equipment damage, defects, documentation, and failure to complete the entirety of works for practical and post-completion by the deadlines. The security clause to offset costs was used in November 2021.[a]

4.1 The General Conditions permit recourse to the Contractor's security under clause 5.2 which is in the following terms:

5.2 **Recourse**

E infonsw@icon.co P +61 2 8456 6500
W icon.co ABN 66 617 747 458

Icon SI (Aust) Pty Ltd
—
Level 2
179 New South Head Road
Edgecliff NSW 2027

Security shall be subject to recourse by the *Principal* where:

(a) the *Principal* remains unpaid after the time for payment;

(b) the *Principal* believes (acting reasonably) that:

(i) the *Contractor* is in breach of any of its obligations under the *Contract;* or

(ii) the *Principal* otherwise has a bona fide claim against the *Contractor* in relation to the *Contract;* or

(c) the *Principal* is entitled to terminate the *Contract.*

4.2 In September 2021 ANSTO and Icon entered into an amendment deed which was in substance a settlement deed (**Settlement Deed**).

4.3 As touched on at subsection 3.31 of the Proposed Report key releases/mechanisms removed contained in that Settlement Deed were that:

(a) Icon released ANSTO from all extension of time claims (past, present and future); and

(b) ANSTO released Icon from any liquidated damages claim (past, present and future).

4.4 Four documents that purported to be breach notices were issued to Icon between October and December 2021, each were responded to and none were acted upon by ANSTO. All documents were defective in form and substance (in Icon's view).

4.5 Not noted in the Proposed Report is the fact Icon itself issued a breach notice to ANSTO in November 2021 notifying ANSTO it had engaged in preventative conduct by:

(a) taking possession of parts of the site whilst Icon was still completing the remaining works required by the Settlement Deed, without having a contractual right to do so;

(b) acting unreasonably in the 're-classification' of items within the deed (insisting on completion dates for items that had passed in a number of instances); and

(c) insisting on the maximum 14 day period to review re-submissions of documents when it was clearly unnecessary and unreasonable to do so,

in circumstances where Icon had given up its right to claim an extension of time under the Building Contract (for any cause) in the settlement deed.

4.6 Without:

(a) notice of any amount said to remain unpaid from Icon to ANSTO; and

E infonsw@icon.co P +61 2 8456 6500
W icon.co ABN 66 617 747 458

Icon SI (Aust) Pty Ltd
—
Level 2
179 New South Head Road
Edgecliff NSW 2027

(b) justification or substantiation of any claim ANSTO had against Icon (or details of any costs incurred by ANSTO or loss and/or damage suffered),

ANSTO had recourse to Icon's bank guarantee in the amount of $683,216.50 (**First Icon Security**).

4.7 Icon is yet to receive an explanation from ANSTO as to why it did this noting:

(a) the Settlement Deed contained a provision (clause 4.1(b)) which provided that on the achievement of practical completion: *"…the date for practical completion under the Building Contract is amended to the date identified in the certificate of practical completion as the date of practical completion"*, which means ANSTO could never suffer any time related loss and damage (in keeping with the intent of the deed that liquidated damages were removed);

(b) no third party was engaged by ANSTO (and costs incurred by ANSTO) to rectify any defective works by Icon or general non-performance; and

(c) the Settlement Deed removed the First Icon Security away from being a "risk allocation" device and expressly provided for it to be returned to Icon on completion of certain works under the Settlement Deed as an agreed term of the "settlement".

4.8 It is Icon's submission the recourse mechanism should not have been used by ANSTO, ANSTO had no right to do so and ANSTO should account to Icon in the amount of the First Icon Security.

Regards,

Michael Read
Executive Director – NSW / ACT / Barpa

E infonsw@icon.co
W icon.co
P +61 2 8456 6500
ABN 66 617 747 458

ANAO Comment on the Icon response

(a) The ANAO updated the audit report to reflect advice provided by Icon in its response and ANAO consideration of additional evidence.

www.ghd.com

Your ref: Your email dated 22 March 2022
Our ref: 2123236

19 April 2022

Grant Hehir
Auditor General for Australia
Australian National Audit Office

Letter of Reply from Extract from Auditor-General Proposed Audit Report on the Australian Nuclear Science and Technology Organisation's Management of Nuclear Medicine Assets

Dear Grant

With reference to your letter dated 22 March 2022, GHD confirms engagement to the SyMo project for various stages of design and construction support.

We have reviewed the extract and appreciate opportunity to provide comment however note that no specific questions were asked of us and so our opportunity to respond is similarly limited.

We remain available to ANSTO and ANAO should there be opportunity to respond to specific questions.

Regards

David Williamson
Project Director

+61 457 027 680
david.williamson@ghd.com

Appendix 2 Improvements observed by the ANAO

1. The existence of independent external audit, and the accompanying potential for scrutiny improves performance. Improvements in administrative and management practices usually occur: in anticipation of ANAO audit activity; during an audit engagement; as interim findings are made; and/or after the audit has been completed and formal findings are communicated.

2. The Joint Committee of Public Accounts and Audit (JCPAA) has encouraged the ANAO to consider ways in which the ANAO could capture and describe some of these impacts. The ANAO's 2021–22 Corporate Plan states that the ANAO' s annual performance statements will provide a narrative that will consider, amongst other matters, analysis of key improvements made by entities during a performance audit process based on information included in tabled performance audit reports.

3. Performance audits involve close engagement between the ANAO and the audited entity as well as other stakeholders involved in the program or activity being audited. Throughout the audit engagement, the ANAO outlines to the entity the preliminary audit findings, conclusions and potential audit recommendations. This ensures that final recommendations are appropriately targeted and encourages entities to take early remedial action on any identified matters during the course of an audit. Remedial actions entities may take during the audit include:

- strengthening governance arrangements;
- introducing or revising policies, strategies, guidelines or administrative processes; and
- initiating reviews or investigations.

4. In this context, the below actions were observed by the ANAO during the course of the audit. It is not clear whether these actions and/or the timing of these actions were planned in response to proposed or actual audit activity. The ANAO has not sought to obtain assurance over the source of these actions or whether they have been appropriately implemented.

5. In April 2021 the Australian Nuclear Science and Technology Organisation (ANSTO) began developing enterprise-wide 'executive' key performance indicators, which were finalised in October 2021. The purpose of the initiative was described by ANSTO as providing an enterprise-wide approach to performance measurement that was aligned to the corporate strategy. The metrics built on measures developed at the group, division or asset level and were supported by a document that outlined metric definitions, targets, tolerances, owners and reporting frequency. In July 2021 ANSTO conducted a review of its public performance measures through a centralised team, bringing together previously disparate work on annual report, corporate plan and Portfolio Budget Statements measures.

6. In early July 2021 the Capital Program Management Office replaced the Strategic Assets Program Office following a transition to a new project methodology, known as the Project Management Lifecycle Framework. Concurrently, ANSTO updated its intranet page on asset management, with the main change being new guidance in relation to asset management plans including the requirement that each business unit maintains an asset management plan. This was to be 'reviewed and refreshed annually', and subject to review and endorsement by the

appropriate Capital Portfolio Committees, the Capital Program Management Office and the Capital Committee. A number of new policies and documents were associated with this change.

7. The focus on nuclear medicine manufacturing assets of planned management system audits increased to 34 per cent of planned audits in 2021–22, compared to 15 per cent in 2020–21 and seven per cent in 2016–17 and 2017–18.

8. In July 2021 ANSTO decided to transfer the Australian Radiation Protection and Nuclear Safety Agency licence for Building 54 from ANSTO Health to the Waste Management Services division. ANSTO advised the ANAO this would likely occur in mid-2022. In September 2021 ANSTO advised the ANAO that ANSTO Health was developing asset management documentation for Building 54 in preparation for its eventual transfer.

9. In December 2021 ANSTO advised the ANAO that the asset management plan oversight function had moved from the Asset Management and Services Group to the new Capital Program Management Office, and that a 'Lead, Asset Management and Controller' was in the process of being recruited, with the position to be established by early 2022. The purpose of the new position was to provide 'a centralised and holistic role to collate and manage all asset management plans across site with the commitment to ensure detailed discussion and management of the plans across all business units with Capital Committee oversight'.

10. In February 2022, ANSTO advised the ANAO that ANSTO was planning to develop an internal contract management guide based on the Department of Finance's *Contract Management Guide* of December 2020. ANSTO's guide is due for completion by June 2022.

Appendix 3 Overview of ANSTO external reviews (2018 to 2021)

Table A.1: Overview of review findings and actions

Review	Key findings and recommendations	Follow-up actions
Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) safety review (2018)	The review was commissioned by ANSTO on the direction of ARPANSA following a series of safety incidents. The review was conducted by a collective of experts in occupational health and safety and nuclear industry. The review found that since 2010, there had been an increased focus on the customer, safety and performance, and notable improvements in safety, and that an asset management system had been recently introduced. It found that: • workload and resourcing, psychosocial and biomechanical issues were impacting on safety; • there had been a decline in morale and safety culture and there was misunderstanding of hazards; • there was no centralised function with an exclusive focus on nuclear safety; and • incident statistics were consistent with nuclear industry norms but not all incidents were being reported or sufficiently analysed. The review made 85 recommendations covering occupational health and safety (32), workforce management (15), governance (14), risk management (11), stakeholder management (6), asset management (4), incident reporting (2) and regulation (1). Expediting the replacement of Building 23 was the first recommendation.	ARPANSA approved ANSTO's implementation plan for the review recommendations in December 2019. The implementation plan prioritised actions based on the reduction of risk and the timely protection of workers. ANSTO committed to provide semi-annual progress reports to ARPANSA commencing January 2020, with the fourth provided in July 2021. The July 2021 report noted that 97 per cent of 166 actions had been completed and 80 of 85 recommendations had been closed. After an action is considered by ANSTO to have reached practical completion, it undergoes a review and validation process prior to reporting to ARPANSA. ARPANSA has indicated that it is generally satisfied with ANSTO's actions to address the recommendations.

Review	Key findings and recommendations	Follow-up actions
2019 independent review of ANSTO's financial sustainability and governance arrangements	Phase 1 (Short-term funding) — ANSTO was found to have used depreciation funding to fund core business operations. This was viewed as an unsustainable business practice that would increase risks to the reliable and safe operation of ANSTO facilities. The review identified the need for funding to support the urgent remediation of Building 23, address the findings and recommendations of the 2018 safety review, and manage radioactive waste, spent reactor fuel and decommissioning.	The government agreed to provide $56.4 million over three years in the 2019–20 Budget under the *Strengthening the Australian Nuclear Science and Technology Organisation* measure. This included $38.5 million to address high priority activities focused on short-term safety or operational risks and $18 million to maintain ANSTO's asset base. The government also provided ANSTO with an equity injection of $56 million. In the 2019–20 Mid-Year Economic and Fiscal Outlook, the government provided additional funding of $49.5 million.
	Phase 2 (Governance) — The review made 14 recommendations relating to governance (12), stakeholder management (1) and asset management (1). The asset management recommendation was for ANSTO to urgently review the decision to defer asset maintenance spending and ensure that maintenance necessary to maintain a safe workplace and environment and to perform critical tasks was undertaken as a matter of priority.	The government accepted the recommendations. Between 2017–18 and 2020–21 there were a number of changes made to the ANSTO Board and executive management. The 2020–21 Budget included $238 million for ANSTO over four years (including $37.7 million per year, ongoing, indexed) under the *Australian Nuclear Science and Technology Organisation - additional funding* measure, comprising: • $93.8 million to maintain Building 23 and respond to nuclear medicine production disruptions; • $81.6 million to support waste management and decommissioning activities; and • $62.7 million to support core operations. The 2021–22 Budget committed an additional $116.7 million over four years (including $14.2 million per year, ongoing, indexed) under the *Australian Nuclear Science and Technology Organisation – ongoing sustainability* measure. This included: • $59.8 million to construct a temporary waste storage facility; and • $56.9 million to support maintenance and renewal of infrastructure and equipment.

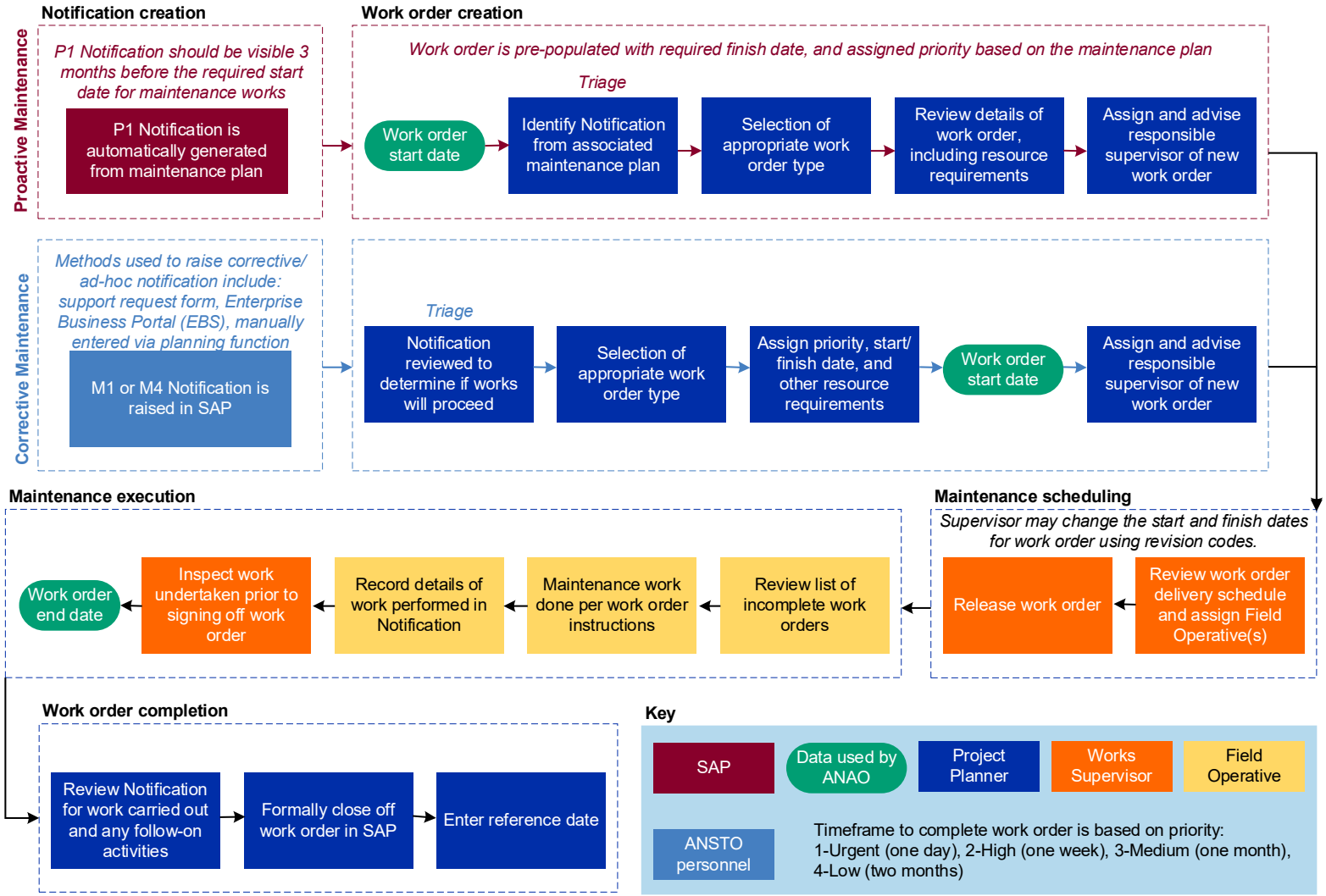
2019 independent review of ANSTO's financial sustainability and governance arrangements	Phase 3 (Sustainability) — The review identified the critical challenges to be ageing infrastructure and the need to replace critical facilities, the decommissioning of contaminated infrastructure and cost and time overruns in the ANM facility project. It noted that decommissioning had depended on ad hoc New Policy Proposal funding which impeded strategic decommissioning planning and a National Radioactive Waste Management Facility, and that there had been no indexation of the depreciation allocation since 2006–07. There were 22 recommendations relating to asset management (9), financial management (6), governance (4), waste management (2) and performance measurement (1). Asset management recommendations comprised: 1. new projects involving significant funding are subject to detailed business cases and discussed at an early stage with the Department of Industry, Science, Energy and Resources; 2. all capital expenditure plans and major contracts valued at greater than $5 million be approved by the ANSTO Board; 3. depreciation funding be preserved for its intended purpose of funding the maintenance, upgrade and renewal of assets; 4. the annual depreciation appropriation be re-based every three years starting in 2020–21; 5. ANSTO's annual appropriate be increased to $211.3 million, with annual indexation; 6. a detailed operating and capital investment plan to deliver agreed standards of operating safety, reliability and compliance for Building 23 be developed and renewed each year; 7. that a Building 23 replacement business case include a base case where Building 23 is not replaced and domestic nuclear medicines are obtained from alternative sources; 8. that ANSTO develop a business case for increased waste storage capability as part of the replacement project; and 9. that ANSTO adopt the principle of decommissioning nuclear infrastructure as	ANSTO agreed to keep the Minister informed of progress against the recommendations in quarterly report. The government would oversee the Board's program of operational reforms including the implementation of the review's recommendations. At October 2021 16 of 22 recommendations were categorised as 'completed' by ANSTO, with five of the six outstanding recommendations described as 'in progress – dependent on government decisions'. Several of those related to the operational and financial status of ANSTO Nuclear Medicine Pty Ltd. All asset management recommendations were described as completed at October 2021. Some of these recommendations relate to ongoing business practices or long term outcomes. In these instances, ANSTO closed the recommendation by citing new governance arrangements and planning (for example, a 50-year depreciation funding plan to 2075). In relation to recommendation nine, ANSTO noted that 'ANSTO has adopted a principle of decommissioning nuclear infrastructure and implemented in planning processes'. Aspects of two recommendations (numbers four and six) were described as dependent on government decisions. At November 2021 ANSTO Nuclear Medicine Pty Ltd was dependent on ongoing financial support from its parent entity, ANSTO, which included a $15 million loan facility with a repayment date of 30 June 2023.

Review	Key findings and recommendations	Follow-up actions
	close as possible to the cessation of operational activities (noting dependence on the National Radioactive Waste Management Facility).	
Building 23 replacement business case (2020)	The recommended option was to construct a new manufacturing facility at Lucas Heights. Partial and full import options were not recommended due to concerns about supply chain exposure, product wastage and higher costs.	The recommended option was endorsed by the ANSTO Board. The total overall cost of the project was estimated to be $418.5 million, with $30 million for the first phase of the project approved by the government in July 2021 (comprising $26 million for design and planning work, and $4 million to support the current operations of Building 23). There was an estimated completion date for the final facility of 2029–30. ANSTO advised the government in July 2021 that in the interim Building 23 can be sustained through a diligent maintenance program and additional government support but that it could not eliminate the risk of production disruption.
Department of Finance scoping study (2021)	In the wake of the 2019 review of ANSTO's financial sustainability and governance arrangements, the government commissioned a scoping study into options for ANSTO's governance and commercial arrangements, with the objective of reducing the Budget impact of ANSTO's future funding requirements. Phase one, to inform the 2021–22 Budget, was completed in June 2021. Phase one concluded that constructing a replacement facility to Building 23 was the only sustainable and most cost-effective solution to securing long term, reliable and affordable supply of nuclear medicines for domestic use. It endorsed the recommended option of the 2020 business case and presented three funding options. It also recommended the re-integration ANSTO Nuclear Medicine Pty Ltd into ANSTO. Phase two, to inform the 2022–23 Budget, was due to commence at November 2021.	

Source: ANAO analysis of review findings and budget options.

Appendix 4 Proactive and corrective maintenance workflow

Figure A.1: Proactive and corrective maintenance workflow



Source: ANAO analysis of ANSTO documentation and advice.

Appendix 5 Public asset-related performance measures (2021–22)

Table A.2: 2021–22 asset-related public performance measures

No.	Portfolio Budget Statements	Corporate Plan	Performance measure	Further specification (in Corporate Plan or other ANSTO documentation)	Relevant asset	Link to strategic imperative[a]	Target 2021–22
1	Yes	Yes	Days at power	Number of operating days per year	Open Pool Australian Lightwater (OPAL) reactor	SI-1	290
2	Yes	Yes	% utilisation	Delivered number of hours available out of the scheduled number of hours available (also referred to as beamline availability)	Synchrotron	SI-1	95%
3	Yes	Yes	% utilisation	The number of actual operating days out of the scheduled operating time	Australian Centre for Neutron Scattering (ACNS)	SI-1	85%
4	Yes	Yes	% utilisation	Number of actual operating days out of the scheduled operating time (also referred to as average instrument/user projects accelerator usage)	Centre for Accelerator Science (CAS)	SI-1	65%
5	Yes	No	Supply of human health products: Radiopharmaceutical doses	–	Building 23	–	–
6	Yes	Yes	Publications undertaken with national and international collaborators	–	ACNS, National Deuteration Facility (NDF), CAS, Cyclotron	SI-1	>95%
7	Yes	Yes	Case studies demonstrating the impact of our research	Direct impact - national interest, policy development, new knowledge, new technology etc.	Synchrotron, ACNS, CAS, NDF	SI-1	8 per reporting period

No.	Portfolio Budget Statements	Corporate Plan	Performance measure	Further specification (in Corporate Plan or other ANSTO documentation)	Relevant asset	Link to strategic imperative[a]	Target 2021–22
8	Yes	Yes	Improvement in safety culture	Increase in opportunities for improvement (OFI)[b] to actual incidents recorded	All or multiple	EO-2	Increase
9	No	Yes	On time completion (OT) of critical site compliance maintenance	–	All or multiple	EO-2	95%
10	Yes	Yes	% utilisation	Percentage of NDF production capacity utilised by the approved user demand	NDF	SI-1	90%
11	No	Yes	User satisfaction (NPS)	Average NPS across all facilities	OPAL, Synchrotron, ACNS, CAS, NDF	SI-1	90%
12	No	Yes	ANM (Mo-99) Delivery in Full on Time (DIFOT)	Reliability of support	ANSTO Nuclear Medicine Molybdenum-99 facility	SI-2	>95%
13	No	Yes	Total publications	ANSTO only, ANSTO with national co-authors, ANSTO with international co-authors, ANSTO with both national and international co-authors	ACNS, NDF, CAS, Cyclotron	SI-1	>600
14	No	Yes	NTD Silicon DIFOT	–	OPAL	SI-2	>95%
15	No	Yes	Australian government stakeholder satisfaction (Federal, state and local government)	–	All or multiple	SI-3	75%
16	No	Yes	Case studies to highlight and assess the impact of our engagement with government-related stakeholders	Case studies per annum	All or multiple	SI-3	>4 per annum

No.	Portfolio Budget Statements	Corporate Plan	Performance measure	Further specification (in Corporate Plan or other ANSTO documentation)	Relevant asset	Link to strategic imperative[a]	Target 2021–22
17	No	Yes	Participation in active Regional Cooperative Agreement (RCA) projects	Percentage of active projects	All or multiple	SI-3	80%
18	No	Yes	Leading Regional Cooperative Agreement (RCA) projects	Participation in active projects/ leading projects	All or multiple	SI-3	≥1
19	No	Yes	Participation in International Atomic Energy Agency Coordinated Research Projects (CRP)	CRP project relevant to nuclear applications	All or multiple	SI-3	>10
20	No	Yes	Case studies to highlight and assess the impact of our engagement with international stakeholders	Case studies per annum	All or multiple	SI-3	>2
21	No	Yes	Share with general public research outcomes enabled by ANSTO	Science stories published on the ANSTO website	All or multiple	SI-3	>36
22	No	Yes	Offer a range of resources for teachers and students to support the national science curriculum outcomes for years 3 to 12	National programs delivered	All or multiple	SI-3	>6
23	No	Yes	Increase accessibility of STEM teacher training programs	Teacher professional development days delivered	All or multiple	SI-3	All states and territories
24	No	Yes	Conduct educational tours and science experiences at ANSTO's Sydney and Melbourne campuses	Visitors to ANSTO's campuses per annum	All or multiple	SI-3	>15,000
25	No	Yes	Postgraduates supervised	–	All or multiple	EO-1	120

No.	Portfolio Budget Statements	Corporate Plan	Performance measure	Further specification (in Corporate Plan or other ANSTO documentation)	Relevant asset	Link to strategic imperative[a]	Target 2021–22
26	No	Yes	Improvement in site-wide safety	Year on year decrease in Class 1, 2 & 3 incidents[c]	All or multiple	EO-2	Decrease
27	No	Yes	ANSTO Nuclear Medicine Production Facility DIFOT	(also referred to as DIFOT — Health products)	Building 23	SI-2	>95%

Note a: From the Corporate Plan 2021–22.

Strategic Imperative 1 (SI-1) = Research and research infrastructure (To conduct research and enable external use of our research capability and infrastructure for the national benefit).

Strategic Imperative 2 (SI-2) = Commercial products and services (To provide nuclear medicines and commercial services for the benefit of Australia and the world).

Strategic Imperative 3 (SI-3) = Expert and trusted advisor (To be an expert and trusted advisor to government, industry, international partners, and the Australian public).

Enabling Objective 1 (EO-1) = To mobilise and develop the nuclear science and technology workforce of the future.

Enabling Objective 2 (EO-2) = To ensure the ongoing financial and operational sustainability of ANSTO.

Note b: OFI – An event that did not result in any adverse effects to personnel or the environment and is not considered to have had the potential to cause a lost time injury, medical treatment injury or exposure of personnel, or harm to the environment; but could have resulted in a minor occurrence or damage to plant and equipment.

Note c: Class 1 – Damage that permanently alters a person's life; Class 2 – Damage that temporarily alters a person's life; Class 3 – Inconveniences in person's life or 1-5 days/shifts off work.

Source: ANSTO 2021–22 Corporate Plan and 2021–22 Portfolio Budget Statements.

Appendix 6 Internal asset-related performance measures

Table A.3: Number and type of asset performance indicators

Asset	Environmental	Governance, risk, compliance	Operational	Quality	Safety	Strategic planning	Total
Nuclear Science and Technology Group	1	28	107	–	5	10	**151**
Australian Centre for Neutron Scattering	1	16	41	–	4	6	**68**
Centre for Accelerator Science	1	16	43	–	4	6	**70**
National Deuteration Facility	1	16	53	–	4	6	**80**
Australian Synchrotron	1	18	45	–	6	7	**77**
Nuclear Operations and Nuclear Medicine Group	14	35	128	6	52	7	**242**
ANSTO Nuclear Medicine Molybdenum-99 facility	3	20	69	3	16	6	**117**
Building 23	4	19	73	3	18	5	**122**
Open Pool Australian Lightwater Reactor	10	29	65	3	35	8	**150**
Total	**14**	**55**	**228**	**6**	**55**	**19**	**377**

Note: As the same performance measure could apply to multiple assets or groups, the number of performance measures for individual assets may exceed the total for a group or overall. Duplicate performance measures were identified and removed where possible, but some may still exist. Some performance measures in documents were identified as obsolete by the Nuclear Medicine division and are not shown or counted.

Source: ANAO analysis of ANSTO documentation.