Australian Government
Department of Industry, Innovation and Science

National Radioactive Waste Management Facility

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Transport

Transportation of radioactive materials

Radioactive material has been safely transported for about the past 60 years and there has never been an accident resulting in a significant impact on the health and safety of people or the environment. The in-built safety features of the packages, regulatory controls, and emergency response procedures have always worked to ensure safety. Around the world, 20 million packages of radioactive material are safely transported each year on public roads, railways and ships.

Just like all the other routine and daily transports of radioactive materials that occur in Australia and around the world, the transport of radioactive waste from more than 100 locations around the country to a centralised National Radioactive Waste Management Facility will be conducted in a way that is completely safe for people and the environment.

The specific transport routes and methods from the many existing radioactive waste storage locations around Australia will be determined as part of detailed planning, following selection of a preferred site.
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This document is part of a series of factsheets providing information on the process to site the National Radioactive Waste Management Facility.

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A range of strict regulations apply to the transport of radioactive waste. Some are specific to this type of material. Others are more general, applying to anything classified as “dangerous goods”, such as fuel, fertilisers and farming chemicals. Established measures, practices, standards and requirements that have been proven both in Australia and around the world will guide the transport of radioactive waste.

The safety of all radioactive waste transport will be subject to independent regulatory approval and oversight by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) and potentially other regulatory bodies depending on the specific mode of transport.

In Australia each month, the Australian Nuclear Science and Technology Organisation (ANSTO) safely ships 2,000 packages containing medical radioisotopes and other radioactive materials, including more than 10,000 doses of potentially lifesaving nuclear medicines a week across Australia and throughout its region.

These nuclear medicines are safely transported on public roads and commercial flights to around 250 Australian hospitals and clinics, where they are used to diagnose or treat a variety of cancers and other heart, lung, brain, bone, liver and kidney conditions.

Transport of radioactive materials

The safety of workers, the community and environment will be assured through best practice policies and procedures, and underpinned by independent regulatory oversight.

Before any radioactive material can be transported, it has to meet ARPANSA’s *Code for the Safe Transport of Radioactive Material* available at www.arpansa.gov.au/regulation-and-licensing/regulatory-publications/radiation-protection-series/codes-and-standards/rpsc-2, which is based on the International Atomic Energy Agency’s *Regulations for the Safe Transport of Radioactive Material* available at www.iaea.org/topics/transport-regulations-and-provisions.

To be compliant with the Code, packages are tested to ensure they can safely withstand the normal rigours of transport, and conceivable transport accidents.

ARPANSA is the primary authority for overseeing and approving the design of packages, and the transportation of all Commonwealth radioactive material, including nuclear medicines and radioactive waste.

Other organisations such as the Civil Aviation Safety Authority and the Australian Maritime Safety Authority are the Authority for air and maritime transport respectively. The relevant state and territory regulators oversee and approve the transportation of radioactive materials by non-Commonwealth entities, adhering to the same ARPANSA code as Commonwealth transports do.

Before it is transported from existing sites to the Facility, the form and content of radioactive waste must be known, and external radiation levels must be measured, known and controlled to ensure compliance with transport requirements, and the Facility’s Waste Acceptance Criteria.

▼ *Nuclear medicine is sent from ANSTO and delivered safely to over 250 hospitals and clinics*

Waste has to meet Waste Acceptance Criteria

As well as complying with the Transport Code, radioactive waste will only be accepted by the Facility if it meets strict Waste Acceptance Criteria, which will mandate what materials in what form and amount can and cannot be accepted and how waste will be managed onsite.

The Waste Acceptance Criteria will require that waste must be physically and chemically stable, solid and non-dispersible, and not reactive or flammable. This will ensure that the packaged material is safe for people and the environment. The treatment and conditioning of waste will also form part of the multi-barrier approach to safety.

More information on the Waste Acceptance Criteria can be found in the dedicated factsheet *Safely managing radioactive waste* at www.radioactivewaste.gov.au.

▲ *Example of low level waste treatment*

Regulations

Just as with other types of material classified as dangerous goods, like fuel, fertilisers or farming chemicals, a number of regulations apply to the transport of radioactive waste.

Commonwealth entities, like the future operator of the national facility, and entities acting on behalf of the Commonwealth, are regulated by ARPANSA and are required to comply with Radiation Protection Series C-2 – *Code for the Safe Transport of Radioactive Material*.

The Code provides for:

- limits on the contents of individual containers of radioactive waste according to each container's radiation characteristics;
- standards for the design, construction and testing of packages or containers to be used in the transport of radioactive materials;
- accepted levels of radiation, temperature and pressure for such packages;
- marking, labeling and placarding requirements for containers of radioactive waste; and
- handling and storage conditions during transport.

The Australian Safeguards and Non-Proliferation Office (ASNO) also regulates transport security of nuclear material under the *Nuclear Non-Proliferation (Safeguards) Act 1987*, for quantities of nuclear material above the thresholds set in the Safeguards Regulations.

Transport routes

As part of the ongoing site assessment works, engineering firm AECOM is also considering the service infrastructure that will be required to support the operation of the Facility. This includes services such as water and communications, as well as transport.

AECOM is examining:

- What roads could be used to provide access to and from the site?
- Would they require upgrades for year-round reliability?
- Would they require upgrades to meet requirements of the vehicles that would use them?

The Commonwealth entity that operates the Facility will lead the development of a plan for the transport of Australia's radioactive waste to the Facility. This will include detailed planning of transport routes to the Facility, and will commence following site selection.

The transport plan will also form part of the full environmental and nuclear regulatory assessments undertaken prior to operation of the National Radioactive Waste Management Facility.

Community consultation

Given that these movements are routine and pose no credible risk, it is usually the case that consultation is not required. That said, community consultation is carried out in instances where there is significant public interest.

For example, ANSTO and the regulator ARPANSA, conducted significant programs of community consultation in the lead up to the return of Australian intermediate level radioactive waste from France in December 2015.

This included public information on traffic impacts and consultation with key stakeholders along the possible routes. This waste was safely brought in by ship to Port Kembla, and then transported to ANSTO by road.

ANSTO has also safely undertaken nine export shipments of spent fuel since 1963, to the UK, France and the USA, with the tenth occurring in 2018.

The TN81 cask being unloaded for transport to ANSTO

Types of radioactive waste packaging

The packages used for transport and storage of radioactive materials are designed according to internationally-developed standards to ensure safety and security. Multiple barriers will be used during transport to ensure appropriate and proportionate levels of radiation shielding, safety and security.

Low level radioactive waste will be stabilised, treated and packaged to minimise radiation levels outside the package to well within safe limits.

For example, ANSTO's low level waste will be assessed and sorted, and packaged into 200 litre metal drums. Those drums will then be compacted into a puck-shape, loaded into 400 litre drums and cemented in place with a high-performance cement mix. This process immobilises the waste, as well as providing shielding.

Intermediate level waste contains higher concentrations of radioactive material and therefore requires purpose-designed transport packaging. Intermediate level waste will have undergone a multi-staged treatment process to make it stable and immobilised, and will be packaged in secure, approved containers for temporary storage at the National Radioactive Waste Management Facility.

As an example, the intermediate level waste that returned from France in 2015 was treated through a process called vitrification, which immobilises the waste in a glass matrix. Alternatively, other intermediate level waste will be treated with Synroc, an Australian invention, which locks waste in a synthetic form that mimics rock's natural ability to contain radiation.

The treated waste will then be placed into a shielded container, which blocks radiation and makes it safe for handling, transport and storage. The vitrified waste that returned from France in 2015 was stored in a TN81 Type B container. This cask is internationally approved and manufactured under the strictest quality assurance and oversight.

Containers of this type have been designed and tested to withstand all plausible accident conditions including:

- submersion pressures of up to 200 metres and external pressure of at least 2 megapascals;
- high speed collisions or projectile impacts;
- dropping from a height of 9 metres; and
- burning at temperatures of around 800 degrees for over half an hour without damage.

The TN81 has also undergone more severe impact tests to simulate the impact of a jet aircraft, with no loss of containment.