NEWSLETTER

Radiation Safety and Radioactive Waste Management

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FNCA 2008 - Workshop on Radiation Safety and Radioactive Waste Management (RS & RWM) November 3- 7, Sydney, Australia

Participants in the 2008 Workshop

The FNCA 2008 Workshop on Radiation Safety and Radioactive Waste Management (RS&RWM) was held in Sydney, Australia, 3 - 7 November, 2008. The Workshop was hosted by the Australian Nuclear Science and Technology Organisation (ANSTO) and the Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan, in cooperation with the Nuclear Safety Research Association (NSRA) of Japan.

Representatives from eight FNCA member countries (Australia, Bangladesh, China, Indonesia, Japan, Malaysia, Thailand, and Vietnam) were involved in the workshop sessions. The sessions included discussions on policy, regulations, operations and R&D on RS & RWM. Countries attending the workshop included.

On the first day, following the opening addresses and welcome speeches were made by Mr. Lubi Dimitrovski (ANSTO & Project Leader of Australia), Dr. Ron Cameron (Acting CEO ANSTO, & FNCA Coordinator). Professor Toshiso Kosako provided the Keynote FNCA Address as the Project Leader of Japan. Session 1 included explanatory lecture on the theme of Radiation Safety Principles by Dr. Takatoshi Hattori. In Session 2, the country reports were presented detailing the current status of RS&RWM in each country followed by a Poster/Mini-Exhibition was held to facilitate enhancement and understanding of the relative important activities in RS & RWM.

On the second day, Sessions 3 and 4 were presented. Session 3 provided topics on specific radiation safety issues including examples and experiences in radiation measurements using personal dosimeters, decommissioning management involving mixed wastes (radioactive and asbestos), spent source disposal, dose constraint measures, and air/water discharge limit assessments. Session 4 focused on radioactive waste management within two specific themes. Theme 1 comprised of presentations by Australia and Bangladesh on the siting of radioactive waste facilities and Theme 2 presentations by Thailand and Japan on specific safety issues relating to radioactive waste management. A technical visit to ANSTO's waste operation facilities was conducted at the end of Day 2.

Workshop

Poster Session

On the third day technical visits were made to the HIFAR & MOATA research reactors, both under various stages of decommissioning, to ANSTO's Low Level Waste Storage Facility and the OPAL Reactor and Bragg Institute.

On the fourth day Session 5 consisted of a Sub-Meeting on Radiation Safety at Nuclear Power Plants & Nuclear Research Reactors. Session 6 consisted of a Round-Table discussion on 'Future cooperation with other international programs such as IAEA/ANSN and RCA/RAS9042'.

Visit to Moata Reactor

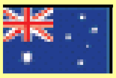
The "RS & RWM 3-Year Work Plan for 2008-2010" under the FNCA framework was discussed and successfully concluded.

All FNCA Project Leaders recognised the valuable technical discussions and networking opportunities provided by the FNCA RS & RWM Workshop. The benefits of this workshop included information exchange and the sharing of experiences on common radiation safety and radioactive waste management issues. The Project Leaders were unanimous in their ongoing support for the FNCA RS & RWM workshop and the need to sustain this cooperation to ensure that RS & RWM issues are being continually addressed in this region. The participants noted a possible exchange of information between the FNCA and the ANSN.

All participants expressed their gratitude to the organisers, ANSTO, MEXT, and to the cooperation of NSRA.

Topics from Participating Countries

AUSTRALIA



Mr. Lubi Dimitrovski

Waste Operations Manager
Australian Nuclear Science & Technology Organisation (ANSTO)

Status of Decommissioning the MOATA Reactor

'Moata' is a 100 kW Argonaut type reactor that was operated for 34 years from 1961 to 1995. The Australian Atomic Energy Commission (now ANSTO) installed the Moata research reactor to train scientists in reactor control and neutron physics and to accumulate experimental nuclear data on fuel/moderator systems. The scope of operations was extended to include activation analysis and neutron radiography from the mid 1970s.

Moata (early 2008)

In 1995, the Moata reactor was shutdown as its continued operation could no longer be economically justified. The fuel was removed and the primary coolant (demineralised water) drained from the reactor.

The reactor core is contained within a monolithic concrete bioshield, approximately 5.8 m wide, 6.4 m long and 3.3 m high. The core cavity measures approximately 1.2 m wide, 1.5 m long and 1.6 m high.

The 90% high enriched uranium (HEU) fuel assemblies consisted of 12 aluminium clad fuel plates each containing about 22 g of U235 in an aluminium/uranium alloy.

The HEU spent fuel assemblies from Moata were unloaded and stored in pits beside the reactor for 11 years before being sent to the USA in 2006 (under the US origin HEU return program).

The licence for Moata changed from an operating licence to a 'possess, control and decommission' licence in 2001 under Australia's nuclear regulator (ARPANSA).

Decommissioning will compromise of three stages, preliminary dismantling, dismantling of the bioshield, and site restoration.

Preliminary dismantling involves the removal of all internal separable parts of the reactor. The reactor tanks and connecting coolant pipework, control absorbers and drives, graphite reflector, internal lead shielding, and various steel support plates will all be removed in this stage.

Core area showing fuel tanks, pipework, control absorbers and graphite (Oct 08)

All equipment around Moata such as beam lines and instruments has been removed previously; the external cooling system was removed in mid 2008. The majority of this equipment was cleared for free release, while the remainder stored as low level solid waste.

Radiological surveys of the building, surroundings, reactor and reactor core have been conducted to provide a baseline for later surveys and to characterise the reactor to provide preliminary estimates for the different waste streams arising from the process. Table 1 shows estimates of the different wastes expected to be produced by the decommissioning process.

Material	Free release (kg)	LLW (kg)	ILW (kg)	Total Mass (kg)
Graphite	5,400	6,200	0	11,600
Metallic components	150	3,400	0.15	3,550
Concrete	222,100	60,300	0	282,400
Total	227,650	69,900	0	297,550

Table 1: Solid waste from decommissioning

A temporary tent enclosure has been set up on top of the reactor block to contain any possible contamination that may arise from the removal of items from the reactor core.

Preliminary dismantling tent (Jan 2009)

Metallic items in the core will be removed and wrapped in plastic, labelled and sent for characterisation and storage. The graphite will be removed from the reactor block by crane and placed in specially constructed steel containers. All the graphite will be stored on site as it is nuclear grade material.

The preliminary-dismantling stage is expected to be completed during June 2009.

The bioshield is comprised of 300mm of high density concrete (50% iron) around the core and normal density concrete for the remainder. Core-hole drillings of the low density concrete have been done to characterise the concrete. Analysis showed that the level of activation was significantly lower than predicted by early calculations.

A radiological profile of the concrete was established and allowed the low density concrete to be classified as either free release waste (the majority) or low level solid waste. Refer to Table 1.

The dismantling of the reactor block (bioshield) will involve wire cutting it into smaller blocks. Characterisation has found that the structural integrity of the concrete may limit the size of the blocks that can be cut out of the reactor block.

A large tent will be constructed around Moata to control the waste produced by the cutting of the concrete and to minimise the potential spread of contamination.

Concrete blocks will be initially scanned in the building to ensure that there is no contamination or activated parts that leave the building. They will be removed from the building and taken to a low background area for re-scanning and clearance.

If the concrete satisfies clearance criteria at the second radiological check the block will be classified as free release waste and be disposed of off site. All large material leaving the ANSTO site passes through a radiation vehicle scanner as a final check.

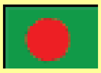
ANSTO vehicle scanner

Rejected concrete will be returned for further segregation. Concrete which exceeds clearance levels, including the high density concrete from around the core, will be treated as low level solid waste and stored in specially constructed containers within the current ANSTO waste system. Activated concrete and material beneath the reactor will also be removed and treated in this manner.

Radiological surveys will be conducted following the removal of Moata. Any residual areas of higher than background dose rates will be decontaminated or removed. The building will then be restored to a fully functional area with no limitations or classifications subject to regulatory approval

The decommissioning process is proceeding and should be finalised before the end of 2009.

BANGLADESH



Dr. M. Moinul Islam

Principle Scientific Officer
Institute of Nuclear Science & Technology
Atomic Energy Research Establishment
Bangladesh Atomic Energy Commission

Establishment of Central Radioactive Waste Processing and Storage Facility (CWPSF)

Establishment of CWPSF

Radioactive waste is generated from a large number of different activities in Bangladesh in the use of radioisotopes in medicine, research, and industry. Compared to other hazardous waste generated by human activity, the amount of radioactive waste is relatively small. Even though the amount of radioactive waste produced is very small, extreme care must be taken when dealing with it. One of the most important objectives of Health Physics and Radioactive Waste Management Unit, AERE, Savar is to ensure optimal protection of humans and the environment, at present and in the future, from hazardous effects of ionizing radiations associated with radioactive wastes (RW) and radiation sources (RS).

In order to fulfil this objective the Bangladesh Government has approved the "Central Radioactive Waste Processing and Storage Facility" project and provided a total amount of US$1.25 million to implement the development project under ADP with the technical assistance of IAEA at the Savar site. The objectives of this facility are: Collection, Segregation, Packaging, Conditioning, Treatment and Storage of low and intermediate level radioactive wastes from different radiation and nuclear facilities. The facility is intended to serve as a semi-pilot scale infrastructure for safe pre-disposal management of radioactive waste including spent radioactive sources.

Design characteristics

The building layout and the design of the facility were based on the IAEA generic reference design. The main building is a single storey building (total area 1163 m^2; size: 40 m x 35 m), divided internally into a number of rooms and areas for different purposes. The main building consists of a suitable combination of two main areas:

- receiving and processing area
- storage area

Equipment in the facility

The following major equipment is available in the CWPSF for segregation, treatment, conditioning of low and intermediate level liquid and solid wastes within the facility:

Solid waste sorting box: The sorting cabinets have been set-up to segregate the different types of mixed solid low level wastes.

Aqua-Express (liquid waste treatment plant): For the treatment of liquid low and intermediate level radioactive waste (LL& ILRW). Productivity of the plant by purified water depends on composition of the initial liquid waste and makes up to 300 l/h.

In-drum mixer: The electrically driven mixer unit for the cementation of small volume of liquid wastes, sludges, and an ion-exchange resin, etc.

In-drum compactor: An in-drum compactor operates on the compactable waste drum to give compacted waste drum. The expected volume reduction factors are in the range of between 2 to 5.

Current activities of CWPSF

The following work has been performed during the year 2000-2008

- Pre-operational Safety Analysis Report (PSAR) has been developed as a part of the licensing process of CWPSF

- Some of the RW and SRS are collected, transported and safely stored in interim-storage rooms of the CWPSF
- Conditioning of some sources (e.g., ^{226}Ra)
- Short–lived, low-level solid and liquid wastes are stored for delay decay, while high active sources are kept inside the shielding awaiting further management
- Research activities are being conducted with academic departments
- A country-wide inventory of RS and RW, to establish a database, is in progress
- Physical security system of CWPSF has been strengthened with the technical assistance of the US DOE.

Storage of SRS at CWPSF

Storage of RW drums at CWPSF

Future activities

Approximately 16m^3 of LILW have been collected and safely stored in the CWPSF. There are several spent sealed sources safely stored in CWPSF that need to be processed to a conditioned form prior to disposal. Planning is in place to manage these radioactive wastes and the other wastes generated by the various stakeholders in Bangladesh in a safe, effective and secure manner.

INDONESIA

Dr. Djarot S. Wisnubroto

Director of Radioactive Waste Technology Centre
BATAN

Transportation of Decommissioning Waste from Yellow Cake Production Facility

A fertilizer company PT. PETROKIMIA GRESIK (PKG) in Gresik, East Java had a facility for recovery of uranium by-product that operated for only 1 year in 1989. The facility was designed to extract U_3O_8 from phosphate rock through phosphoric acid purification; with the final product being yellow cake. The facility was commissioned at 1989 and generated a small amount of yellow cake (7.2 ton). However due to market problem, the management of the company decided to cease operations and left the facility inactive for years. At 2001, Nuclear Energy Regulatory Agency (BAPETEN) recommended that the facility be decommissioned, and BATAN was requested by PKG to put together a decommissioning program for their facilities. Permission for decommissioning was given by BAPETEN (regulatory body) in 2004, but due to budget issues, this activity was delayed. By the end of 2007, PKG decided to start the decommissioning in consultation with BATAN personnel, as they wanted to use the area for the construction of a small power plant facility.

Table 1:Quantity of Decommissioning Waste from Yellow Cake Production Facility

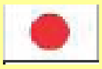
No.	Physical Shape	Form	Quantity
1	Concrete debris	Solid	111 drums
2	Sludges	Semi liquid	88 drums
3	Metal scraps	Solid	4 wooden boxes

The decommissioning activity was conducted from March to July 2008. As most of the yellow cake was already in storage in BATAN years before the decommissioning project began, only a small quantity of waste was sent to BATAN at the end of the decommissioning. Table 1 gives the amount of waste transported from PKG to BATAN, Serpong on 16-17 July 2008.

Wooden boxes containing metal scraps

Drums containing sludges

JAPAN



Dr. Toshiso Kosako

Professor
Nuclear Professional School
Graduate School of Engineering
The University of Tokyo, Japan

Mr. Hiroyuki Murakami

Deputy Director
Nuclear Technology & Education Centre
Japan Atomic Energy Agency

Activities of Japan Atomic Energy Agency on Human Resources Development in the fields of nuclear and radiation engineering

In Japan, Human Resources Development (HRD) in the field of atomic energy has a 50-year history since its commencement in 1958 at the Radio-isotope School of Japan Atomic Energy Research Institute (JAERI). JAERI was re-organized into the Japan Atomic Energy Agency (JAEA) by integrating with Japan Nuclear Cycle Development Corporation (JNC) in 2005. At present, JAEA clearly identifies nuclear HRD as one of its important missions, and Nuclear Technology and Education Centre (NUTEC) of JAEA has been given the leading role in progressing this mission. NUTEC's HRD activities are conducted in line with government policy and programs, and aim at comprehensive nuclear education and training.

NUTEC's training programs are divided into 3 categories;

1. Domestic training courses
2. Cooperation with universities and
3. International cooperation.

Every year, NUTEC conducts more than ten different domestic training courses for Japanese engineers on atomic energy, which include radiation usage and/or safety. The total number of engineers who graduated from NUTEC's training program amounts to around 120,000 since its commencement in 1958. Table 1 gives some examples of domestic training courses held for radioisotopes and radiation engineers.

One of NUTEC's international cooperation objectives on HRD includes the running of international training courses. This consists of the Instructor Training Program and the Joint Training Course. Both are conducted under the sponsorship of the Japanese Government, MEXT. These training courses train the trainers of the participating countries on the peaceful usage of atomic energy in Asian countries, with the aim to develop a self-sustainable training capability within each country.

NUTEC has been conducting several courses on the following subjects - radiation safety, nuclear (radiation) emergency preparedness, reactor engineering, etc., in Indonesia, Thailand and Vietnam in collaboration with their official organizations, BATAN, TINT (or OAP) and VAEC respectively. In recent years, these organizations have become capable of carrying out such training courses themselves. Many engineers of each country have participated in the programs. Engineers who wish to participate in future training programs should contact the official atomic energy organization in their countries.

Table 1: Example of Domestic Training Courses

Training Courses for Radioisotope and Radiation Engineers		
Basic Course	Basic Radiation Course	15 days; once/year
Special Course	Radiation Safety Management Course	14 days; once/year
	Radiation Protection Basic Course	4 weeks; once/year
Legal Qualification Course	1st Class Radiation Protection Supervisor Course	5 days; 8 times/year
	3rd Class Radiation Protection Supervisor Course	2 days; 3 times/year

Cooperation with the HRD project within the FNCA is also an important mission for NUTEC, JAEA. Dr. Jun Sugimoto, the director of NUTEC, is the project leader of the FNCA-HRD project and takes an active role in the education and training of nuclear engineers. In the project, utilization of existing nuclear training and education resources to meet each country's HRD needs, and sharing relevant information among FNCA member states on HRD toward the development of atomic energy are considered important. Information exchange and cooperation on HRD are expected to be enhanced by effective utilization of the FNCA website.

Instructor Training Program (top) and Joint Training Course (bottom) on the subject of nuclear and radiological emergency preparedness and response

MALAYSIA

Dr. Mohd Abdul Wahab Yusof

Senior Research Officer
Waste Technology & Environment
Division Nuclear Malaysia

Safety Audit at the Waste Technology Development Centre (WasTeC), Malaysian Nuclear Agency

Radiation safety is a very important topic for anyone who deals with radioactive material or radioactive waste. Being a promoter of radiation safety in Malaysia, it is the responsibility of the Management of Nuclear Malaysia to ensure that radiation safety is given priority in order to promote public confidence in the safety of nuclear technology.

In Nuclear Malaysia there are two levels of safety audits, namely internal audit and external audit. The internal audit is carried out by the auditors from Radiation Safety and Health Division (RSH) whilst external audits are conducted by the regulatory body. Beside these two audits, WasTeC also carries out its own safety audit.

Recently (January 2009) a radiation safety audit has been performed at WasTeC by two auditors from the RSH. The purpose of the audit is to ensure that all activities involving radioactive material at WasTeC comply with the safety rules and procedures and do not endanger the workers, members of the public and the environment. The auditors visited working areas in WasTeC such as the analytical laboratory, counting room, high radiation laboratory, waste reception, compaction room, laundry, low level effluent treatment plant and storage facility for radioactive wastes. They also checked personnel dose monitoring and medical records.

The overall outcome of the audit showed that WasTeC was compliant with most of the requirements in radiation safety. The result of the safety audit demonstrated the commitment to radiation safety by WasTeC's staff. It is hoped that this safety culture will continue and be adopted by all WasTeC's staff and Nuclear Malaysia.

Ms. Maria V. B. Palattao
Senior Science Research Specialist

Philippine Nuclear Research Institute
Philippines

Ms. Corazon M. Garcia

Assistant Scientist
Department of Science and Technology
Metro Manila

Nuclear Power Development Program in the Philippines

In early 2008, the Philippine Government requested for an IAEA mission to advise on the development of infrastructure to support a nuclear power program and the feasibility of rehabilitating the mothballed 620 MW PWR type Bataan Nuclear Power Plant (BNPP).

Bataan Nuclear Power Plant

Consistent with the IAEA recommendations, an Interagency Core Group on Nuclear Power was established in January 2009 by virtue of a Joint Department Order No. JDO2009-01-001 and signed by the Secretaries of the Department of Energy (DOE) and the Department of Science and Technology (DOST). The Core Group is chaired by the DOE Undersecretary for Planning; and Co-Chaired by the DOST Undersecretary for R&D and the National Power Corporation (NPC), the country's utility organization, Senior Vice President. The Members of the Core Group are the following.

- DOE Task Force on Nuclear Power Program
- DOST: Philippine Council on Industry and Energy Research and Development
- Philippine Nuclear Research Institute (PNRI)
- National Power Corporation (NPC)

To address the recommendation of the IAEA Mission, the PNRI started its activities on the preparation of human resource development program for nuclear power in 2008. These activities involved the preparation of syllabi for three training modules on nuclear power. These are:

- Module 1: Introduction to Nuclear Power
- Module 2: Introduction to Nuclear Engineering, and
- Module 3: BNPP Systems and Components.

The three day training course on Module 1 entitled Introduction to Nuclear Power was conducted in January 2009. Four teams of engineers and other technical personnel totaling about 100 from the NPC, the DOE and the PNRI participated in this module. This course is designed to provide the core information essential in a nuclear power program.

Dr. Carlito R. Aleta, former PNRI Director and IAEA RCA Coordinator, Div. for Africa and East Asia, lecturing

Training Course on Module 2 will be conducted starting June 15, 2009. This is a ten- day course and is designed for technical personnel with possible future involvement in activities related to Nuclear Power. The NPC, the DOE and the personnel from the local Universities were invited to participate in this training course.

Module 3 which is specific to the BNPP Systems and Components will be held in August, 2009.

The following current initiatives in the Philippine Congress are also underway.

- House Bill No. 3254 or the "Comprehensive Nuclear Law" proposes to create a separate and independent nuclear regulatory authority and address gaps in the present laws
- House Bill No. 4631 proposes for the rehabilitation, commissioning and operation of the BNPP, and appropriates funding for a feasibility study

THAILAND

Ms.Nanthavan Ya-anant

Nuclear Science Specialist RWM Center
Thailand Institute of Nuclear Technology (TINT)

Mr.Sutat Thiangtrongjit

FNCA RS&RWM Project Leader
Manager of RWM Center Thailand Institute of Nuclear Technology (TINT)

Sustainable Management of Disused Sealed Sources - Working Towards Disposal

The IAEA/ANSN International Workshop on "Sustainable Management of Disused Sealed Sources: Working towards Disposal" was held on January 12-16 2009, at Centara Duong Tawan Hotel in Chiang Mai, Thailand.

In an effort to highlight these issues and promote the safe and secure management of DSRS, the Thailand Institute of Nuclear Technology (TINT), under the auspices of the Asian Nuclear Safety Network (ANSN), has hosted this international workshop organized by the IAEA.

About 80 managers and experts from 23 countries representing national programs, regulatory bodies, international projects and implementing and source management organizations, attended the workshop.

The topics discussed covered the life cycle of disused sealed radioactive sources (DSRS) with a special focus on long term management aspects, namely storage and disposal. The workshop had six themes as follows:

- International programs
- National policies and strategies
- Storage
- Current DSRS disposal status in member states
- The "BOSS" concept for DSRS disposal
- Regulatory aspects of DSRS disposal

In addition to the above, there were several panel discussions and a small group session for participants to work on selected topics.

In a few countries, certain types of DSRS are currently being disposed of. For example, some US origin sources repatriated to the US are disposed of at WIPP. Certain limited categories of sources are being disposed of in the near surface repositories. No country has implemented appropriate disposal solutions for all of its DSRS. The participants encoring member state organizations involved in R&D activities to further pursue their R&D efforts.

Welcoming of participants

Representatives from Asian Nuclear Safety Network (ANSN) from Philippines & Thailand

Conclusion

The participants acknowledged the efforts of IAEA to strengthen the safety and security of DSRS and to support the upgrading of DSRS management infrastructure in Member States. The "BOSS" (borehole disposal of sealed sources) was recognized as a mature concept which is ready for implementation in candidate member states. All participants identified it as a simple, flexible and cost-effective solution that provides for safety and security for all types of DSRS.

Australian Government

Delivering excellence in nuclear science & technology

Discovering ANSTO

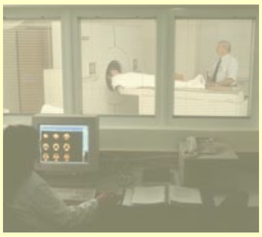
ANSTO is the centre of Australia's nuclear science capabilities, operating the nation's only nuclear reactor. ANSTO offers a wide range of scientific and technical services and expertise to governments and organisations in Australia and around the world.

What ANSTO does

ANSTO's world-class OPAL research reactor and neutron beam instrument facility allows scientists from Australia and around the world to conduct research that can take science, medicine and industry into the future.

ANSTO's vision is to be recognised as an international centre of excellence in nuclear science and technology. In that role, ANSTO is a crucial part of Australia's science and innovation infrastructure. It's facilities provide essential capabilities to medical research, industry and research groups.

1. Nuclear medicine



Imaging organs and looking inside the human body was never thought possible a few decades ago, yet now nuclear medicine is one of the most relied upon medical techniques to diagnose and treat major disease. ANSTO provides 80 per cent of the nuclear medicines to Australian hospitals to help doctors diagnose and treat diseases such as cancer, heart disease and other conditions.

2. Environment

Climate change and water resources are high on international agendas and are serious issues faced by the human race. Australia itself is looking down the barrel of the environmental gun, with increasing water supply and climate issues like drought and soil salinity. ANSTO's Institute for Environmental Research (IER) looks at all of these environmental challenges daily, both in the lab and out in the field.

3. Operating nuclear facilities

Nuclear science and technology is the core business of ANSTO and its primary nuclear facilities are the:

- OPAL research reactor
- National Medical Cyclotron
- Gamma Technology Research Irradiator (GATRI)

Other non-nuclear but complimentary facilities, such as particle accelerators, X-ray machines, and electron microscopes, to name a few, are also part of the ANSTO mix.

4. Industry support

ANSTO's wide range of expertise provides Australian and international industry with a variety of services to enhance productivity, increase technological advancement and manage waste materials.

Some of the services include forensic carbon dating, silicon irradiation for the semiconductor industry, nano-biotechnology solutions and radioactive waste management using Synroc technology, just to name a few.

5. Radiological services and training

As one of Australia's largest radiation protection services, ANSTO provides practical training and expertise in almost all facets of health physics and the control of radioactive substances.
The health physics expertise of ANSTO is available on a consultative basis to organisations such as the defence forces, emergency services and overseas countries which need training in handling radioactive materials and compliance with International Atomic Energy Agency (IAEA) standards.

6. Undertakes research

ANSTO undertakes research that advances the application of nuclear science and technology in areas as diverse as materials, health, climate change, mining and engineering.

ANSTO also provides the international research community with state-of-the-art facilities to advance knowledge of how the world works, at the atomic level.

7. International liaison

ANSTO is at the forefront of international nuclear research and technologies. Participating in international decision-making and offering services and expert advice to organisations overseas, keeps ANSTO and Australia at the cutting edge of the nuclear science and technology world.

ANSTO has representatives based both in the United States capital, Washington DC and Vienna, home to the International Atomic Energy Agency (IAEA) where ANSTO acts as Australia's representative on the Board of Governors.

8. Government and community

ANSTO regularly communicates to government and the community, keeping them informed of key events and scientific outcomes. This is achieved through formal reporting and communication tools such as the ANSTO website, media releases, local community discussions, newsletters and free community site tours.

Local councils, relevant Federal Ministers and other government-related personnel, both State and Federal, are kept up to date about what's happening at ANSTO through reporting systems and regular personal contact.

For more information on any of the above, please contact ANSTO

T: +61 2 9717 3111
E: enquiries@ansto.gov.au
W: www.ansto.gov.au