ANA2025 Conference

CONFERENCE HANDBOOK

Regional Progress in Nuclear

17th Australian Nuclear Association Conference on Nuclear Science and Engineering in Australia

Friday 10 October 2025

Ultimo, NSW, Australia

ANA2025

Australian Nuclear Association Inc (ANA)

Seventeenth Conference on

Nuclear Science & Engineering in Australia

Aerial UTS Function Centre
Level 7, UTS Building 10, 235 Jones Street, Ultimo, NSW

Friday 10 October 2025

Regional Progress in Nuclear

#ANA2025

Handbook Editor **John Harries**

The Australian Nuclear Association acknowledges the Gadigal people of the Eora Nation upon whose ancestral lands this conference is being held and pay our respect to the Elders past and present.

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Australian Nuclear Association Inc.

Conference Handbook

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Nuclear Science & Engineering in Australia
Ultimo, NSW, 10 Oct 2025

John Harries, editor

Includes titles and authors of papers

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Message from ANA President

I welcome all participants to this the seventeenth conference in the series of conferences hosted by the Australian Nuclear Association Inc. on Nuclear Science and Engineering in Australia. Since 1995, these conferences have highlighted the achievements of nuclear science and engineering contributing to the wellbeing and prosperity of Australians.

The papers at this conference demonstrate the vitality of nuclear science and engineering in Australia and the increased interest in nuclear power for dispatchable, low-carbon power and energy security.

We have an impressive program of speakers. The abstracts of the papers and biographies of the speakers are included in this Handbook. Where possible, slides and videos of the presentations will be made available on the ANA website (www.nuclearaustralia.org.au) after the conference.

I look forward to greeting all participants on the day. Please contribute to discussions and enjoy the ANA2025 conference. For those of you on social media, please use the hashtag #ANA2025.

I gratefully acknowledge the assistance of the members of the Conference Organising Committee, the Principal Sponsorship support from the Australian Nuclear Science and Technology Organisation (ANSTO), Gold Sponsorships of ZW Solutions and Erilyan and the Sponsorship of SMR Nuclear Technology Pty Ltd.

Dr Mark Ho

ANA President and Conference Chair

Australian Nuclear Association Inc (ANA)

The Australian Nuclear Association Inc (ANA) is an independent incorporated scientific institution which promotes the education, knowledge and practice of the peaceful, safe and effective use of nuclear science and technology to benefit people, science and the environment.

The Australian Nuclear Association supports the use of nuclear science and technology in Australia, including nuclear techniques in research, industry and medicine; research reactors as a source of neutrons for research and production of radioisotopes; nuclear power plants to produce electricity and the use of nuclear power for marine propulsion.

Public Debate

The ANA makes submissions to government inquiries on nuclear issues and makes press releases on nuclear topics. In addition, ANA members give talks on nuclear issues to a wide range of organisations.

Publications

The ANA quarterly newsletter "Nuclear Australia" on events in the nuclear science and technology in Australia and overseas.

Meetings

Technical lectures by leading experts are held regularly and coordinated with meetings hosted by the Nuclear Engineering Panel of Engineers Australia Sydney.

Conferences

The ANA hosts national conferences on nuclear science and engineering in Australia. The ANA2025 Conference is the seventeenth conference in the series. ANA hosted the international 9th and 15th Pacific Basin Nuclear Conferences, Sydney, 1994 and 2006.

Linkages

The ANA is a member of *Science & Technology Australia*, the *Pacific Nuclear Counc*il and the *International Nuclear Societies Council*.

Joining the ANA

The ANA welcomes new members. Membership application can be made on the ANA web site https://www.nuclearaustralia.org.au.

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SMR NUCLEAR TECHNOLOGY PTY LTD (SMR-NT) is a firm specialising in the development of nuclear power generation. It is leading the effort to bring the safest SMR nuclear power generation technology to Australia, providing a means to reduce Australia's greenhouse gas emissions and increase Australia's energy security.

What are SMRs?

SMRs are small modular reactors with electricity generating capacity of between 50 – 200 megawatts, enough to safely power a small city or a large industrial plat.

SMRs are self-contained, factory-produced plants that can be shipped by road, rail or sea to suitable sites. They are safer and much simpler to operate than the larger nuclear plants.

SMRs provide for 'passive' safety operation. Most of the larger reactors utilise active safety features (mainly electromechanical devices) to provide reactor cooling and shut off systems in the event of reactor incidents. SMRs do not rely on such devices and do not require external electricity supplies or pumps to cool the reactor.

SMRs also do not require large water supplies and can be located away from the coast. They are installed partially underground for additional safety protection.

Who is SMR-NT?

SMR-NT is an Australian firm established in 2012. Its directors together have over 100 years' experience in power generation and over 50 years' experience in nuclear power.

SMR-NT has a paramount commitment to safety, transparency, and honesty in all of its dealings. It also supports the involvement of the Australian community in nuclear power development.

What is SMR-NT doing?

SMR-NT is negotiating with nuclear technology suppliers and is studying suitable sites for the development of SMRs in regional generation-deficient locations where costly upgrades to the transmission grid can be avoided.

SMR-NT is advocating to the Australian Government that it should establish an Australia-wide best practice regulatory regime for SMR nuclear power generation, in accordance with the best practice guidelines of the International Atomic Energy Agency.

SMR NUCLEAR TECHNOLOGY PTY LTD

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ANA2025 Conference

PROGRAM

MORNING SESSIONS

08.00 am **Registration Desk Opens**

09.00 am **Opening and Welcome: Dr Mark Ho, ANA President**

SESSION 1:
Session Chair: Mark Ho

FACILITIES IN AUSTRALIA

09:00 **Australian Nuclear Science and Technology Organisation (ANSTO).** Miles Apperley, Group Executive Nuclear Operations, Safety and Security, ANSTO.

09:30 **Australian Submarine Agency (ASA).** Jasmin Craufurd-Hill, Assistant Director-General Nuclear Regulation, ASA.

10:00 **Tellus Sandy Ridge Facility for Disposal of Low-level Radioactive Waste**. Robert Blackley, Tellus.

10:30 am **Break for Tea/Coffee** (10:30 – 11:00)

11:00 **SESSION 2**

Session Chair: Helen Cook, Global Nuclear Energy Advisory

COUNTRIES CONSIDERING OR ADOPTING NUCLEAR ENERGY

11:00 **Philippines - Why the Philippines is moving towards nuclear energy.** Congressman Hon. Mark Cojuangco, Philippines House of Representatives.

11:30 **Egypt's Nuclear Energy Program.** Dr Mohamed Saad Dwiddar, Advisor to the Board Chairman of the Nuclear Power Plant Authority of Egypt.

12:00 **Indonesia's plans for nuclear energy.** Bob S. Effendi, Director, PT Xpert Synergy Solution, Indonesia.

1**2.30 am** **Lunch (12:30am -1:20pm)**

AFTERNOON SESSIONS

1:20 pm **SESSION 3**

Session Chair: Joanne Lackenby

NUCLEAR TECHNOLOGY

1:20 **Case for Microreactors in Australia.** Tony Irwin, SMR Nuclear Technology.

1:45 **Building a Nuclear Workforce: A whole-of-nation challenge.** Elizabeth Williams, ANU.

2:10 **The ANSTO Synroc® Radioactive Waste Treatment Facility.** Rohan Holmes, ANSTO.

2:35 **Modernising Regulation for Emerging Nuclear Technologies.** Jasmin Diab, Global Nuclear Security Partners.

3:00 pm **Break for Tea/Coffee**

3:30 pm **SESSION 4**

Session Chair: Hasliza Omar

3:30 **Benefits of Nuclear Energy for Remote Industrial Applications.** Peter Zajac, ZW Solutions.

3:50 **Panel: What industries would benefit from nuclear energy?**
Tony Irwin, SMR Nuclear Technologies
Peter Zajac, ZW Solutions

4:20 **Panel: Regional Progress in Nuclear.**
Mohamed Saad Dwiddar
Bob S. Effendi,
Helen Cook

5:00 pm **Session Closes**

5:00 pm **Post-Conference Reception for discussion/networking**

Presentation 1 – Session 1

Australian Nuclear Science and Technology Organisation (ANSTO)

Miles Apperley
Group Executive - Nuclear Operations, Safety and Security
Australian Nuclear Science and Technology Organisation

Biography

As Group Executive Nuclear Operations, Safety and Security, Miles has responsibility for all nuclear operations, including reactor operations and waste management, high reliability (safety), nuclear security and nuclear safeguards, nuclear stewardship, and ANSTO's Nuclear-Powered Submarine Working Group.

At ANSTO, Miles has managed the safe, secure and sustainable planning and operation of the organisation's entire portfolio of Landmark and National Research Infrastructure. He now has responsibility for nuclear stewardship across all ANSTO.

Miles has more than thirty-five years of experience in strategic planning and leadership of science and technology collaborations between government, industry, and universities. He has established multi-node, multi-disciplinary collaborative research infrastructure networks for the characterisation of matter (chemical, mineral, biological) across a broad range of resolution and sensitivity scales.

Miles has a Bachelor of Metallurgical Engineering and a PhD from the University of New South Wales. He has extensive industry-based R&D experience in collaboration with universities, national laboratories and government agencies and has completed an Advanced Certificate in Management, Innovation and Technology from MIT and is a Graduate of the Australian Institute of Company Directors.

Abstract

For more than 70 years, ANSTO has been at the heart of Australia's nuclear capability, serving as the nation's knowledge centre for nuclear science and technology. With deep expertise in the safe, secure, and sustainable stewardship of complex nuclear infrastructure, including the OPAL multi-purpose reactor, nuclear medicine production facilities, and programs in waste management and decommissioning, ANSTO is a trusted leader in nuclear technology.

The past year has been one of significant achievement, reinforcing ANSTO's role as a reliable steward of critical national capability. This includes the successful completion of critical upgrades to the OPAL reactor, the commencement of the safe decommissioning of the HIFAR reactor, and the delivery of a complex spent fuel shipment - each milestone representing both technical excellence and ANSTO's commitment to safety, security, and international best practice. These outcomes reflect the depth of in-house expertise and strong partnerships across government and industry.

In a time of renewed global focus on nuclear technologies, including with the AUKUS trilateral partnership and the nuclear-powered submarine program, ANSTO's expertise is increasingly critical. Our landmark infrastructure not only supports world-leading translational research but also underpins Australia's contributions to public health, industry, defence, and the environment.

ANSTO is also shaping the nuclear workforce of the future, by building national nuclear literacy through tailored education and training programs, including through the Basics of Nuclear Literacy, and the Senior Officer and Executive training courses. These courses are designed to foster informed decision-making, enhance understanding of the strategic context, and prepare Australia for the challenges and opportunities of a nuclear future. By extending training to government, industry, and broader community audiences, ANSTO is also helping to cultivate the skilled workforce and societal understanding required to sustain nuclear capability over the long term.

As we approach the 20th anniversary of OPAL in 2026, this keynote will reflect on the enduring impact of ANSTO's stewardship, highlight our role in advancing nuclear technology, and explore how Australia can continue to benefit from nuclear science in a rapidly evolving national and global context.

Presentation 2 – Session 1

Australian Submarine Agency (ASA)

Jasmin Craufurd-Hill MStJ FIML FGIA

Assistant Director-General ASA

Nuclear Regulation

Biography

Jasmin is a technical leader with expertise in sovereign capability, national facilities and resilience. Prior to her current role, Jasmin held senior leadership roles including Assistant Director-General (Technology Enterprise) in the ASA, Assistant-Secretary for Innovation, Science and Technology in the Department of Defence, Vice-President for Advanced Technology at the Australian Risk Policy Institute, Director of the Institute for Regional Security, and Regional Executive/Board Member of Women-in-Nuclear (Global).

Jasmin has over two decades' experience leading nuclear technologies, from project management and systems engineering to leading the I&C Commissioning Operations Group for the OPAL Reactor's commissioning and early operational phases. Jasmin has served as the inaugural Future Technology Fellow at the Centre for Defence Research / 3Ai and has led Australian Government-funded and academic research programs in cyber and critical technology. She is also a Fellow of the Institute of Managers & Leaders (ANZ), and of the Governance Institute of Australia.

Jasmin is a Certified Nuclear Security Professional with cybersecurity and STEM specialisations and holds a Bachelor of Science (Physics), Graduate Certificate in Intelligence Analysis, Master of Business Administration, Master of International Relations and a Master of Applied Cybernetics.

In 2018, Jasmin was invested as a Member of the Most Venerable Order of the Hospital of Saint John of Jerusalem, a Royal Order of Chivalry, in recognition of her contribution to emergency services and the Australian community.

ABSTRACT

Australia is taking a thorough and considered approach to all issues related to safety, security, and safeguarding, demonstrating our commitment to becoming a responsible steward of nuclear propulsion technology.

This presentation will provide an overview of the significant progress that has been made by the Nuclear-Powered Submarine (NPS) Enterprise to build the people and infrastructure capability, in collaboration with our AUKUS partners, keeping Australia on track to deliver the Optimum pathway announced in March 2023.

This has included progress in developing Australia's workforce, industrial uplift and major investments in infrastructure, significant legislative reform, and new international agreements to enable and implement AUKUS cooperation.

Presentation 3 – Session 1

Tellus Sandy Ridge Facility for Disposal of Low-level Radioactive Waste

Robert Blackley
General Manager – LLW and Radiological Waste

Biography

Robert has more than 24 years of technical and project management experience in Australia and overseas, and is internationally recognised as a subject matter expert in LLW management and nuclear safety. His expertise spans diverse projects and locations, from storage and transport of LLW and NORM; decommissioning and remediation; radiation safety training, and emergency response.

Recently, Robert led the supply chain solutions and eventual clean up and disposal of thousands of tonnes of low level radioactive wastes from the East Coast of Australia to their final disposal at Sandy Ridge.

Prior to joining Tellus, Robert worked at the Australian Nuclear Science and Technology Organisation (ANSTO) in senior roles in Radiation Safety. He was also responsible for the development and provision of training to other Australian Government organisations, response teams and government officers.

ABSTRACT

Tellus is a Western Australia based company specialising in the management and permanent disposal of hazardous materials. The Sandy Ridge facility, located 240 km northwest of Kalgoorlie, is uniquely positioned in a remote, geologically stable and arid region, providing optimal conditions for the permanent isolation of hazardous and radioactive waste. Low-level-radioactive waste is permanently isolated by emplacing materials in the near surface geological repository at Sandy Ridge.

This presentation will detail examples from industry of overcoming challenges in the management and disposal of low-level radioactive waste in Australia. By presenting the challenges and lessons learned from an industry perspective, Tellus can provide valuable insights for future remediation efforts on complex sites.

Robert will also discuss, and provide detail on, the future of radioactive waste disposal. Explaining future Tellus endeavours such as the Deep Borehole Demonstration project, and the Chandler project, a proposed deep geological repository in the Northern Territory.

.

Presentation 4 – Session 2

Why the Philippines is moving towards nuclear energy.

Congressman Hon. Mark O. Cojuangco,
District Representative, Pangasinan, 2nd District
Philippines House of Representatives.
Quezon City

Biography

The Hon. Mark O. Cojuangco represents the Pangasinan, 2nd District in the House of Representatives Quezon City, Philippines. He is Chairperson of the House Committee on Nuclear Energy.

He received the Distinguished Public Service Award from the American Nuclear Society in 2023 "in recognition of his advocacy of nuclear power in the Philippines for over a decade. He has been a visionary leader for his country."

Abstract

The Senate of the Philippines passed legislation in June 2025 to establish the Philippine Atomic Energy Regulatory Authority. This bill sets a comprehensive framework for regulating civil nuclear energy in the country, marking a milestone for nuclear energy governance in the country. Congressman Mark Cojuangco was the principal sponsor of the bill in the House of Representatives.

The Philippines aims to have its first nuclear power plant operational by 2032. It is exploring the possible revival of the Bataan project or constructing a small modular reactor

Notes:

Presentation 5 – Session 2

Egypt's Nuclear Energy Program

Dr. Mohammed Dwiddar

Egyptian Nuclear Power Plants Authority

Biography

Dr. Mohammed Dwiddar is the Advisor to the Egyptian Nuclear Power Plants Authority Board Chairman for Nuclear Projects and Operation and Maintenance, having served as the interim NPPA Board Chairman prior to his current role. Dr. Dwiddar was appointed as a Board Member of the World Nuclear Association in the first of 2025.

Prior to January 2025, Dr. Dwiddar was Project Manager of the El-Dabaa Nuclear Power Plant Project, leading the team overseeing the implementation of the El-Dabaa Nuclear Power Plant Project in Egypt. The El-Dabaa Nuclear Power Plant will have four VVER reactors and is Egypt's first nuclear power plant.

Before joining the NPPA in 2009, Dr. Dwiddar worked at the Egyptian Atomic Energy Authority as a reactor operator in the Nuclear Research Reactor in Inshas.

Dr. Dwiddar has extensive experience in areas related to the nuclear fuel cycle and was closely involved in the development and updating of national strategies with respect to the nuclear fuel cycle for the Egyptian civil nuclear power programme.

Dr. Dwiddar obtained a Bachelor of Science degree, a Master of Science and a PhD in Nuclear Engineering from the University of Alexandria in Egypt.

Abstract

In the 1960s, Egypt started up its first research reactor and began considering nuclear energy. In 1981 the El-Dabaa site was selected for Egypt's first nuclear power plant. The El-Dabaa site is located on the Mediterranean coast – around 170 km west of Alexandria.

In 1976 Egypt established the Nuclear Power Plants Authority (NPPA), which is the owner/operator entity responsible for the construction and operation of NPPs for electricity generation and seawater desalination.

Egypt is currently constructing its first nuclear power plant on El-Dabaa Site, in Matrouh Governorate. The El-Dabaa Nuclear Power Plant will comprise four generation 3+ VVER reactors with a capacity of 1200 MW each in furtherance of the intergovernmental agreement signed between the Government of the Arab Republic of Egypt and the Government of the Russian Federation in November 2015. The project contracts include an EPC contract, a fuel supply contract, a spent nuclear fuel treatment contract and an operation support and maintenance contract which became effective in September 2017. Once the 4 units will be in operation, the El Dabaa NPP will supply around 8-10% of the Egypt's electricity.

Over the past 3 years, the El-Dabba Nuclear Power Plant Project has witnessed the achievement of a number of key milestones. In July 2022, first concrete pouring for Unit 1 successfully took place following the obtainment of the construction permit from the Egyptian Nuclear Radiological Regulatory Authority (ENRRA). This was closely followed by the granting of the construction permits and the first concrete pouring for Units 2 and 3 in November 2022 and May 2023. In January 2024, first concrete for unit 4 of the El-Dabaa Nuclear Power Plant was poured, marking the commencement of full-scale construction works across all four units

On the 21st of March 2023, the core catcher for Unit 1, being the first major item of long lead equipment, arrived at the El-Dabaa site via the docking facility constructed by the Egyptian Party. Other key items of long lead equipment are currently being manufactured including, reactor pressure vessel and reactor top head; primary circuit equipment (steam generators, pressurisers and pipeline components); and steam turbine sets.

The Project continues to be implemented in accordance with the project time schedules, with the reactor pressure vessel for Unit 1 anticipated to arrive to the site for installation in Q4 of 2025, and the pre-commissioning activities are scheduled to start by the end of 2025.

Presentation 6 – Session 2

Indonesia's Plans for Nuclear Energy

Bob S. Effendi

Founder of PT Xpert Synergy Solution

Biography

Bob S. Effendi is Founder of PT Xpert Synergy Solution, a consultancy advancing nuclear and clean energy adoption in Indonesia. With over 30 years of leadership experience in the energy sector — spanning oil & gas to nuclear — and a decade as Chief Operating Officer of PT Thorcon Power Indonesia, he has been instrumental in shaping Indonesia's nuclear energy policy. Bob is also recognized for his active role in policy advocacy, strategic advisory, and stakeholder engagement across government, academia, and industry

Abstract

Indonesia's nuclear journey reflects decades of institutional evolution, policy reform, and lessons from past attempts. The creation of **BATAN (1964)** for nuclear research and **BAPETEN (1998)** as an independent regulator established a governance framework that separates promotion from oversight, ensuring safety and compliance with international standards. Early efforts, including the **Gunung Muria project**, highlighted challenges of financing, politics, and public acceptance, reinforcing the importance of regulatory trust and stakeholder coordination.

Policy has shifted significantly over time. Under **PP 79/2014**, nuclear was considered a "last resort," but revisions now position it as part of Indonesia's clean energy mix. This change is reflected in the **RUPTL 2025–2034**, which allocates **250 MW in Bangka Belitung** and **250 MW in West Kalimantan** as the first nuclear projects. Key actors in this process include the **Ministry of Energy and Mineral Resources (ESDM)**, the **National Energy Council (DEN)**, **BRIN**, and **BAPETEN**, with the proposed **NEPIO**—to be established by presidential decree—intended to coordinate program implementation.

BAPETEN, in line with IAEA standards, is involved in the **SMR Regulatory Harmonization Initiative** to support future reactor development. **With nuclear energy targets of 10 GW by 2040 and 54 GW by 2060**, nuclear is set to provide stable baseload power alongside renewables. **Repowering**—converting coal plants to clean energy sources by changing boiler with reactors, geothermal, and thermal storage—is now part of revised energy policy.

In addition to national objectives, **regional cooperation** plays an important role because **nuclear safety, security, and waste management are issues that extend beyond individual countries**. This necessitates collaboration with ASEAN partners and Australia, as well as consideration of developing regional nuclear supply chain industries.

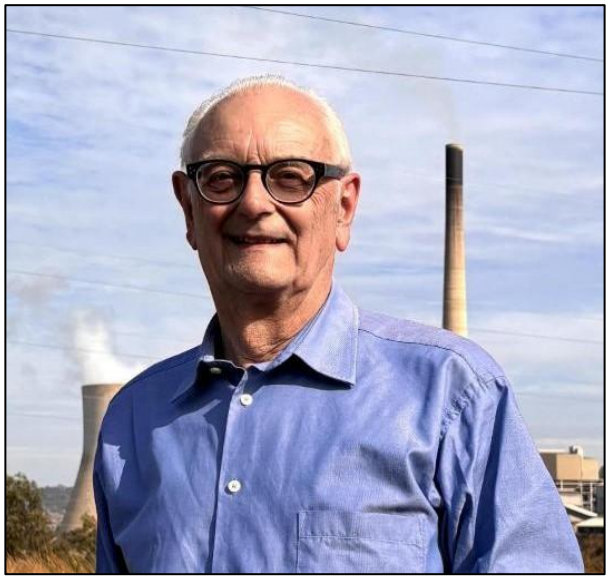
Presentation 7 – Session 3

Case for Microreactors in Australia

Tony Irwin FIEAust MIET CPEng

SMR Nuclear Technology.

Biography



Tony Irwin is a Chartered Engineer, Technical Director of SMR Nuclear Technology Pty Ltd and immediate past Chair of Engineers Australia Sydney Nuclear Engineering Panel.

Tony worked for British Energy in the UK for more than thirty years commissioning and operating 8 nuclear power reactors.

Following the Chernobyl accident, he worked with Russian reactor operations engineers to improve their safety culture and was a member of a World Association of Nuclear Operators (WANO) team that went to Russia to review operating practices at Leningrad RBMK, sister station to Chernobyl.

In 1999, Tony moved to Australia and joined ANSTO, initially in the area of Government and Public Affairs, where he managed fuel strategies, represented Australia at international meetings and was Project Manager for two spent fuel shipments to France. Tony was subsequently appointed as Commissioning Reactor Manager and then first Reactor Manager of ANSTO's new OPAL research reactor.

Tony is now a Consultant, Honorary Associate Professor and principal lecturer for Nuclear Reactors and the Nuclear Fuel Cycle at the ANU.

Abstract

Micro Modular Reactors (MMRs) or simply "microreactors" are small nuclear reactors with an electrical output of typically up to 10 MWe. They can reliably provide any combination of electricity supply and heat in all weather conditions. MMRs are suitable for remote

communities, off-grid applications, mining operations, critical infrastructure, strategic military installations, data centres and disaster response.

Microreactors are factory assembled and transported to site typically in standard shipping containers. Site installation in days instead of years.

The presentation will review the latest developments and examine examples from Westinghouse, Radiant Industries, BWX Technologies, Oklo and Nano Nuclear energy.

Presentation 8 – Session 3

Building a nuclear workforce: A whole-of-nation challenge

Elizabeth Williams

ANU

Biography

Associate Professor Elizabeth Williams (Liz) is a nuclear physicist by training, with a PhD in experimental nuclear structure from Yale University. She completed postdoctoral work at the CSIRO before joining ANU in 2012, where she held an Australian Research Council DECRA Fellowship in nuclear reactions before moving to various roles in the College of Engineering and Computer Science from 2018. There, she convened the Algorithmic Futures Policy Lab series, which was supported by the Erasmus+ Programme of the European Union. She also served as AUKUS Response Lead, where she led the creation of the new nuclear systems major and minor for the ANU Bachelor of Engineering programs. These programs, including the nuclear major, are the first engineering offerings with a named nuclear component to achieve provisional accreditation from Engineers Australia.

Liz is currently Associate Professor and Nuclear Systems Discipline Lead in the School of Engineering. Her research focuses on the responsible integration of artificial intelligence-enabled systems in safety-critical contexts. She is particularly interested in ensuring such work begins with contextually appropriate and inclusive definitions of safety. She is actively engaged in the nuclear engineering community through service on several NEA Global Forum Working Groups on Nuclear Education, Science, Technology and Policy. She also serves as the Chair of the ANU Nuclear Stewardship Steering Committee, which supports cross-disciplinary nuclear research and education at the ANU, and lectures on epistemic communities and nuclear cultures for the ANU / Charles Sturt Graduate Certificate for Nuclear Safeguards and Security. She is involved in running the Australian Nuclear Research and Education Network (ANREN).

Finally, she is a keen science communicator and loves podcasting as a medium. She served as creator, co-producer, and co-host of the Algorithmic Futures Podcast for three years, and recently launched the Nuclear Matters podcast, which explores Australia's nuclear past, present, and future with the help of experts actively working on nuclear issues. to the implementation, operation and regulation of a nuclear-powered submarine programme.

Abstract

Since the 1940s, Australia has been directly involved in the global nuclear fuel cycle and has contributed strongly to nuclear science and technology initiatives and nuclear non-proliferation and safeguards efforts at home and abroad. We have largely supported these efforts through on-the-job training or overseas recruitment, with few formal pathways for sustaining and growing this capability via the Australian tertiary education sector. Following the AUKUS announcement in 2021, the need for a skilled nuclear workforce has grown, putting pressure on the existing workforce and raising questions about how we can best support our sovereign nuclear needs in the coming years.

In this talk, I will present some of the challenges and opportunities Australia faces in supporting sovereign nuclear workforce needs, and discuss the current state of nuclear research and education in the Australian university sector. I will also share information on the Australian Nuclear Research and Education Network (ANREN), a collaboration of university-affiliated academics and professional staff interested in supporting a whole-of-nation approach to nuclear research and education.

This talk has been collaboratively developed with the help of the following ANREN members: Eva Bezak (UniSA), Igor Bray (CU), Patrick Burr (UNSW), Geoff Currie (CSU), Julieanne Dougherty (ANU), Pejman Farzad (UWA), Kim Harvey (UoA), Tony Hooker (UoA), Ivan Kempson (UniSA), Michael Lerch (UOW), AJ Mitchell (ANU), Michael Preuss (Monash), Anatoly Rozenfeld (UOW), Edward Simpson (ANU), and Nigel Spooner (UoA).

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Presentation 9 – Session 3

ANSTO Synroc® Waste Treatment Plant for Liquid Mo-99 Wastes

Rohan Holmes, Dan Gregg, and Gerry Triani

ANSTO

Biography

Rohan Holmes is ANSTO Synroc's Lead Engineer. He is responsible for the technology translation and implementation of ANSTO Synroc Technology for the ANSTO Synroc Waste Treatment Plant

Abstract

ANSTO Synroc Technology for processing radioactive wastes has been an evolving research and development program for several decades aimed at treating a variety of radioactive waste feedstocks. The ANSTO Synroc Waste Treatment Plant (SWTP) represents the first industrial scale implementation of Synroc technology with the design targeted to the treatment of alkaline intermediate level liquid waste (ILLW) resulting from radiopharmaceutical manufacture. The primary objective of the process technology is to transform this liquid waste into an engineered material (wasteform) with performance and durability properties suitable for disposal. This is achieved though mixing waste with waste-forming additives, preparing a tailored granular material that is subsequently consolidated via hot isostatic pressing.

The delivery of the SWTP will represent a significant achievement for ANSTO, reflecting the organisation's commitment to drive the technical maturation program entirely through internal expertise developing its people and technology as opposed to a pure procurement approach which is more typical for nuclear technologies within Australia. This path has leveraged many years of nuclear knowledge, skills, and development effort at ANSTO to implement a technology maturation plan to translate laboratory scale research into plant capable of safely and reliably treating radioactive waste. The technology maturation approach has been used to de-risk the SWTP through addressing technical and integration risks as well as generating data used to support detailed design and implementation.

ANSTO Synroc Technology represents a substantial Australian sovereign capability that has the potential to treat many radioactive wastes globally, particularly those that currently have no viable pathway for waste treatment. The overarching objective of the SWTP is to demonstrate ANSTO Synroc Technology at an industrially relevant scale and develop evidence to support use of the technology for treating other challenging radioactive wastes within Australia and internationally. Successful demonstration of the technology not only reinforces ANSTO's reputation for safe, secure, and sustainable operation of nuclear technologies, but also demonstrates commitment to the responsible management and treatment of radioactive wastes.

The delivery programme for the SWTP is mature with the facility construction and fit-out essentially complete. A comprehensive commissioning programme has been developed for the facility aimed at verifying and validating the safety envelope of the plant as well as allowing substantial time for performance qualification through the technology acceptance phase. The outcome of this qualification phase will be to deliver the baseline configuration and operational readiness objectives to support ongoing operation of the SWTP.

This presentation will provide background describing the capability of ANSTO Synroc Technology as well as how this technology has been tailored to treat liquid waste arising from nuclear medicine production. The status and achievements of the SWTP delivery programme will also be presented.

The authors would like to acknowledge all members of the ANSTO Synroc team and the SyMo project delivery team who have contributed to the development and implementation of the SWTP.

External view of the Synroc Waste Treatment Plant.

Internal view of the Rear of Cells area showing the hot cell complex.

Presentation 10 – Session 3

Modernising Regulation for Emerging Nuclear Technologies.

Jasmin Diab, CSC

Managing Director, Global Nuclear Security Partners

Biography

Jasmin describes herself, somewhat modestly, as a mum, leader, nerd and diversity advocate. Jasmin is a nuclear security specialist with decades of experience in the Australian nuclear scene. She is the Managing Director of Global Nuclear Security Partners Australia, President of Women in Nuclear Australia, the Oceania representative on the Women in Nuclear Global executive, a Senior Associate with Mettle Global, a member of the ARPANSA (Australian Radiation Protection and Nuclear Safety Agency) Nuclear Safety Committee and a 2025/26 Superstars of STEM candidate.

With a background in explosive ordnance disposal, Jasmin spent most of her 22 years of active service providing operational and training support in countering chemical, biological, radiological, nuclear, and explosive threats and has seen operational service both domestically and overseas.

Jasmin is a certified nuclear security professional through the World Institute of Nuclear Security, a Fellow with Engineers Australia, has a Bachelor of Science in physics and chemistry, a Masters in Defence and Military Studies, a Masters in Engineering Science (Nuclear Engineering) and is a Graduate of the Australian Institute of Company Directors.

Abstract

The accelerating deployment of emerging nuclear technologies—including microreactors, small modular reactors (SMRs), advanced nuclear batteries, commercial maritime nuclear propulsion, space-based reactors, nuclear medicine isotope production and fusion systems—demands a fundamental re-examination of nuclear safety, security, and safeguards regulation. Traditional regulatory frameworks, developed for large-scale light-water reactors, are increasingly challenged by the distinct technical, operational, and proliferation risk profiles of these new technologies. Without timely modernisation, regulatory lag could impede

innovation, hinder deployment, and undermine international confidence in nuclear energy's role in the global clean energy transition.

Modernisation of nuclear governance requires adapting to several pressing challenges. First, the diversity of technology designs presents regulators with the task of overseeing an assorted fleet, each with unique safety and security considerations—from factory-fabricated microreactors deployed in remote locations, to mobile reactors aboard vessels, to reactors intended for extraterrestrial environments. Second, the pace of innovation in reactor design and deployment timelines threatens to outstrip the ability of regulators to conduct thorough assessments under existing processes. Third, the integration of digital systems, including autonomous controls and AI-supported monitoring, expands the regulatory scope into cybersecurity and resilience. Fourth, the globalised supply chain and multinational ambitions of reactor developers create new complexity in safeguarding materials and ensuring harmonised international oversight.

To address these challenges, regulatory frameworks must evolve along three key axes. Safety must be redefined for modular, mobile, and extreme-environment applications, with increased reliance on performance-based standards, risk-informed assessment, and real-time digital monitoring. Security must expand beyond physical protection to include cyber resilience, insider threat prevention, and measures against illicit use in unconventional environments such as maritime shipping lanes or lunar outposts. Safeguards, under the oversight of the International Atomic Energy Agency (IAEA) and national authorities, must adapt to dispersed and smaller-scale deployments, requiring novel approaches to nuclear material accountancy, remote verification, and international collaboration.

Emerging tools and techniques can facilitate this regulatory modernisation. This includes concepts like regulatory sandboxes (controlled environments where new technologies can be tested under regulatory observation) to offer a pathway to adaptive learning. Digital twins and advanced simulation tools to accelerate licencing by modelling reactor behaviour under diverse conditions. Artificial intelligence and machine learning can support anomaly detection, predictive maintenance, and safeguard verification. International initiatives, such as the IAEA's SMR Regulators' Forum and industry's Nuclear Energy Maritime Organisation (NEMO) as well as bilateral harmonisation efforts, provide mechanisms to reduce duplication and ensure consistent global standards.

Ultimately, modernising nuclear safety, security, and safeguards regulation is not merely a technical necessity but a strategic imperative. The credibility of emerging nuclear technologies depends on the ability of regulators, industry, and international institutions to demonstrate that innovation does not come at the expense of rigorous oversight. A forward-looking regulatory ecosystem that is adaptive, collaborative, and technology-inclusive, will enable nuclear innovation to advance in lockstep with safety, security, and non-proliferation commitments. This ensures that these emerging technologies can deliver on their promise of sustainable energy, resilient infrastructure, and peaceful space exploration.

Presentation 11 – Session 4

Benefits of nuclear energy for remote industrial applications

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ABSTRACT

Difference between large grids and islanded industrial grids:

- Industrial grids have much lower day/night and seasonal load fluctuations, compared to large, interconnected grids.
- The ratio of a size of a single generating device to a single large load is significantly different (which makes industrial system much more prone to instabilities). For example, grinding mills, that are typically the largest loads in mining operations, may constitute 50% of the entire mining load. For that reason, the supply is, in a way, more complex than just having one large generator, and load is not enough to have multiple large size generators. In this case, nuclear would have to be coupled with energy storage facilities. For examples, in gold mining, where autoclaves and oxygen plants are used, oxygen production consumes lots of energy. For this reason, oxygen storage could be implemented, so when the mill trips, oxygen compression ramps up. Or other energy storage facilities, related to processing

- Mining grids have lower inertia compared to large, interconnected grids with large penetration of synchronous generators (mainly large steam turbines)

Technical and commercial limitations of use of renewables in remote mining areas:

- Low percentage versus high percentage of renewable penetration
- Oversizing renewables compared to load to achieve low penetration of renewables, with thermal backup (case study)
- Economic limitations of high penetration of renewables (over 50% of annual energy generation)

Cost of liquid and gaseous fuel storage, for example LNG, issues with long term storage

- Logistic of fuel delivery, especially for places with little to no road infrastructure, reliant on sea/river transport
- Cost of establishing of fuel delivery. For example, LNG would require building a dedicated port, or refuelling dock, plus getting gas transportation ship or vehicles, scaled to the fuel requirements. Those are not often established in remote areas, and the cost can include purchasing a dedicated ship of selected size, as RoI for the delivery company may be tens of years

Cycles of nuclear refuelling can be aligned with major mining shutdowns to minimise production loses

Use of floating nuclear power stations like Russian Akademik Lomonosov, which is 2 x 35Mwe, or Russian nuclear ice breakers, that can be repurposed to work as generators. Barges with engine or turbine generators are commonly used in remote mining areas, across the world (PNG, South America, Asia, etc.)

Installation time. Time between exploration and commencement of the mine operation can take 10-15years or more, so even for naysayers, this would be enough time to build a reactor / reactors

Potential benefits of using nuclear with short term battery storage

Similar approach to AI data centres in US approaching nuclear generators to provided dedicated supply

Lower risk of security breaches due to remoteness and already heightened level of security and use of armed guards, especially in gold mines

POSTER

Influence of Mesh Layer Count on Wick Performance: A Study on Figure of Merit for Microreactor Heat Pipes

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Abstract

Background

The efficient thermal management of microreactor systems relies heavily on passive heat transfer devices such as heat pipes, where capillary driven fluid return is entirely governed by the wick structure. In such applications, optimizing wick design is critical to ensure reliable operation without mechanical pumps or external power. While geometric parameters like mesh layer count are often adjusted to enhance performance, their impact is not always intuitive. This study investigates the influence of mesh layer count (10, 12, and 14) layers on the overall capillary efficiency of stainless steel screen wicks using the Figure of Merit (FOM) as the primary evaluation metric. FOM is dimensionally consistent performance metric that quantifies the balance between capillary pumping capability and flow resistance in porous wick structures.

$$FOM = \frac{k \,.\, \mu}{\mu \,.\, r_{eff}}$$

where k = permeability (m²), σ = surface tension of the working fluid (N/m), and μ = dynamic viscosity of the fluid (Pa·s), r_{eff} = effective pore radius

Method

Stainless steel mesh wicks (100×100) were used in three configurations: 10, 12, and 14 layers. Each wick was rolled uniformly onto a cylindrical support. Ethanol was used as the working fluid due to its low contact angle and strong wettability on stainless steel. Each wick was immersed in the fluid reservoir for 90 seconds while mass uptake was recorded. MATLAB scripts processed the data to determine absorption dynamics and extract the K/Reff ratio, which was used to calculate the effective pore radius. The Figure of Merit (FOM) was then calculated using ethanol's thermophysical properties.

Results: The results demonstrate a clear degradation in performance with increasing layer count. The 10-layer wick achieved the highest FOM of 2.71×10^{-5} m, indicating superior

capillary efficiency. The 12 layer configuration exhibited a reduced FOM of 2.31×10^{-5} m, reflecting a decline in overall transport effectiveness. The 14-layer wick recorded the lowest FOM at 1.98×10^{-5} m. This trend reveals that increasing mesh layers does not enhance performance; instead, it compromises the capillary pressure to flow resistance balance essential for passive fluid return.

Conclusions

This study concludes that the FOM is a powerful, integrative tool for evaluating wick performance beyond isolated structural parameters. The 10 layer wick emerges as the optimal configuration, delivering the best compromise between fluid mobility and capillary action. These findings provide critical insight for the design of high efficiency heat pipes in compact thermal systems, emphasizing that more layers do not equate to better performance.

Future wick optimization should prioritize FOM driven design to achieve reliable and efficient and related research fields both nationally and internationally.

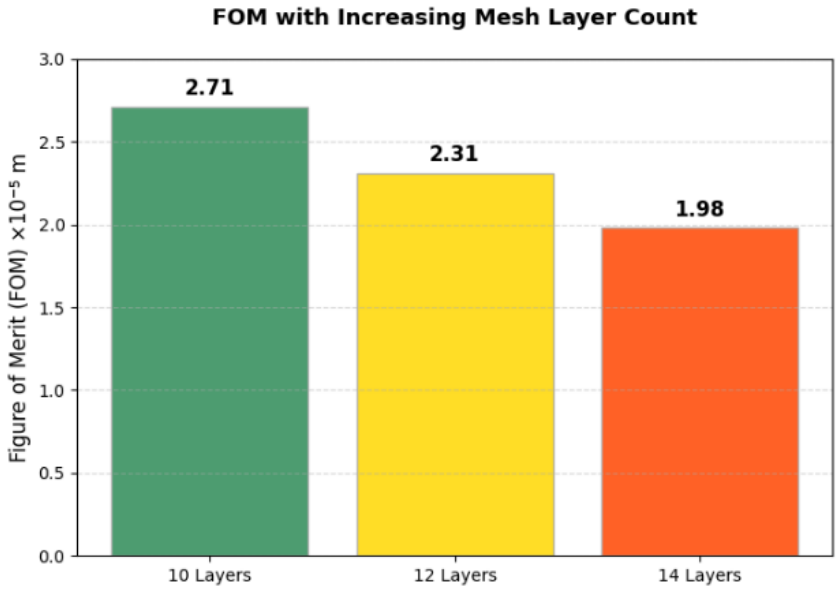

Fig 1. FOM decreases with increasing mesh layer count, indicating reduced capillary efficiency. The 10-layer wick delivers the highest performance, demonstrating that more layers do not improve wick function.