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Radioactive waste management in Australia

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Radioactive waste management in Australia – a national approach

The proposal for a national radioactive waste facility in Australia has generated significant public debate recently. This information paper has been prepared to support informed community consideration about the need for such a facility, given ANSTO is Australia's centre of nuclear expertise and is responsible for generating and managing much of Australia's radioactive waste.

Introduction

The Australian Nuclear Science and Technology Organisation (ANSTO) is the home of Australia's nuclear science expertise.

The organisation's nuclear infrastructure at Lucas Heights near Sydney features a state-of-the-art research reactor OPAL, which is used to produce a number of radioactive products, including radioisotopes for nuclear medicine.

Over 30,000 packages of radiopharmaceuticals are shipped from ANSTO by road and air each year. These products provide health benefits to over half a million Australians.

The current global crisis in the supply of these radioisotopes has made Australia's self-reliance in this regard the envy of much of the world.

ANSTO houses several other important scientific facilities and instruments, including particle accelerators.

For more than 50 years ANSTO has safely managed its radioactive wastes. The organisation has an active waste minimisation program that is managed in accordance with national and international standards.

ANSTO has the capability to safely manage its waste now and into the future.

Understanding radiation

Naturally occurring radiation comes from many sources, including outer space, the sun, the rocks and soil beneath our feet, the buildings we live in, the air we breathe, the food and drink we ingest. Even our own bodies.

In Australia, the average natural background radiation dose is much lower than many other areas of the world.

Man-made radiation, created in a nuclear reactor or cyclotron, is widely used for beneficial purposes in medicine, agriculture, industry and environmental research.

Understanding decay

Radioactive materials reduce or decay over time. This decay is measured by half-lives - the time required for the radioactivity to be reduced by half.

Half-lives can vary from fractions of a second to billions of years.

Radioactive waste decays naturally, becoming less radioactive and safer to handle over time. The time this takes depends on the half-life of the radioactive substance associated with the waste.

Waste types

There are three types of radioactive waste – high, medium and low-waste.

High-level wastes come from the reprocessing of used nuclear fuel generated by nuclear power reactors, which do not exist in Australia.

Intermediate-level waste is generated chiefly from radiopharmaceutical production and reactor operations. It requires shielding during handling, processing and storage, typically by using concrete or lead.

Low-level waste typically comprises paper, plastic, gloves, cloths and filters. It contains small amounts

of radioactivity and does not require shielding to protect workers during normal handling or transportation. Low-level waste can eventually be handled in the same manner as normal waste.

Radioactive 'sources'

In contrast to the strong safety record of national waste management facilities, there have been a number of serious incidents involving disused radioactive sources in circumstances where such facilities were unavailable or unused.

Those accidents have caused a number of deaths and serious injuries, and significant financial loss.

For example, in 1987 in Brazil, a disused radioactive source used in teletherapy was dismantled, causing exposure to 20 people and four deaths.

In recent years, as concerns about the security of radioactive materials have increased, ANSTO and other organisations have worked nationally and internationally to secure disused high activity sources.

Last year, the International Atomic Energy Agency (IAEA) called upon all countries to ensure secure storage and disposal practises for disused radioactive sources. Most countries have central storage or disposal facilities for disused sources. This is regarded as international best practice.

Currently in Australia holders of radioactive sources continue to retain the material indefinitely. This is not consistent with international best practice.

Benefits of a national facility

A national waste facility would not only have the capacity to receive radioactive waste produced by Commonwealth agencies such as ANSTO, but wastes currently held at more than a hundred locations around Australia. These locations hold wastes generated by various medical, industrial and research applications including unwanted radioactive sources.

Indefinite storage of radioactive waste by small holders is inconsistent with international best practice, which advocates for the provision of central disposal facilities, or government-run stores with the imposition of regulatory requirements to ensure the risks are minimised.

State facilities currently exist to store radioactive waste in Queensland and Western Australia.

A further factor in the establishment of a national facility is the imminent return of wastes generated from the reprocessing of the used fuel from Australia's former research reactors which operated over several decades and supported research and the production of radioisotopes for medical applications.

The used nuclear fuel was shipped to the UK and France for reprocessing, with the resulting intermediate-level waste scheduled to return to Australia from 2015.

Once a permanent central radioactive waste facility is established, waste packages will be transported from Europe as well as numerous Australian locations where it is currently held and placed in the facility.

Location for a national facility

There have been suggestions that ANSTO's Lucas Heights campus should become the site of the national radioactive waste facility.

This would require changes to the *Australian Nuclear Science and Technology Organisation Act 1987* which precludes non-Commonwealth waste being moved to Lucas Heights. Additionally the waste storage capacity at Lucas Heights is insufficient to store all of Australia's radioactive waste.

Importantly, Lucas Heights does not meet the geographical and geological criteria for a disposal facility outlined in the *Code of Practice* issued by the National Health and Medical Research Council and supported by the nuclear safety regulator, the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA).

The code states that a repository should be in an area of low population density, where the prospects for future development are very low.

It also states that the majority of Australia's low-level waste and intermediate-level waste should be held at sites other than Lucas Heights.

The transport logistics of such a move would be similar in scale to moving waste to any remote site – thus the choice of location does not eliminate the movement of radioactive waste on a large scale.

Transport of radioactive waste

Radioactive materials are transported around Australia every day for a variety of purposes including:

- nuclear medicine procedures
- sterilisation of medical equipment and blood
- industrial radiography of welds

- quality control processes for materials and slurries
- element analysis in borehole logging, and
- research applications using radioactive tracers to follow biological processes in a living organism or the environment.

All shipments of radioactive materials in Australia, including any shipments of radioactive waste, are required to be transported in accordance with Australian and international standards.

These codes ensure that the standard of packaging is appropriate for the level of radioactivity in the material being transported – whether or not that material is waste.

Low risk

The transportation of radioactive materials has a remarkable safety record. Over several decades, tens of millions of packages of radioactive material, including packages of radioactive waste, have been transported around the world.

There has never been an in-transit accident with serious consequences to human health, the economy or the environment, attributable to the radioactive nature of the goods.

All radioactive waste to be transported to the national waste facility will be in solid form and, in the extremely unlikely event of an accident, must not release radioactive material into the environment.

Once the facility is established, there will be a large number of transport movements to remove the backlog of accumulated waste. Thereafter, transport of waste to the facility will be infrequent.

ANSTO generates about one standard shipping container of low-level waste per year. Transport may therefore occur on a five-yearly frequency.

Experience demonstrates that the risks associated with the transport of radioactive waste are much lower than the risks associated with the transport of many other hazardous materials classified as dangerous goods.

Global comparisons

In 2007, Australia's total current holdings of low-level waste and intermediate-level waste were approximately 4,000 m^3.

This volume can be reduced by compacting and repackaging existing drums before transport to any facility.

By comparison, by the end of 2007 the French government had transported and disposed of 735,000 m^3 of similar wastes in repositories. The United States has disposed of almost four million m^3 of such waste.

In 2007, Australia's holdings of long-lived intermediate-level waste was approximately 500 m^3, of which ANSTO holds the majority. In addition, there is 132 m^3 of wastes arising from the reprocessing of used fuel from 50 years operation of former research reactors currently held in Europe.

By comparison, France produces 930 m^3 of this class of waste every year, together with another 155 m^3 of high-level waste (that Australia does not produce). The storage and transport of that material has not caused any significant exposure to people or the environment.

Co-location of Low and Intermediate Waste

A typical facility may comprise of a co-located repository for low-level radioactive waste and an above-ground store for the higher activity intermediate level waste.

A typical low-level waste repository may look like a large concrete Olympic pool structure into which low level waste packages are placed. This would be encapsulated, covered and sealed, and left to decay to natural background radiation levels over time and equivalent to normal waste. Typically the period of storage for decay of low-level waste is about 300 years after which time the waste would be equivalent to domestic or industrial rubbish, and would pose no radiological risk to humans or the environment.

The storage facility for intermediate-level waste constructed as an above ground store would allow the option of relocating the waste after a century or more, according to the needs and radiation levels at that time.

International community involvement

Many countries operate low-level waste repositories. For example, such a repository was inaugurated in Hungary in 2008 with strong community support.

Waste storage policies are increasingly relying on ‘volunteer’ sites whereby local communities are able to ‘host’ facilities in return for economic benefits and financial contributions to local projects.

The operation of these facilities has had no impact upon surrounding areas, and the transport of waste to them has not caused any significant exposures to people, or the environment.

This overseas experience would indicate that a similar facility in Australia would not pose significant threats to human health, or the environment.

Timely decision making

The preparation time for the establishment of an intermediate level waste storage facility is lengthy.

Therefore determination of a location to receive this waste in the very near future is vital. Once the location is finalised, then detailed planning can progress on package, preparation and transport as well as the facility design and construction.

Criteria developed for similar facilities overseas will be applied to the design and construction of Australia’s radioactive waste facility to ensure international best practice is met.

Conclusion

Due to the lack of a central radioactive waste disposal or long-term storage facility in Australia many holders of radioactive waste, in particular disused industrial and medical sources, are forced to store them in facilities that may be unsafe or insecure.

The construction of a central radioactive waste management facility, designed and constructed specifically for the disposal or long term storage of such wastes, will alleviate these problems, bringing Australia’s management of radioactive wastes in line with international best practice.

Australia is well-positioned to establish its own national radioactive waste disposal facility. The experience and well-established practices of the numerous waste disposal facilities overseas, including the exemplary safety record in waste transportation, can be employed in the design and operation of our facility, under the guidance of national and international regulatory bodies.

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