COMMONWEALTH DEPARTMENT OF EDUCATION SCIENCE & TRAINING

SAFE STORAGE
of radioactive waste

The National Store Project:

A REPORT RESPONDING TO PUBLIC COMMENT

April 2002

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Copies of the paper and information packs on radioactive waste management in Australia can be obtained from the Information Officer, or the DEST web site:

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1 BACKGROUND

Most Australians benefit either directly or indirectly from the medical, industrial and scientific use of radioactive material. However, a small amount of radioactive waste results from the use of these substances.

The low and intermediate level radioactive wastes are in temporary storage at numerous locations around Australia, including in hospitals, universities and other research institutions. Individual waste producers currently have the responsibility of looking after their own waste. As a consequence, waste is often stored in facilities that were not designed for the long-term storage of such material, in circumstances that, while safe, are not ideal.

In order to improve community safety and confidence, the Commonwealth Government is progressing two separate projects for the safe and responsible management of Australia's small inventory of radioactive waste: the national repository project, to dispose of low level radioactive waste; and the national store project, for the storage of intermediate level radioactive waste.

The national repository project for the disposal of low level radioactive waste started in 1992. In 2001, after exhaustive scientific work and extensive consultation with the community, the Government announced a preferred site and two alternatives for the facility. The sites are located in central-north South Australia and are currently undergoing environmental assessment. The waste disposed of at the national repository will be monitored until it decays to background levels.

The national store project for the storage of Australia's intermediate level radioactive waste was announced in 2000. In order to promote the safe management of radioactive waste, the project was refined following consultation with the states and territories and, in 2001, the Government announced that a national store for Commonwealth intermediate level radioactive waste would be established on Commonwealth land. While the states and territories support the storage of waste in purpose-built facilities, they were not unanimous in their support for a nationwide search for a site for a national store for all of Australia's intermediate level radioactive waste.

The national store will be a purpose-built, above-ground facility and it is the Government's intention that the waste will be stored so that it can be safely retrieved and disposed of at a later time. Storage isolates the radioactive waste, provides protection for people and the environment, and facilitates control while allowing time for a geological repository or other suitable facility to be developed, where the waste will ultimately be disposed of.

The national store project was recently advanced when a public discussion paper, *Safe storage of radioactive waste — The National Store Project: Methods for choosing the right site*, was released for comment. The paper outlined the issues to be considered and proposed a methodology to be used to identify a site for the facility.

The Government considers that the establishment of a national repository for the disposal of low level radioactive waste and a national store for the storage of intermediate level radioactive waste is a responsible, feasible and sound strategy for the management of Australia's small quantity of radioactive waste.

2 INTRODUCTION

The Government is committed to the development of a national store to ensure that intermediate level radioactive waste produced by Commonwealth agencies is managed in a manner that protects both people and the environment.

Australia does not generate high level radioactive waste and thus has no need or responsibility to store or dispose of any such material.

In November 1996, in its response to a Senate Select Committee inquiry into radioactive waste, the Commonwealth Government made an in-principle decision to establish an above-ground national store for Australian radioactive waste that was not suitable for near-surface, underground disposal in the national repository for low level radioactive waste.

In August 2000, the former Minister for Industry, Science and Resources, Senator Nick Minchin, announced an Australia-wide site selection study to identify a suitable site for the national store for intermediate level radioactive waste.

Senator Minchin outlined a siting process that would involve:

- development of selection criteria that would be used to identify potentially suitable sites;
- identification of potentially suitable sites; and
- public comment at various stages of the process.

The Minister indicated that an expert advisory committee, the National Store Advisory Committee (NSAC), would advise on the process, and that the earliest a preferred site for the store could be announced would be late 2002. He sought the views of states and territories on the proposal.

In February 2001, Senator Minchin announced that the Commonwealth Government would establish on Commonwealth land a safe, purpose-built facility for the safe and responsible management of intermediate level radioactive waste produced by Commonwealth agencies and departments. His decision resulted from a lack of unanimity among the states and territories over his proposal to conduct a national search for a site for a national store for intermediate level radioactive waste.

The Minister indicated that there would be a nationwide search for a suitable site, on Commonwealth land, based on scientific and environmental criteria. In order to ensure the process of selecting a site for the national store is completely separate from the process of selecting a site for the national radioactive waste repository, Senator Minchin ruled out co-location of the two facilities.

The discussion paper, *Safe storage of radioactive waste — The National Store Project: Methods for choosing the right site*, was released for public comment in July 2001. The discussion paper provided, as a basis for public discussion, background information on radioactive waste management in Australia and described the issues that will be considered and proposed a methodology to be used to assess individual potential sites for a national storage facility.

After taking into account public comment on the discussion paper, the suitability of Commonwealth land holdings for the siting of a national store will be assessed.

Scientific experts will undertake the analysis of the suitability of various sites on Commonwealth land for the national store, and subsequent site investigations.

Prior to the 2001 federal election, the Commonwealth Department for Industry, Science and Resources had responsibility for the national store and national repository projects. After the election, responsibility for the projects was transferred to the Commonwealth Department of Education, Science and Training.

3 PURPOSE OF THIS REPORT

The purpose of this report is to summarise and respond to comments received on the discussion paper, *Safe storage of radioactive waste — The National Store Project: Methods for choosing the right site*. Copies of the report responding to public comment will be distributed to all groups, organisations and individuals who provided written comment or expressed an interest in the discussion paper. In addition, it will be circulated to each organisation, group and individual that had previously expressed an interest in the national repository or store project. It will also be available to other interested persons through the Department of Education, Science and Training or via the Department's website.

4 THE NATIONAL REPOSITORY FOR LOW LEVEL RADIOACTIVE WASTE

A project to find a site for a national repository for Australian low level radioactive waste commenced in 1992. The social and technical siting themes published by the National Health and Medical Research Council in the 1992 *Code of Practice for Near-surface Disposal* were applied to the Australian continent in order to identify potentially suitable areas. In 1994, eight regions that contained large areas of potential suitability were identified.

In 1998, the former Minister for Resources and Energy, Senator Warwick Parer, announced that the central-north region of South Australia had been selected for siting studies for the national repository as, of all the regions identified in the 1994 study, it contained the largest area of suitability.

On 24 January 2001, the former Minister for Industry, Science and Resources, Senator Nick Minchin, announced that a preferred site and two alternatives in central-north South Australia were to undergo environmental assessment in order to decide on a final site. On 2 March 2001, the Minister for Environment and Heritage, Senator Robert Hill, announced that an Environmental Impact Statement (EIS) should be prepared for the national repository project.

PPK Environment and Infrastructure Pty Ltd has been engaged to prepare the draft EIS for the national repository. Work on the EIS started in July 2001 and it is anticipated that a draft EIS will be submitted to the Minister for the Environment and Heritage in April 2002. The draft EIS will then be released for public comment. The issues raised by the public will be responded to in a supplementary report. Together the draft EIS and the supplementary report will form the final EIS that will be submitted to Environment Australia for a decision during 2002.

5 SUMMARY OF PUBLIC COMMENT ON THE NATIONAL STORE DISCUSSION PAPER

Over 1750 hard copies of the discussion paper, *Safe storage of radioactive waste — The National Store Project: Methods for choosing the right site*, were circulated for public comment. Copies were provided to those who had previously expressed interest in radioactive waste management issues and the national repository project, as well as to those who had responded to the advertisement for public submissions on the paper that had been placed in national and regional newspapers. Copies were also sent to Commonwealth, state and territory members of parliament; relevant Commonwealth, state and territory government departments, agencies, and organisations; the media; local government councils; environmental groups, industry groups, tertiary institutions, medical institutions and other non-government interest groups. In addition, the paper was made available on the departmental website (formerly http://www.isr.gov.au/radwaste, now http//www.dest.gov.au/radwaste).

Comment on the discussion paper was received from Commonwealth and state agencies; local governments; research, industry and environmental organisations; local community groups; and individuals. A list of respondents to the discussion paper can be found in Appendix 1.

In all, a total of 171 submissions were received from 172 respondents. Of these, 130 submissions were form letters that opposed the concept of a national store. Thirty-seven of the form letters did not have full name or address details.

Of the remaining 41 submissions:

- 13 supported the establishment of the store and the site selection approach proposed in the discussion paper;
- 15 indicated no clear position but requested more information; and
- 13 opposed the concept of a national store.

Figure 1 shows the distribution of the discussion paper and the number of public submissions received from each jurisdiction.

The type and number of submissions received in response to the discussion paper from each jurisdiction is shown in Figure 2. The number of submissions from individuals and interest groups is presented in Figure 3.

Figure 1: Number of papers distributed and the number of submissions received from each jurisdiction.

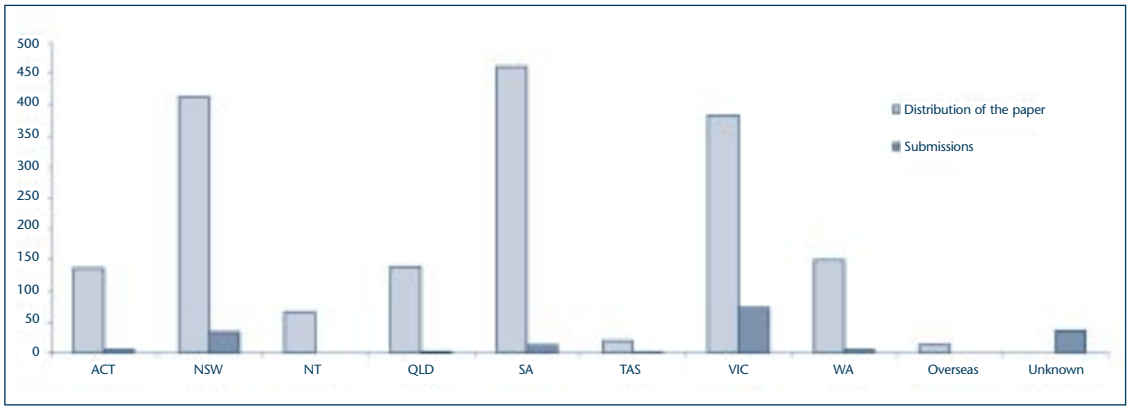


Figure 2: Type of submission received from each jurisdiction.

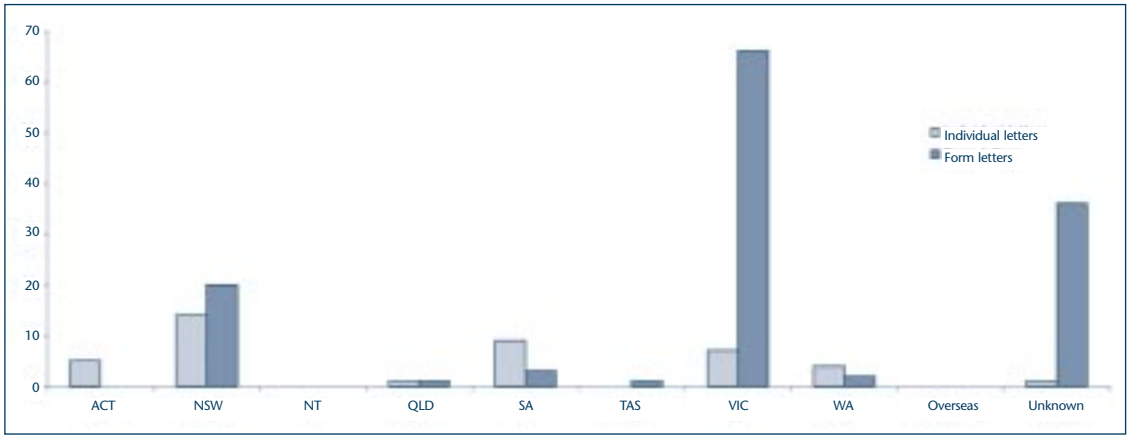
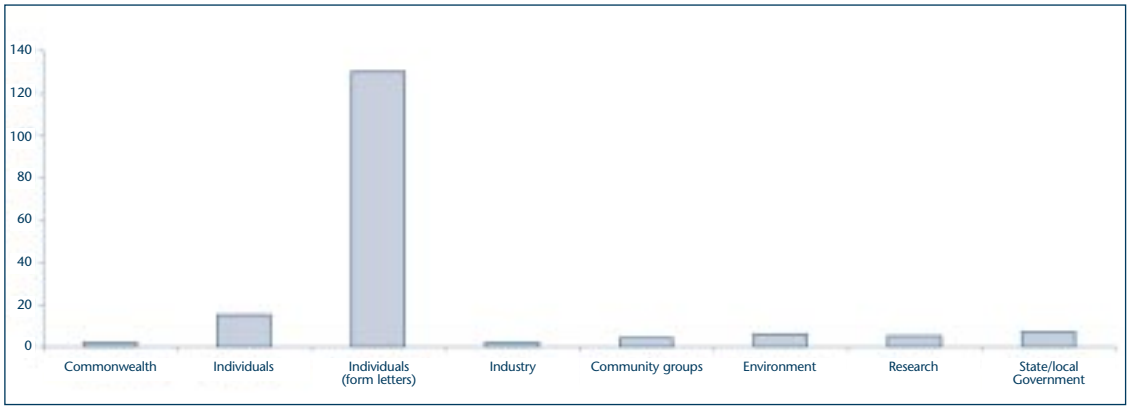


Figure 3: Number of submissions received on the discussion paper from individuals and various interest groups



Support

The majority of the submissions that supported the project noted the need for a national store and the Commonwealth's proposal to establish a facility. A number of technical and general matters were raised for consideration by the National Store Advisory Committee (NSAC) and the Government. Support for the project came from a range of organisations including the Australian Academy of Science, the Australasian College of Physical Scientists and Engineers in Medicine, the Australian Geoscience Council, the CSIRO, the Australian Nuclear Association, and ANSTO.

Areas that attracted particular support included:

- the site selection methodology and in particular the role of the geographic information system (GIS) and the site selection themes;
- the need for a national store; for example, recognition of the fact that the facility would improve upon the current storage arrangements and improve community safety; and
- the conceptual design for the store.

Other issues that attracted comments from supportive submissions included:

- the potential link between the national store and any future geological disposal facility for intermediate level radioactive waste, in particular if the storage and disposal facilities were to be co-located;
- whether there was the intention to co-locate the national store and the national repository for low level radioactive waste;
- disposal at mine sites; for example, the feasibility of using an underground mine site to store or dispose of intermediate level radioactive waste;
- the state and territory intermediate level radioactive waste inventory, in particular the quantity of intermediate level radioactive waste states and territories actually hold; and
- non-Commonwealth intermediate level radioactive waste; for example, the potential capacity of the national store to accommodate all of Australia's intermediate level radioactive waste, including that produced by non-Commonwealth parties (both states/territories and industry).

No position stated — more information requested

Several authors of submissions that did not clearly state objection to or support for the project requested more information.

Questions were asked and issues raised in relation to the following:

- alternatives to a national store, in particular the capability of the waste producers to continue to manage their own waste;
- the public consultation process, in particular the commitment of the Government to an open consultation process;
- the possible link between the national store and any future geological repository for intermediate level radioactive waste, in particular if the storage and disposal facilities were to be co-located;
- whether there was the intention to co-locate the national store and the national repository for low level radioactive waste;

- transport of radioactive waste; for example, what ensures the safety of radioactive waste shipments, and whether the Government intends to consult with the community along the waste transport routes;
- the state and territory intermediate level radioactive waste inventory, in particular the quantity of intermediate level radioactive waste states and territories actually hold;
- the nature of the radioactive waste to be stored; for example, the kind of waste the facility will accept and the length of time the waste will remain radioactive;
- ground water quality, in particular will the storage of intermediate level radioactive waste in an above-ground facility affect the local groundwater;
- mineral and petroleum prospectivity, in particular will a national store limit exploration access around the facility;
- climate change, in particular the extent to which climatic change will be taken into account when siting and constructing the national store;
- the safety/risk associated with a national store; for example, will the facility be safe and what measures will the Government put in place to regulate and monitor the store; and
- possible disposal at mine sites, in particular the feasibility of using an underground mine site to store and dispose of intermediate level radioactive waste.

Opposition

Most submissions that stated opposition to the project were also against the proposed replacement research reactor and viewed the national store as a means of encouraging the use of radioactive substances and increasing the volume of radioactive waste. In general very few comments specifically related to the selection themes.

Authors of submissions that were opposed to the project objected on the basis that, in their opinion:

- there is no proven disposal solution for radioactive waste and waste created today would be a burden on future generations in perpetuity;
- the transport of radioactive material is highly dangerous and hundreds of serious accidents, involving radioactive material, have occurred around the world;
- the knowledge of the current radioactive waste inventory is inadequate to develop a real waste management plan;
- the nature of the radioactive waste to be stored has not been presented to the Australian community; for example, Australians needed to know:
  - how long waste in the store will remain radioactive;
  - why spent fuel is not classified as high level radioactive waste; and
  - why the Government insists on reprocessing Australian spent fuel.
- the community has not been involved in the decision-making process to date and the Government lacks a process for real community consultation on the project;
- the national store is not consistent with the principles of sustainable development and, in particular, waste minimisation should to encouraged;
- the national store is part of the nuclear cycle, which needs to be opposed;

  for example, Australia:

  - has no need of a replacement research reactor;
  - should develop cyclotron technology for the production of medical isotopes or should import radiopharmaceuticals;
- a national store will damage the image of the community around the facility;
- Australia needs legislation to prevent the importation of foreign radioactive waste into the country; and
- climate change should be considered when siting the national store.

Summary

The consultation process identified several issues that people either wanted further information about, expressed concerns about and/or made relevant suggestions about. These included: the need for a national store and its possible impact on the relevant local community; the consultation process; the site selection process; radioactive waste types; the Government's long-term waste management plan; the management of the storage facility; transportation of radioactive waste; alternative waste management methods; alternatives to waste creation; and other issues not directly related to the national store project. Comments in response to the broad issues are provided in the following sections.

6 COMMENTS ON MATTERS RAISED IN RELATION TO THE NATIONAL STORE

Most submissions supporting the proposal acknowledged the need for the national store. Some submissions, which requested further information or which were opposed to the project, asked if a national store was really necessary. Other submissions, which were opposed to the proposal, considered that the store would adversely affect the image of the local community and was not consistent with the principles of ecologically sustainable development.

Comments in response to the above concerns and additional matters raised by respondents are provided below.

6.1 Why do we need a national store?

Australia requires a national store to ensure that intermediate level radioactive waste is safely and responsibly managed.

At present, low and intermediate level radioactive waste is stored at over one hundred locations around Australia, in both rural locations and urban centres. Individual waste producers currently have the responsibility of looking after their own radioactive waste. As a consequence, waste is often stored in facilities that were not designed for the long-term storage of such material, in circumstances that, although safe, are not ideal.

In many cases current storage facilities are nearing capacity, and storage is undertaken in facilities that were not purpose-built and where there is no guarantee of continuity of arrangements. Such ad hoc and physically dispersed stores may lead to incidents where members of the general public could be needlessly exposed to radiation.

In time, Australia will need to develop a geological repository or other suitable facility for the disposal of its intermediate level radioactive waste. Because of the complexities involved, the small amount of intermediate level radioactive waste in Australia, and the cost of establishing such a facility, the creation of such a facility is a long-term national project. In the meantime, in order to ensure that the existing waste is managed in a safer, more responsible manner than is currently the case, it is necessary to develop a national store.

A national store is also needed for the safe management of the small amount of Australian intermediate level radioactive waste that will be returned to this country around 2015. This waste will result from the overseas reprocessing of spent fuel from the existing research reactor at Lucas Heights, Sydney. Waste from the overseas reprocessing of spent fuel from the replacement research reactor will also need to be stored from around 2025 onwards.

For these reasons, and in order to improve overall community safety and confidence, the Commonwealth Government is developing a national store for Australia's small intermediate level radioactive waste inventory produced by Commonwealth agencies.

The Commonwealth Government's decision to develop its own facility rather than a store for all Australia's intermediate level radioactive waste resulted from consultation with the states and territories. While the states and territories support the storage of waste in purpose-built facilities, they were not unanimous in their support for a nationwide search for a site for a store for all of Australia's intermediate level radioactive waste.

To provide for the possibility of non-Commonwealth parties wishing to negotiate for access to the national store in the future, the Commonwealth will ensure that the national store is designed to accommodate all of Australia's current inventory and expected future arisings of intermediate level radioactive waste.

The national store will be a purpose-built storage facility designed to operate for a period of up to at least 50 years, until a suitable geological repository is established or other disposal technology is developed.

Storage of waste at the national store will not be a passive process. Waste will be accessible for the routine monitoring of packaging integrity and inventory-keeping purposes. The store will be designed and constructed to allow expert radiation protection personnel to undertake routine work safely both inside the store itself and in the surrounding areas within the store compound.

The establishment of the national store will ensure that intermediate level radioactive waste is placed in a facility where it can be managed over the long term in a safe and responsible manner.

The community and the environment will benefit from the establishment of the store through its capacity to isolate intermediate level radioactive waste from the environment and from people. It will also enable such waste to be responsibly monitored, managed and regulated. Moreover, it is this generation's responsibility to safely manage radioactive waste so that human health and the environment are protected today and in the future without imposing undue burdens on future generations.

6.2 Will the national store affect the image of the community around the facility?

There is no reason why the national store should significantly affect the image of the local community as the facility will:

- occupy only a small area of Commonwealth land;
- be a relatively small structure;
- be designed and operated to ensure minimal visual impact;
- be designed and constructed to ensure that no radioactive material can be accidentally released; and
- be regulated and monitored to ensure that there is no risk to the local community.

At present, siting studies for the national store are at an early stage and no site has been identified for the facility.

The siting process will involve extensive scientific assessment and public consultation. The community around any potential site will be consulted about the nature of the facility and the waste that will be housed in it. There will be further consultation with the public through the environmental assessment and licensing processes.

The facility will only be constructed and commissioned after the satisfactory completion of detailed environmental assessment and licensing processes, which will address the issue of the potential impact of the facility on the surrounding region. The facility will also be monitored by the operator and audited by the Commonwealth's regulator, the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), in strict accordance with the relevant regulations and codes of practice.

Socio-economic issues relevant to the local community where the site for the national store is located will be addressed. There may be some minor economic benefits to the local community through the siting of the facility. These could include the employment of local contractors, where possible and the local purchase of goods and services, where practicable.

The presence of radioactive waste need not affect the image of local communities and it is worth noting that many of our trading partners, such as Japan, the US, and France and other European nations have safe, purpose-built radioactive waste management facilities, including stores, close to towns or located in areas of agricultural production.

6.3 Is the proposed national store consistent with the principles of ecologically sustainable development?

The proposal to establish a national store is consistent with the principles of ecologically sustainable development and will be assessed, after a site has been selected, under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The EPBC Act defines the process for the assessment of proposed actions that may have an impact on matters of national environmental significance or are on Commonwealth land.

The objects of the EPBC Act are:

a to provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance;

b to promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources;

c to promote the conservation of biodiversity;

d to promote a cooperative approach to the protection and management of the environment, involving governments, the community, land-holders and indigenous peoples;

e to assist in the cooperative implementation of Australia's international environmental responsibilities;

f to recognise the role of indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity; and

g to promote the use of indigenous peoples' knowledge of biodiversity, with the involvement of, and in cooperation with, the owners of that knowledge.

The EPBC Act also identifies the principles of ecologically sustainable development (ESD), which include the following:

a decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equity considerations;

b if there are threats of serious or irreversible environmental damage, the lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation; and

c inter-generational equity — the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

The establishment of a purpose-built facility for the safe storage of intermediate level radioactive waste will better address the protection of the environment in a manner consistent with the objectives of the EPBC Act and the principles of ESD. In particular, storage of intermediate level radioactive waste in a well managed facility will provide better protection for the environment and the public than the current arrangements where waste is largely stored in non-purpose-built facilities (EPBC Act – object a: ESD – principle a).

Issues relating to biodiversity, the protection and management of the storage site, the consideration of long-term and short-term economic, social and equity considerations will all be addressed during the environmental assessment process and the subsequent licensing process by the Commonwealth's regulator, ARPANSA.

7 COMMENTS ON MATTERS RAISED IN RELATION TO THE CONSULTATION PROCESS

Several submissions asked what the level of public and state government involvement has been in the decision-making process. Most submissions that opposed the concept of the store also objected to the Government's consultation process and asked if the public would be involved in the decision-making process. Others suggested that there should be a full public inquiry into waste management under the EPBC Act.

Comments in response to the above concerns and additional matters raised by respondents are provided below.

7.1 Will the community be involved in the decision-making process?

Public comment will be taken into consideration in decision making as the project progresses. Public consultation will be undertaken as part of the siting process, the environmental assessment (through the EPBC Act), and ARPANSA's licensing process.

The call for public comment on the discussion paper, *Safe storage of radioactive waste — The National Store Project: Methods for choosing the right site*, provided the first opportunity for public consultation on the project. Public comment was invited on all aspects of the proposal, including the methodology suggested for the selection of a site for the national store. The current paper responds to public submissions on the discussion paper.

As the study progresses and potentially suitable sites are identified, the consultation program will be focused on the relevant local communities.

Public documents will be widely available to ensure all interested members of the public have an opportunity to comment.

Details of the national store project are available at the Department of Education, Science and Training website: http://www.dest.gov.au/radwaste.

Further information on the project or copies of the discussion paper and information packs on radioactive waste management in Australia can be obtained from:

The Information Officer
Radioactive Waste Management
Location code 742
Department of Education, Science and Training
GPO Box 9880
Canberra ACT 2601

Telephone Tollfree: 1800 682 704
Facsimile: (02) 6240 9184 Email: Store@dest.gov.au

7.2 Have state and territory governments had any input into the siting process?

The Commonwealth has consulted extensively with state and territory governments, as well as with the Australian public, over the need to establish a national store for the safe management of our intermediate level radioactive waste.

In 1980, the Commonwealth–State Consultative Committee on Radioactive Waste Management was established. This Committee consists of representatives of government agencies in each respective jurisdiction with responsibility for radioactive waste management. The terms of reference for this Committee include: "identify and consider issues relating to the management of the establishment and operation of waste management facilities". The decision to establish appropriate waste management facilities, including a national store, has been based on the expert knowledge of the Committee members.

In 1997, the Committee supported the need for a national store for intermediate level radioactive waste.

After the announcement in August 2000 that there would be a nationwide search for a site for a national store, the former Minister for Industry, Science and Resources, Senator Nick Minchin, sought the views of the states and territories on the proposal. The current proposal to establish a national store on Commonwealth land for waste produced by Commonwealth agencies resulted from this consultation.

The states and territories will continue to be briefed on the progress of the national store project through the Commonwealth–State Consultative Committee on Radioactive Waste Mangement. They will also have the opportunity to formally comment on the proposal through public comment processes.

7.3 Will there be a public inquiry into radioactive waste management under the EPBC Act?

The level of assessment of an issue under the EPBC Act is a matter for the Commonwealth Minister for the Environment and Heritage to decide after a proposal is referred to him under the Act.

The proposal will be referred to the Minister when a preferred site is selected.

The options for assessment provided for by part 8 of the EPBC Act are:

- preliminary documentation;
- public environment report (PER);
- environmental impact statement (EIS);
- public inquiry; or
- an accredited assessment process.

By way of comparison, assessment of the national repository project is currently being undertaken under the EPBC Act through preparation of an environmental impact statement.

8 COMMENTS ON MATTERS RAISED IN RELATION TO THE SITE SELECTION PROCESS

Most submissions that supported the project stated their support for the site selection process as outlined in the discussion paper. Several submissions asked for more details on the group of experts that were advising the government on the store project. They also asked if the selection themes would be weighted; if tidal zones were considered suitable for a national store; and if the Commonwealth could override state and territory legislation. Other submissions suggested that the Government should also consider the issue of ground water, climatic change and mineral prospectivity when siting the facility. There were very few direct comments in relation to the site selection process and individual selection themes, although a small number of submissions did object to the Cities and Towns theme on the basis that 1.5 km from the national store to the nearest residence was not far enough.

Comments in response to the above concerns and additional matters raised by respondents are provided below.

8.1 What is the role of the National Store Advisory Committee and who are the experts on the Committee?

The National Store Advisory Committee (NSAC) has been established to oversee the site selection process for the national store.

The terms of reference of NSAC are:

- to oversee the scientific work associated with the siting of a national store for long-lived intermediate level radioactive waste, including assessment of the results/studies undertaken by technical specialists;
- to provide recommendations to the Government on the siting of the store; and
- to consider and to develop concepts for the ultimate disposal of Australia's long-lived intermediate level radioactive waste.

The scientific experts have been chosen to serve on the Committee for their expertise in the field of radiation protection and in other disciplines relevant to the site selection study.

Members of NSAC are:

Dr Colin Chartres (Chair)

- Expert in land and water resources,
- Business Director, CSIRO Land & Water, and
- formerly, Chief of Land and Water Sciences Division of the Bureau of Rural Sciences.

Peter Burns

- Radiation protection expert, and
- Director, Environmental and Radiation Health Branch, Australian Radiation Protection and Nuclear Safety Agency.

Dr Brad Cassels

- Expert in radiation protection and in the siting of radioactive waste management facilities, and
- Manager, Victorian Radiation Safety Program, Department of Human Services.

Simon Critchley

- Expert in radiation protection and in the siting and management of radioactive waste storage facilities, and
- Director, Radiation Health, Queensland Department of Health.

Dr Gerald Laurence

- Radiation protection expert,
- Radiation Safety Officer, Adelaide and Flinders Universities, and
- Adelaide University representative and Council Member, Australian Institute of Nuclear Science and Engineering (AINSE), and Chair, AINSE Environment Specialist Committee.

Dr Phil McFadden

- Expert in geohazards/earthquakes,
- Chief Scientist, Geoscience Australia,
- Fellow of the Australian Academy of Science, and
- Fellow of the American Geophysical Union

Dr Ernst Warnecke

- Expert in radioactive waste management;
- Director and Professor, German Federal Office for Radiation Protection, and
- formerly, Head of Disposable Waste Unit, Nuclear Safety Department, International Atomic Energy Agency.

8.2 Are the themes, outlined in Appendix 1 of the discussion paper, all of equal importance?

The order of themes as outlined in Appendix 1 of the discussion paper does not correspond to a defined hierarchy based on importance.

In the geographic information system (GIS) used to identify broadly suitable blocks of Commonwealth land, each theme will be of equal importance and will not be weighted. However, on a local scale, when individual locations identified by the GIS are undergoing site-specific desktop and field investigations, individual themes may be used to differentiate or rank the suitability of each site.

8.3 Will the national store affect the quality of the surface and ground water around the facility?

As a well designed purpose-built facility the national store will have no impact on the quality of surface or ground water.

The Government does not consider that a ground water theme needs to be added to the site selection themes as:

- the store will be well designed and constructed above-ground; and
- only conditioned and packaged waste in solid form will be accepted by the facility.

8.4 Are tidal zones suitable areas in which to site a national store?

According to the site selection considerations outlined in the discussion paper on page nineteen, areas that are prone to flooding, such as tidal zones, are not suitable for the siting of the national store.

The decision not to site a store in an area prone to flooding is based on practical and economic considerations rather than on safety issues, as a purpose-built store can be engineered to overcome the physical shortcomings of any individual site and thus ensure safety.

8.5 Will long-term climatic change be considered when siting the national store?

The Government will consider climatic change scenarios likely to be encountered over a period of up to at least 50 years when selecting a site for the national store, as this is the time over which the facility will be expected to operate.

Short-term, extreme climatic events will also be taken into account during the site selection, design and construction processes to ensure public and environmental safety.

A specialist study of climate change with respect to the preferred site, when selected, may also form be part of the environmental assessment or the ARPANSA licensing process.

8.6 Will a full assessment of the mineral and petroleum prospectivity be undertaken?

The Government considers that a full assessment of the mineral and petroleum prospectivity is not necessary as the national store will:

- occupy only a small area of Commonwealth land; and
- have a limited operating life of up to at least 50 years, with the waste eventually being removed from the site to be disposed of in a geological repository or other disposal facility.

The general site prospectivity will, however, be considered via a review of the currently available geological data.

It is important to note that the store will not affect the appropriate management of Australia's mineral resources, and that the site on which the store is placed may be put to other uses in the future, including, potentially, minerals exploration if there is prospectivity.

The national store is a place in which radioactive material will be stored for a period. In this way it is different from the national repository, which is intended as a final disposal site for low level radioactive waste and the location in which the waste will remain until it decays to background levels.

8.7 Is the proposed distance from the national store to the nearest residence sufficient from a public safety perspective?

The proposed distance of 1.5 km from the national store to the nearest residence is not dictated by safety considerations but has been adopted to the accommodate boundary concerns of current potential residents. Use of land adjacent to the store would be quite feasible from a radiation safety perspective.

Around the world, radioactive waste is currently safely stored within a 1.5 km radius of the nearest occupied residence. The preference to exclude existing, permanently occupied dwellings from this zone has been suggested to reduce community concern and is not safety-related.

The national store will be designed and constructed to ensure containment of radionuclides in the waste and will have sufficient radiation shielding to ensure that, within a few metres of the building, radiation will be at background levels.

Radiation attenuation rates (or the rate at which radiation decreases) depend on the type of radiation released by each radioactive element. The inventory that is proposed to be emplaced within the store is known, hence the types of radioactive materials involved are known. The strength and penetrating capability of each radionuclide's emissions and their interaction with matter are fundamental physical properties that are also well established.

Each type of radiation, for example, alpha particles, beta particles and gamma rays, can be managed in different ways to ensure safety. For instance,

- alpha particles can only travel a few centimetres in air and can be stopped by a sheet of paper or a layer of skin;
- beta particles can travel several metres through the air, or several millimetres into the human body, but they can be stopped by a small thickness of light material such as aluminium or plastic sheeting;
- gamma rays are a type of electromagnetic radiation similar to X-rays that can pass right through the human body, but can be stopped by lead or walls of concrete.

The containment of radionuclides in the national store together with the radiation shielding will make sure that the exposure to radiation from the facility is kept within the accepted safe levels allowed for by regulation. They will also ensure the safety of both the general public and on-site personnel, who will often be working inside the store. Additional safety is provided by the solid waste form and specialised packaging for the waste which will contribute to the containment of the radionuclides and radiation shielding.

The Government recognises that in the future members of the public may wish to build houses outside the intended Commonwealth-owned 200-metre security buffer, which will surround the facility, but closer than 1. 5 km to the national store. Accordingly, in order to allow for all potential safe future land uses and to more accurately characterise the parameters that will be applied to site selection for the national store, the Government has refined the City and Towns theme, outlined in Appendix 1 of the public discussion paper. The term "the nearest residence" has been modified to "the nearest existing permanent residence at the time of site selection". Details of the updated site selection theme are provided in Appendix 2 of this paper.

8.8 Does the Commonwealth have the power to override state and territory legislation in the area of radioactive waste management?

The Commonwealth has the power to override state and territory legislation if the state or territory law is inconsistent with Commonwealth legislation.

With respect to the management of radioactive waste, the Commonwealth has the *Australian Radiation Protection and Nuclear Safety Act 1999* in place, which provides for the establishment and regulation of national radioactive waste management facilities.

Although the state parliaments can pass laws on a wider range of subjects than the Commonwealth parliament, section 109 of the Constitution, provides that, if a valid Commonwealth law is inconsistent with a law of a state parliament, the Commonwealth law operates and the state law is invalid to the extent of the inconsistency.

9 COMMENTS ON MATTERS RAISED IN RELATION TO RADIOACTIVE WASTE

Most submissions that opposed the national store stated that there was no safe solution to the problem of the disposal of radioactive waste; that spent fuel was high level radioactive waste; and that reprocessing spent fuel simply creates more waste. Several other submissions asked if the waste could be safely managed; how much waste the states and territories held; what kind of waste the national store will accept; how long the intermediate level radioactive waste will remain radioactive; why Australia reprocesses spent fuel; and if Australia requires legislation to stop foreign waste coming into the country.

Comments in response to the above issues and additional matters raised by respondents are provided below.

9.1 Can radioactive waste be safely disposed of?

There is clear evidence, from the operation of purpose-built facilities around the world over the past 30 years that low level radioactive waste can be safely disposed of.

Intermediate level radioactive waste has been safely disposed of more recently.

The principles of radioactive waste management and disposal do not differ significantly from those routinely followed for the disposal of other hazardous wastes. Each waste type, toxic or radioactive, requires a management approach that takes into account the specific characteristics of the waste. Safe waste management can be achieved by adopting appropriate handling, conditioning, storage, packaging, transport and disposal procedures.

Low level radioactive waste is suitable for near-surface underground disposal. Near-surface disposal of radioactive waste has been safely practised in many countries around the world. For example, a number of near-surface disposal facilities are located in the USA, including at the Nevada Test Site and in Utah. France is in the process of closing one near-surface repository, in Brittany, which has reached capacity and contains over 500,000 cubic metres of low level radioactive waste, and is now operating another repository in the Champagne district.

For intermediate level radioactive waste there is broad international consensus that the material should be stored in specially built facilities and then disposed of in geological repositories at depths of several hundred metres.

Geological disposal involves the underground emplacement of solid wastes in excavations containing an engineered barrier system tailored to the disposal site. Disposal in a mined cavity is currently the preferred technique although deep vertical-bore disposal is being investigated. The basic requirement of any geological formation is its ability to ensure the safety of humans and the environment while also facilitating the safe disposal of the radioactive waste.

The overall safety of waste disposal facilities depends on the sum of all the engineered and natural barriers. As part of the approval process comprehensive safety assessments must be undertaken, taking into account all the elements of the multi-barrier system, in order to demonstrate compliance with the relevant safety standards for the protection of humans and the environment.

There is currently one operating geological disposal facility for intermediate level radioactive waste in the USA. The Waste Isolation Pilot Plant (WIPP) in New Mexico commenced operations in 1999. The radioactive waste is disposed of in caverns excavated at a depth of 650 metres below the ground surface in a bedded salt formation.

Several other countries, including Finland and, Sweden, have advanced siting programs and site characterisation studies for their own geological disposal facilities.

9.2 Does the Government have an inventory detailed enough to allow the development of a realistic long-term radioactive waste management plan?

The level of detail available in the current Commonwealth intermediate level radioactive waste inventory is adequate to allow the development of a comprehensive long-term radioactive waste management plan.

The Government will continue to update its inventory of intermediate level radioactive waste that will be stored in the national store as required.

The size of the current inventory and future arisings of non-Commonwealth waste, including waste from the states and the private sector, will be taken into consideration in the design of the national store to ensure the facility will have adequate storage capacity for all of Australia's intermediate level radioactive waste, should other parties wish to negotiate for access to the facility in the future.

9.3 How much intermediate level radioactive waste do the states and territories actually have today and how much are they likely to produce in the future?

The combined inventory of the intermediate level radioactive waste of the states and territories is about 100 cubic metres (Table 1). Based on current trends the total annual accumulation rate of waste other than Commonwealth waste is expected to be less than 3 cubic metres a year. This is because many radiation sources in current use are now being recycled or sent back to the original suppliers.

Table 1: Estimates of Australia's existing inventory and expected future arisings of intermediate level radioactive waste

SOURCE	Typical waste	Volume (cubic metres)	Generation rate (cubic metres per year)
ANSTO			
Radioisotope production, reactor operation and research aluminium end pieces, some solidified liquid waste	Target cans, ion exchange columns, used control arms,	205	1.5 - 1.6 (both for HIFAR & RRR)
HIFAR – decommissioning*	Core support structure	(5)	0
spent fuel	Packaged conditioned waste in concrete	20	0
	Vitrified (glass) residues and compacted waste	6	0
RRR – decommissioning*	Core support structure	(Less than 5)	0
spent fuel	Vitrified (glass) residues and compacted waste	(20)	0
Historic waste	Thorium and uranium concentrates from mineral sands processing	165	0
Other Commonwealth agencies	Disused sources from medical, defence and research equipment	35	1
States/territories	Disused sources from medical, industrial and research equipment	100	Less than 3

HIFAR is the existing research reactor that operates at Lucas Heights. The replacement research reactor (RRR) is intended to commence operations in 2005. * Assuming a 30-year care and maintenance period after operations cease. ( ) Waste expected to be generated in the future.

9.4 What kind of waste will be accepted by the national store?

Only solid, appropriately conditioned and packaed intermediate level radioactive waste will be accepted for storage in the national store.

Typical of the wastes produced by Commonwealth agencies that would be considered for storage in the national store are higher activity disused radioactive sources, some radiation gauges used in research, radiotherapy sources, radium needles and mineral sands concentrates arising from past activities. Some operational waste from ANSTO's activities, such as filters, and conditioned residues from the reprocessing of spent fuel from the existing High Flux Australian Reactor (HIFAR) and, in the future, from the replacement research reactor (RRR) will also be stored in the national store. A small quantity of waste resulting from the decommissioning of HIFAR and the RRR will also be stored in the national store.

Waste produced by non-Commonwealth parties, including the states and territories and the private sector, that may be stored in the national store includes higher activity disused radioactive sources, some radiation gauges used in research, radiotherapy sources and radium needles.

The different types of wastes will be conditioned appropriately for storage in the national store. Conditioning involves those operations that transform radioactive waste into a form suitable for handling, transport, storage and disposal. ARPANSA is currently developing a code of practice for the pre-disposal management of radioactive waste, which will be used to guide the management of radioactive waste destined for the national store, including requirements for the conditioning of such waste.

A detailed operational and management plan for the facility, which will include specific waste acceptance criteria, will be developed after a site has been selected. This document will form part of the operating licence application to the Commonwealth's regulator for radioactive materials and radiation safety, ARPANSA.

9.5 How do the different characteristics of each type of radioactive waste affect the overall waste management strategy?

All radioactive waste is classified into categories based on physical and chemical form, the characteristics of the radiation it emits and the length of time over which it will continue to emit radiation.

The purpose of Australia's classification system is to ensure that the waste is handled, stored and disposed of in a way that is appropriate for each type of waste.

The National Health and Medical Research Council (NHMRC) *Code of Practice for the Near-surface Disposal of Radioactive Waste in Australia* (NHMRC Radiation Health Series, number 35, 1992) is based on international recommendations on radioactive waste management. Within this Code,

four categories have been developed for the classification of radioactive waste that specifically describe and are applicable to Australia's radioactive waste.

The correlation between low, intermediate and high level radioactive waste, the NHMRC classification, the IAEA definitions and a suitable waste management strategy is outlined below.

Low level radioactive waste

Low level radioactive waste contains short-lived beta and gamma emitting radionuclides and normally low levels of alpha emitting radionuclides. Special shielding is not normally required for handling and transport. It includes items such as wrapping material, discarded protective clothing and laboratory plant and equipment.

Low level radioactive waste corresponds to Categories A, B and C waste in the NHMRC *Code of Practice* (NHMRC Radiation Health Series, number 35, 1992) and, broadly, to short-lived low and intermediate level radioactive waste, as defined in the IAEA Safety Guide, number 111-G-1.1, 1994, as both refer such waste to near-surface disposal.

Disposal in near-surface underground structures is commonly practised for this category of waste as it does not need to be isolated from the human environment for periods longer than a few hundred years. It is considered that institutional control of disposal sites can be maintained for such periods and that the imposition of such controls should not be an unacceptable burden on future generations.

Intermediate level radioactive waste

Intermediate level radioactive waste contains significant levels of beta and gamma and possibly long-lived alpha emitting radionuclides. Australian intermediate level radioactive waste consists of disused sealed sources and industrial gauges, mineral sands concentrates from past activities, reactor components, irradiated fuel cladding, and waste from the processing of spent fuel and ion-exchange resins and filters. This waste sometimes requires shielding during handling and transport.

This category of waste broadly corresponds to the long-lived low and intermediate level radioactive waste as defined in the IAEA Safety Guide, number 111-G-1.1, 1994, and Category S waste in the NHMRC *Code of Practice* (NHMRC Radiation Health Series, number 35, 1992).

Intermediate level radioactive waste is not suitable for near-surface disposal and in most countries intermediate level radioactive waste is stored in purpose-built facilities while geological repositories for disposal are considered or developed. Several countries have advanced disposal facility site investigations or characterisation studies (for example, Finland and Sweden). One operating disposal facility for intermediate level radioactive waste exists in the USA, the Waste Isolation Pilot Plant (WIPP).

High level radioactive waste

High level radioactive waste contains high levels of beta and gamma radiation emitters and significant levels of alpha emitters and generates significant amounts of heat (>2 kW/m^3).

No high level radioactive waste is generated in Australia and there is no need or responsibility to store or dispose of any such material in Australia.

This category of waste is defined in the IAEA Safety Guide, number 111-G-1.1, 1994.

High level radioactive waste requires careful handling, substantial shielding, provision for the dissipation of the heat generated by the decay of radionuclides and long-term immobilisation and isolation from the biosphere.

9.6 How long will radioactive waste in the national store remain radioactive?

The time radioactive waste in the national store will remain radioactive will depend on the half-lives of the respective radionuclides and the quantity of material in the store. Ultimately, the waste housed in the store will be disposed of in a geological repository or alternative disposal facility where it will decay to background levels.

Both the concentration and half-life of the radioactive waste will be used to determine whether it is suitable for disposal in the near-surface repository or whether it will require above-ground storage. For example, some radioactive waste that contains isotopes (Cobalt-60, Caesium-137 and Strontium-90) with short-half lives (of about 30 years or less) but high concentrations may be held in the national store until it has decayed to levels suitable for near-surface disposal. Other radioactive waste containing substances such as thorium will decay over thousands of years.

9.7 Why is Australian spent fuel reprocessed?

Australian spent fuel is reprocessed to convert the material from a form that needs careful management into a robust waste form that is stable for the very long term and suitable for storage and disposal.

Reprocessing also allows for the recovery, and thus recycling, of unused uranium and reduces the volume of radioactive material that needs to be managed. In addition, while the resulting waste contain a similar amount of radionuclides as the original spent fuel, the concentration of long-lived radionuclides in the waste is lower and thus the level of radioactivity in the conditioned waste, in the longer term, falls much more rapidly than that in the spent fuel.

Due to the small quantity of spent fuel produced in Australia it is not practical or economically sensible to reprocess spent fuel in Australia. Consequently, spent fuel rods are sent overseas for treatment.

Most countries reprocess spent aluminium clad research reactor fuel, such as those used in Australia, as experience worldwide has shown that, over the longer term, the aluminium cladding is prone to degradation and this potential for degradation limits the duration for which spent fuel may be prudently stored.

9.8 Why is spent fuel from Australia not classified as radioactive waste?

The spent fuel from HIFAR and the replacement research reactor is not considered waste because it contains significant amounts of enriched uranium that can be recovered by reprocessing.

9.9 Why is the waste arising from the reprocessing of Australian spent fuel classified as intermediate level rather than high level radioactive waste?

The waste returning from overseas reprocessing of Australian spent research reactor fuel is classified as intermediate level radioactive waste as it generates significantly less heat than high level radioactive waste.

Under the guidelines of the International Atomic Energy Agency, high level waste generates more than 2 kilowatts per cubic metre (IAEA Safety Guide, number 111-G-1.1, 1994).

9.10 What would Australia do if the French reprocessing facility closed?

In the unlikely event that the COGEMA's reprocessing facility in France closed, INVAP, the company that is contracted to design and construct the replacement research reactor, is contractually obliged to provide a spent fuel reprocessing route that complies with Australia's requirements.

It should, however, be noted that:

- the contract between ANSTO and COGEMA is backed by French Government assurances that ensure COGEMA is able to fulfil its obligations under the contract;
- COGEMA reprocesses spent fuel from several European countries and Japan under long-term contractual arrangements that extend well beyond the time when reprocessing of HIFAR spent fuel will be completed; and
- ANSTO's contract with COGEMA has provisions for the reprocessing of spent fuel arising from the operations of the proposed replacement research reactor.

There are no plans for the continued long-term storage of spent research reactor fuel on ANSTO's Lucas Heights site or anywhere else in Australia. It is the current Government's view that reprocessing of spent fuel from HIFAR and the replacement research reactor is a sensible and safe management practice.

9.11 Exactly what is the historic radioactive waste from mineral sand mining mentioned in the discussion paper?

The historic radioactive waste from sand mining activities consists of 165 cubic metres of thorium concentrates derived from the industrial processing of mineral sands in the early 1960s. The material is not typical of the bulk waste produced by the mineral sand mining industry and was classified as waste by ANSTO, when it inherited the material from industry, because ANSTO could find no use for the material within their organisation or a buyer for the thorium concentrates.

The processed concentrates fall into three distinct types: (i) thorium hydroxide powder; (ii) mine concentrates containing thorium hydroxide; and (iii) thorium oxalate. Details of these waste types are provided in Table 2.

Table 2: Radioactive waste from the processing of mineral sands by Australian industry

Waste type	i	ii	iii
Description	Thorium hydroxide powder	Mine residues containing thorium hydroxide	Thorium oxalate
Radionuclide	Th-232	Th-232	Th-232
Total activity GBq	211	28	1.7
Average concentration (Bq/kg)	2.6 MBq/kg	1.4 MBq/kg	1.6 MBq/kg
Total mass for disposal (kg)	84,500 kg	20,000kg	1020 kg
Number of drums	668 drums	130 drums	14 drums
Total volume for disposal (m3)	133.6 m3	26 m3	2.8 m3
Disposal category	Cat S	Cat S	Cat S
Current location	ANSTO	ANSTO	ANSTO

9.12 Why is waste from uranium mines not going to be stored in the national store?

Bulk waste produced by the uranium mining industry can be safely managed on site and does not need to be placed in the national store.

All radioactive waste from the mining and processing of uranium ores is disposed of in accordance with the national *Code of Practice on the Management of Radioactive Wastes from the Mining and Milling of Radioactive Ores* (1982), or as otherwise provided for in the legislation of individual jurisdictions.

9.13 What is nuclear transmutation?

Nuclear transmutation, in the context of waste management, involves the conversion of long-lived radionuclides into shorter-lived or even stable nuclides. Transmutation techniques remain under development and expert opinion is that transmutation is not considered feasible as a waste management technology in the near future.

Effective use of transmutation in waste management would require chemical processing of radioactive material and would not eliminate the need for waste disposal facilities.

9.14 Will Australia accept radioactive waste from other countries?

Successive Australian Governments have stated that Australia will not accept nuclear or radioactive waste from other countries for storage or disposal in Australia. Moreover, the Commonwealth Government is not prepared under any circumstances to consider involving organisations in Australia's radioactive waste facilities that may be seen as promoting Australian storage or disposal of international radioactive waste.

The Government's position is based on the clear principle that countries deriving benefits from nuclear technology should expect to make their own arrangements for the safe disposal of their radioactive waste.

9.15 Does the Government have any legislation that prohibits the importation and disposal of foreign radioactive waste in Australia?

The Government has legislation in place that prohibits the importation of foreign radioactive waste.

Radioactive substances, including wastes, are a prohibited import under Regulation 4R of the *Customs (Prohibited Imports) Regulations*. Under these regulations, radioactive waste may only be imported with written approval of the Minister for Health and Ageing or a person authorised by the Minister.

Regulation 4R(1) defines a radioactive substance broadly to include any radioactive material or substance, including radium, and radioactive isotope or any article containing any radioactive material or substance. A permit is required to allow intermediate level radioactive waste generated from HIFAR (or from the RRR) back into Australia. Consistent with the policy that radioactive waste should be managed in the country in which it was generated, the waste from the reprocessing of spent fuel needs to be reimported into Australia.

Existing policy and regulations not only ensure an effective prohibition on importation of other countries' radioactive waste but also ensure we have the flexibility to responsibly manage our own radioactive wastes, such as wastes from the overseas reprocessing of research reactor spent fuel that needs to be returned to Australia.

10 COMMENTS ON MATTERS RAISED IN RELATION TO "A FUTURE DISPOSAL FACILITY"

Several submissions supported the concept of Australia establishing a geological disposal facility for intemediate level waste in the future, as outlined in the discussion paper, and suggested that work should commence immediately on both the storage and disposal facilities. Others asked what the Government planned to do with the waste after the national store is closed, and if the proposed national geological repository would be co-located with the national store. Authors of submissions that opposed the national store project criticised what they saw as a piece-meal approach to waste management that lacks any real plan beyond interim storage for a period of up to at least 50 years.

Comments in response to the above concerns and additional matters raised by respondents are provided below.

10.1 Does the Commonwealth Government really have a comprehensive radioactive waste management plan?

The Commonwealth Government has a comprehensive, integrated plan for the safe management of Australia's small inventory of radioactive waste.

This plan involves the development of a national repository, to dispose of low level radioactive waste, and a national store, for the storage of intermediate level radioactive waste. In the future, a disposal facility for intermediate level radioactive waste will need to be developed.

Australia does not generate any high level radioactive waste and there is no need or responsibility to store or dispose of any such material in Australia.

Both the national repository and the national store are designed to improve upon the current storage arrangements that individual waste producers have in place around the country.

The National Store Advisory Committee and the Commonwealth Government recently undertook a review of storage and disposal options for long-lived intermediate level radioactive waste and will continue to consider options for intermediate level radioactive waste disposal.

This review concluded that:

- the interim storage of radioactive waste in purpose-built facilities is a safe, practical, internationally accepted waste management strategy that maintains options for monitoring and retrieval;
- while several disposal technologies, including deep bore-hole disposal and nuclear transmutation, are being actively investigated, there is broad international consensus that intermediate level radioactive waste should be disposed of in geological repositories at depths of typically several hundred metres.

The review recommended that Australia not commence work on a national disposal facility straightaway. Instead, it recommended that Australia continue progressing the national store while monitoring and assessing the progress of disposal strategies around the world. A review of disposal options will be again undertaken in 2004/2005.

10.2 How does the Government plan to manage Australia's intermediate level radioactive waste after the national store is closed?

The Government will develop a purpose-built facility for the disposal of our small inventory of intermediate level radioactive waste.

A detailed review of international progress in disposal strategies for intermediate level radioactive waste will be prepared by the Department of Education, Science and Training with the assistance of expert scientists in 2004/2005 in order to reassess possible disposal options for Australia.

10.3 Is the Government considering siting a future disposal facility for intermediate level radioactive waste at the same site as the national store?

The establishment of any future disposal facility for intermediate level radioactive waste will be the subject of a site selection study separate from the studies for either the national repository for low level radioactive waste or the national store for intermediate level radioactive waste.

It is unlikely a geological disposal facility will be sited at the national store as the site selection themes and criteria that will be used for the two facilities will be very different. The geology and ground water at depths of several hundred metres will be critical to the siting of a disposal facility, while the national store will be an above-ground structure where local, surficial environmental conditions will be of importance.

11 COMMENTS ON MATTERS RAISED IN RELATION TO THE NATIONAL STORE FACILITY MANAGEMENT

Several submissions asked if the store will be large enough for all of Australia's intermediate-level radioactive waste; if the Government has a waste minimisation strategy; how much waste the states and territories actually held; if the cost of operating the store will be passed on to the users; if the store will be a safe environment for on-site workers and the public; who will own the store; and, if the national store will be a secure facility. Other submissions that opposed the national store project criticised the Government for encouraging waste creation.

Comments in response to the above concerns and additional matters raised by respondents are provided below.

11.1 Will the national store be designed to accommodate Australia's current inventory and future intermediate level radioactive waste arisings, including that produced by non-Commonwealth entities?

The national store will be designed to accommodate the current inventory of Commonwealth intermediate level radioactive waste as well as the small quantity of waste that will be generated in the foreseeable future. However, the national store will also have the capacity to take intermediate level radioactive waste generated in the states and territories, by government and private industry, should they wish to negotiate with the Commonwealth Government for access to the store.

11.2 Does the Government have a waste minimisation strategy in place?

Commonwealth departments and agencies have waste minimisation strategies in place.

The Commonwealth Government agrees that alternatives to the creation of radioactive waste should be encouraged where feasible, and that there should be incentives for the minimisation of radioactive waste production. There will be a cost associated with the storage of waste in the national store to encourage the minimisation of waste.

Recycling of radioactive materials such as radioactive sources in gauges is encouraged but some residual radioactive material cannot be recycled. Much of the waste currently held in storage is historic waste from past beneficial medical, research and industrial uses of radionuclides. Several categories of waste are either no longer generated or the quantities produced have been reduced as a result of technological advances.

11.3 Will the cost of the national store be recovered from waste producers?

It is anticipated that there will be a charge for the storage of waste in the national store. The details will be finalised when the proposal is further advanced.

11.4 Will the national store be a safe environment for the on-site workers and the public in general?

The national store will be constructed and operated in such a way as to ensure the safety of people and the environment. A code of practice for the pre-disposal management of radioactive waste is being developed by ARPANSA to ensure that the activities carried out at the store will not result in health and safety risks to either the public or facility personnel. Guidelines will also be established for the conditioning and packaging of waste to ensure its long-term stability.

The exposure of on-site workers to radiation from waste in the national store will be well within the accepted safe levels allowed for by regulation.

The safety of workers at the site and protection of the environment will be addressed in detail in the management plan for the site. This plan will address operational aspects of radiation safety such as personnel training, personnel monitoring, record maintenance, monitoring within the operational area of the facility, emergency preparedness and protective clothing and apparatus. The management plan will be reviewed regularly by the operator and the relevant regulatory authority. It will also be made available to the public.

In the case of the general public, the exposure to radiation from the national store will be much less than the normal background radiation levels for the site. On average in Australia, we are exposed to about 1.5 mSv per year from natural background radiation. The exact amount varies according to the differing amounts of naturally occurring radioactive elements in soils and rocks around us and the altitude at which we live and work. For example, on a 20-hour international airline flight individuals receive a radiation dose of about 0.08 mSv.

11.5 Who will own the national store?

The national store will be owned by the Commonwealth and regulated by the Commonwealth's regulator for radiation-related matters, the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA).

11.6 Will the national store be a poorly regulated, out of sight, out of mind facility?

The national store will be a well designed and regulated facility built to ensure safe and secure storage of radioactive waste.

Siting studies for the national store are at an early stage and Commonwealth land in all states and territories will be investigated. Transport issues, amongst other selection issues, will be considered when siting the facility to ensure that radiation protection experts can efficiently monitor and audit the national store.

The Commonwealth's independent regulator, ARPANSA, will regulate the national store.

11.7 When will ownership or possession of the waste transfer from the producer to the Commonwealth?

This is a complex issue that has not yet been resolved. The point at which ownership will transfer from one agency to another will be determined when the operational plan for the facility is finalised.

11.8 Will the national store be a physically secure place in which to store Australia's radioactive waste?

The national store will be designed to provide a secure environment for Australia's intermediate level radioactive waste. A range of measures, tailored to suit the physical conditions present at the site selected for the facility, will be considered to ensure that the waste is secure. These may include the type of conditioning and packaging, site fencing, security personnel and surveillance equipment.

The detailed security arrangements will be fully addressed as part of the mandatory facility environmental assessment and licensing processes after a site has been selected.

12 COMMENTS ON MATTERS RAISED IN RELATION TO THE TRANSPORT OF RADIOACTIVE WASTE

Several submissions asked if the transport of radioactive waste is safe; if there are any regulations that govern the transport of radioactive material; if Australia has the capacity to deal with a transport accident. Some asked for more information on the transport of spent fuel overseas. Submissions that opposed the concept of a national store stated that the transport is extremely dangerous and asked whether communities along the transport routes will be consulted.

Comments in response to the above concerns and additional matters raised by respondents are provided below.

12.1 Will the transport of waste to the national store be safe?

The transport of waste to the national store will be safe.

The principle assurance of safety in the transport of radioactive material, including waste, is the physical form of the material and the design of the packaging. Packages used for the transport of radioactive material are designed to retain their integrity under the various conditions that may be encountered while they are being transported and to ensure that an accident will not have any major consequences. Conditions that packages are tested to withstand include: fire, impact, pressure, wetting, heat and cold.

There are strict regulations and codes in Australia, consistent with international practice, for the packaging, handling and transport of radioactive material and these are closely adhered to.

These measures help to ensure that, even in the unlikely event of an accident, public and environmental safety will not be compromised. Indeed, the solid physical form, carefully designed packaging and stringent regulations ensure that the risk associated with the transport of radioactive waste is far less than that associated with the transportation of other hazardous materials such as flammables and corrosive substances.

Internationally and in Australia there has been a long record of safe transport of radioactive substances. More than 20 million packages containing such material are safely transported throughout the world each year.

12.2 What are the transport regulations that govern the shipment of radioactive materials in Australia and how were they developed?

Regulatory authorities in the Commonwealth, states and territories are responsible for the regulation of the transport of radioactive materials by road, rail or waterways within their respective jurisdictions. ARPANSA is the Commonwealth regulator. Regulation in the states and territories is provided either by the department responsible for health or for the environment.

In Australia radioactive materials must be transported in accordance with the relevant Code of Practice and state and territory regulations; this ensures the protection of persons, property and the environment from the effects of radiation during transport.

The Code of Practice for the Safe Transport of Radioactive Substances (1990), published by the former Department of the Arts, Sport, the Environment, Tourism and Territories under the *Environment Protection (Nuclear Codes) Act* 1978, was based on the 1985 International Atomic Energy Agency (IAEA) regulations. The Commonwealth followed this Code of Practice until its revision in 2001. It also formed the basis of the relevant radioactive substance transport controls under state and territory legislation and regulations.

While the *Code of Practice for the Safe Transport of Radioactive Substances* (1990) provided a high degree of safety, some aspects of the Code became out-dated with the publication in 1996 of new IAEA regulations. These regulations were in turn revised by the IAEA in 2000. In the light of

the current knowledge of the risk of exposure to radiation some packaging controls needed to be tightened and others relaxed (ARPANSA Regulatory Impact Statement 2001).

ARPANSA has now revised the 1990 Code of Practice. The new Code, the *Code of Practice for the Safe Transport of Radioactive Materials* (2001), has now been adopted by the Commonwealth and is referred to in the relevant parts of the ARPANS regulations. Adoption of the new Code by other jurisdictions will ensure that the requirements for the transport of radioactive materials in Australia are in keeping with current international practice.

The new Code is in the process of being adopted by the states and territories. Until this happens, the 1990 Code of Practice and the relevant existing state and territory regulations will continue to apply.

The 1985 and 1996 IAEA regulations, on which the 1990 and 2001 Codes of Practice are based respectively, establish standards of safety and provide an acceptable level of control of the radiation and thermal hazards to persons, property and the environment associated with the transport of radioactive material. This is achieved by requiring:

- containment of the radioactive materials;
- control of external radiation levels; and
- prevention of damage caused by heat.

In the 2001 Code, as in the 1990 Code, packaging, labelling and licensing requirements are structured around a series of packaging levels, which are determined by the radionuclides present and their level of activity.

12.3 Does Australia have the capacity to deal with a transport accident relating to a radioactive waste shipment?

Australia has the capacity to respond to and deal with a transport accident involving radioactive material, including waste. In the unlikely event of such an accident public safety is ensured by the solid physical form of the waste and the specialised transport packaging, which is designed to withstand all foreseen accident scenarios.

Emergency response is a matter for the relevant state or territory emergency services and is covered by existing emergency planning arrangements in accordance with the Transport Code. In most emergency situations, the police, ambulance, fire services and state or territory emergency services are the first responders. The fire services maintain specialised HAZMAT teams trained to deal with chemical, biological and radiological incidents.

The Commonwealth can provide assistance on request from the states or territories to Emergency Management Australia (EMA). ARPANSA and ANSTO also maintain trained radiation emergency response teams that can provide assistance on requests from state or territory authorities.

If required international assistance is also available through the IAEA emergency response centre in Vienna.

12.4 Are there any radiation dose limits associated with the transport of radioactive waste in Australia?

Radiation dose limits have been specified for transport containment. The dose limits apply at the surface and at a defined distance from the transport package. The dose limits for occupational and public exposure are defined in the Australian National Standard for Limiting Occupational Exposure to Ionizing Radiation (Radiation Health Series No. 39).

12.5 Will the Government consult with Australian communities along the transport route?

The Government will consult with the communities along possible transport routes after a suitable site for the national store has been found and possible transport routes identified.

Transport of radioactive waste to the national store will also be the subject of consideration under environmental assessment procedures and the facility licensing process. Public consultation would be part of these processes.

12.6 How will waste from the reprocessing overseas of Australian spent fuel be returned to Australia?

Intermediate level radioactive waste resulting from the reprocessing of Australian spent fuel will be returned to Australia by sea in specialised transport packaging.

The Australian Government attaches great importance to the safety and physical security of shipments of radioactive material. Australia's current small inventory of spent fuel and low production rates means that very few shipments of radioactive material will be required.

All past shipments of Australian spent fuel from HIFAR to France and Scotland for reprocessing have been undertaken with the full approval of Environment Australia, the Australian Maritime Safety Authority, the NSW Police, the Australian Safeguards and Non-Proliferation Office and Australia's nuclear regulator, ARPANSA.

Both spent fuel and intermediate level radioactive waste are transported in specially designed transport packaging, which complies with rigorous international standards. The packaging is specifically designed for the particular radioactive material it carries, to give protection to workers and the public against radiation. The packages are also designed to withstand serious accidents.

The transport packaging is built to standards set down by the IAEA. Under these regulations the packaging must have successfully met a series of rigorous fire, impact and immersion criteria.

The protection provided by the waste form, the packaging and the ship ensure that, even in the event of a very severe accident, the radioactive waste will not be released into the environment.

The safety of shipments of nuclear material is subject to review by the relevant international agencies, including the IAEA and the International Maritime Organisation. Moreover, the IAEA Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive

Waste Management provides guidelines for the trans-jurisdictional transport of radioactive material. Australia is a signatory to the Convention and is currently in the process of working towards ratification of its membership of the Convention.

12.7 Do insurance companies cover the shipment of radioactive material overseas?

Comprehensive liability cover exists and, in the extremely unlikely event of a transport accident, redress would be sought under the relevant domestic and international laws dealing with marine pollution and liability for harm to the marine environment.

12.8 Has the Government consulted with countries along the shipment routes?

The Commonwealth Government has consulted and will continue to consult with countries along ocean shipping routes used to transport Australian spent fuel for overseas reprocessing and the return of Australian intermediate level radioactive waste.

Australia has actively discussed the transport of radioactive material with a range of countries including Pacific Island nations, France, Japan and the UK.

In 1998, Australia ratified the Convention to Ban the Importation into Pacific Forum Countries of Hazardous and Radioactive Wastes and to Control the Transboundary Movement and Management of Hazardous Wastes within the South Pacific Region (the Waigani Convention).

In 1999, Australia was active in the 30th South Pacific Forum. Among many other issues, the Forum discussed shipments of radioactive materials through the region, including liability and compensation arrangements.

The Commonwealth Government is committed to the safe transport of radioactive material and to constructive dialogue and consultation with other nations to ensure this objective.

13 COMMENTS ON MATTERS RAISED IN RELATION TO ALTERNATIVE RADIOACTIVE WASTE MANAGEMENT METHODS

Several submissions suggested that the generators of waste should continue to store or dispose of waste on their site rather than in a national facility. One submission asked if waste could be stored in underground mines.

Comments in response to the above concerns and additional matters raised by respondents are provided below.

13.1 Why not just store radioactive waste at the site of origin?

Storage at a purpose-built national facility will best ensure public and environmental safety both today and in the future. A national facility is the most effective way of managing our small radioactive waste inventory. It also offers greater security than the current storage arrangements.

It is in the interest of public safety to secure radioactive waste and materials from possible theft or misuse through storage at a site, such as a national store, specifically designed for this purpose.

Some members of the community have proposed storage of radioactive waste at the site of origin because they consider waste management to be the responsibility of those who produce the waste. This view does not recognise the fact that generators of radioactive waste are often not the only beneficiaries of the use of radioactive materials.

It may also be considered that storage at the site of origin may encourage waste minimisation. This view takes no account of the fact that in Australia much of the waste currently held in storage is from the past medical, research and industrial use of radionuclides. Some types of waste are either no longer generated or the quantities produced have been reduced as a result of technological advances. In many cases the original generator may no longer exist or is unknown, and in some cases the radioactive waste has been collected at a central point by a private organisation or a government agency to help ensure its safe management until it can be disposed of.

13.2 Is it possible to store radioactive waste in underground mines?

The Commonwealth Government has considered the issue of siting a national store for intermediate level radioactive waste in a mine. Although this option may appear simple, the technical difficulties of stabilising the disturbed rock strata, typical of a mined environment, in order to ensure the long-term physical integrity of the facility, combined with the licensing, regulating and monitoring difficulties associated with such a site, do not make such an option attractive.

In addition, the use of an operating or disused mine could limit future exploration activities and cause operational difficulties if future generations decided to activate mining operations in new areas within the mine as a result of changed economic conditions.

14 COMMENTS ON MATTERS RAISED IN RELATION TO ADDITIONAL ISSUES

Issues raised in submissions that were not directly related to the national store project included: the question of the safe disposal of the radioactive material at Maralinga; the need for a replacement research reactor; the use of cyclotrons to produce medical isotopes; and the possibility of importing radiopharmaceuticals from overseas.

Comments in response to the above concerns and additional matters raised by respondents are provided below.

14.1 Has the radioactive material at Maralinga been safely disposed of?

The radioactive material at Maralinga has been safely disposed of in near-surface underground trenches.

The radioactive material buried at Maralinga meets the standards for near-surface disposal as defined in the *Code of Practice for the Near-surface Disposal of Radioactive Waste in Australia* (1992).

14.2 Why do we need a new research reactor?

Australia has obtained very substantial benefits from the existing research reactor (HIFAR) that the Australian Nuclear Science and Technology Organisation (ANSTO) operates at Lucas Heights. HIFAR is a source of neutrons, and Australia benefits from the use of these neutrons in areas as diverse as medicine, the environment, agriculture, industry, mining, science and education. In medicine, for example, ANSTO produces about 430,000 patient doses of radiopharmaceuticals each year, of which around 350,000 doses are reactor-sourced. Over 180 nuclear medicine departments and clinics across Australia use these nuclear medicines for the detection and treatment of illnesses such as cancer and heart diseases. We are now approaching the point where, on average, every Australian will benefit from a reactor-sourced radiopharmaceutical during the course of his or her life.

HIFAR has now been in operation for 41 years. It is technologically obsolete and is nearing the end of its service life. The Government decided in September 1997 that HIFAR would be replaced with a modern, multipurpose research reactor. The replacement research reactor is expected to come into operation in 2005. It will be used for a range of activities similar to those for which HIFAR is used at present.

The replacement research reactor will be a major facility for the nationally important research activities that will continue to be undertaken in Australia in a wide range of scientific disciplines, including emergent areas of technology such as nanotechnology, and potential industrial development.

The replacement research reactor will also ensure that Australians can continue to have access to a first-class standard of health care, with a reliable supply of radioisotopes for use in nuclear medicine, for diagnosis and therapy.

Regardless of the replacement research reactor, Australia needs to develop purpose-built facilities in order to responsibly manage our existing radioactive waste inventory and to ensure the safety of the public and our unique environment.

14.3 Can't we produce medical isotopes using cyclotron technology?

Cyclotrons are already used in Australia for the production of specific medical isotopes but cyclotrons cannot produce the complete range of medical isotopes used in Australia today.

Most medical radioisotopes can only be produced, in commercial quantities and at the required activities, in either a nuclear reactor or a cyclotron. Few can be produced in both and thus both a reactor and several cyclotrons are needed to make the full range of radioisotopes required for medicine. Moreover, both cyclotrons and the research reactor produce radioactive waste that must be managed responsibly.

Currently around 80 percent of all nuclear medicine procedures in Australia use the radioisotope technetium-99m, which is the daughter radioisotope resulting from the decay of molybdenum-99m produced in ANSTO's HIFAR reactor. Molybdenum-99m cannot be produced on a commercial basis in cyclotrons anywhere in the world.

It is noteworthy that:

- the Australian Academy of Science concluded in 2001 that no accelerator-based alternative technology could meet Australia's requirements either for nuclear-based science or for the production of medical radioisotopes; and
- the May 2001 majority report by the Senate Select Committee for an Inquiry into the Contract for a New Reactor at Lucas Heights, stated: "In summary, the committee accepts that, at the moment, nuclear reactors will continue to be the only feasible source of neutrons for the manufacture of technetium-99m and that it is unlikely that anything will compete with the reactor produced molybdenum-technetium generator in the near future" (p. 67).

Australia will need a national store and national repository to manage its existing and future waste regardless of whether a replacement reactor or a cyclotron is used to supply medical isotopes. Moreover, the generation of radioactive waste is a consequence of activities accepted in the community as being beneficial in terms of their contribution to human health and safety, environmental protection and research in these fields.

14.4 Why don't we just import radiopharmaceuticals?

In principle, the importation of radiopharmaceuticals could meet the demand for most commonly used diagnostic radioisotopes. However, a number of short-lived and emerging therapeutic radioisotopes could not be imported. There are also problems with importing that would affect the maintenance of current levels of health care, such as the reliability of supply and the expiry of 'use by' times as a result of in-transit delays.

Even if Australia imported all its radioactive isotopes and radiopharmaceuticals, there will still be a need for a national store for the existing wastes and arisings from the imported radioactive material.

It should be noted that a total reliance on imported radioisotopes for medical, research and industrial uses in Australia would mean that Australia would benefit from the production of radioisotopes by another country while that country bears the burden of dealing with the radioactive wastes resulting from production. In principle this would be the equivalent of exporting Australian radioactive waste overseas.

15 NEXT STEPS

The Government wishes to thank all those who responded to the national store discussion paper released in July 2001.

Following consideration of the issues raised by the community, one selection theme has been refined. The term "the nearest resident" in the City and Towns theme was modified to "the nearest permanent residence at the time of site selection". Details of the final site selection themes are provided in Appendix 2.

The next stage of the project will be to use the final site selection themes to assess the suitability of Commonwealth land to identify a short-list of areas for detailed field study.

Further information on the project may be obtained by contacting:

The Information Officer
Radioactive Waste Management
Location 742
Department of Education, Science and Training
GPO Box 9880
Canberra ACT 2601

Telephone: Tollfree 1800 682 704
Facsimile: 02 6240 9184
Email: Store@dest.gov.au

This report, the discussion paper and general background information on radioactive waste is available at http://www.dest.gov.au/radwaste.

APPENDIX 1

LIST OF RESPONDENTS TO THE NATIONAL STORE DISCUSSION PAPER

Gerry Harant Blackburn VIC Sydney NSW	Michael Priceman Sutherland Shire Environment Centre
Associate Professor Tim van Doorn Australasian College of Physical Scientists and Engineers in Medicine Adelaide SA	Benjamin Collins Mysterton Qld
Caleb Furner New Lambton NSW	Lisa Rusanen Sydney NSW
Catherine Woolnough Sydney NSW	Ned Sevil Sydney NSW
William Bennett Sydney NSW	Peter Zakrzewski Melbourne VIC
Cameron McDonald Melbourne VIC	Natalie Roper Penrith NSW
Kelly Jones Sydney NSW	Lauren Hepher Trevallyn TAS
Katherine Taylor Lathlain WA	Peter Boyle Sydney NSW
Thomas Barnbay Jackson Bondi NSW	Camilla Pandolini Melbourne VIC
Helen Isaac Coolbellup WA	Natalie Wasley Dianella WA
W McKinrick Pt Augusta SA	Neil Terrell Broken Hill NSW
Thalia Robertson Broken Hill NSW	I Garde Broken Hill NSW
J Hall-Pitaway Broken Hill NSW	Helen Hucks Peterborough SA

Hayley Case Happy Valley SA	Craigh Vinren Cabarita Beach NSW
Angela Spall Cabarita Beach NSW	C M Oliver Lismore NSW
Graeme Lambert The Channon NSW	Parvathy Balakrisnan Carlton VIC
Nicole Starbuck Altona Meadows VIC	Louise Mariarty Broken Hill NSW
Teresa Altamore Caulfield Junction VIC	Michael Farbingi South Yarra VIC
Jenna Nation Abbotsford VIC	John Marshall Abbortsford VIC
Eileen Rebecca Saunders Yarra Junction VIC	M Sakurai Brighton VIC
Matt Bell Brunswick NSW	Daniel Banfai Kew VIC
Tim Cummins Ascot Vale VIC	Emily Porter Camberwell VIC
Emily Henry Hawthorn East VIC	Laura Burnell St Kilda VIC
A Banerice Hampton Park VIC	Lisa Barr Rosanna VIC
Amy Brennan Ivanhoe VIC	Ayesha Moss Williamstown VIC
Matt Gale Brunswick NSW	Kate Cornicu Wonga Park VIC
Melissa O'Brien Croydon North VIC	Nick Pastalatzis West Sunshine VIC
Fiona Adams Richmond VIC	Carla Valmorbida Toorak VIC
Madeleine Legge North Cote VIC	Petra Nolan Parkville VIC

Patricia Culhane Flemington VIC	Adrian Pellar-Rice Carlton VIC
Mike Stewardson Northcote VIC	Rayan P Singh Greensborough VIC
Lars Yuencken Melbourne VIC	Susan Hooke Kew VIC
Michael Fonda Parkville VIC	Daniel McGee Parkville VIC
Sharon Simon Balaclava VIC	Cherie Eaton Fitzroy VIC
Tim Olson Strathmore VIC	Melissa Giles North Carlton VIC
Victor Wong Glen Waverley VIC	K Parton Kew VIC
Sophie Yates Rosanna VIC	Alice Boxhall Glen Iris VIC
Ewa Bogatek East Brighton VIC	Henry Hocking North Carlton VIC
Loretto Glen O'Brein Port Fairy VIC	Claire Hayes North Melbourne VIC
Christy Djivandono South Yarra VIC	Neil Ashton Sandoringham VIC
Zheng-Q Teoh Balwyn VIC	Yael Parkville VIC
Juliet Brown Clifton Hill VIC	Sophie Matthiesson Glen Iris VIC
K Throssell Warrandyte VIC	Lisa Travis Fitzroy VIC
Sara Lane Essendon VIC	Cesar El Jbeily Preston VIC
Sarah Welleths Clifton Hill VIC	Monica Raszewski Box Hill VIC

Jenneke Kylstra Alexandra VIC	Vanessa McKay St Kilda VIC
Kevin Foong Melbourne VIC	Matt McKnight Creswick VIC
Kristin Ponithia Hawthorn East VIC	P Schmitt South Melbourne VIC
Loretta O'Brien Melbourne VIC	Peter Jans Streaky Bay SA
J Klarich Southport QLD	F Allam Stawell VIC
Jim Green Sydney NSW	Jane Osborne VIC
Keith Terry Radiation-wise Shelley WA	Ben Aylen SA Nuclear Free Future Mt Barker SA
Helga Saunders Stawell Friends of the Earth Stawell VIC	Judy Blyth Medical Association for Prevention of War Subiaco WA
John Patterson Highbury SA	Amy Williams Victory Harbour SA
John Crowe Caulfield South VIC	Rosalind Byass Stawell VIC
Daniel Moss Wantirna VIC	Kelvin Matthews Broken Hill Council Broken Hill NSW
Lyn Genoni A/Director, Federal Constitutional and Territory Affairs Department of the Premier and Cabinet Perth WA	Bruce Thompson Friends of the Earth Melbourne VIC
P Goodsall General Manager Murrumbidgee Shire Council NSW	George Archbold Tamworth NSW

E Herscovitch Miller NSW	John Rolland ANSTO Sydney NSW
Dougherty Gavin Adelaide SA	Hon Ian Evans MP Minister for Environment and Heritage Government of South Australia Adelaide SA
Dr Garry Smith Environmental Science and Policy Unit Sutherland Shire Council Sydney NSW	Professor J White Australian Academy of Science Canberra ACT
A/Prof Frank Fisher Monash University Melbourne VIC	Roslyn Schumann State President Country Womens Association SA
Barbara Rouch (President) Louise Moriarty (Treasurer) Barrier and Darling Environment Group Broken Hill NSW	Dr David Denham President Australian Geoscience Council Inc. Canberra ACT
A Parkinson Canberra ACT	Tim O'Connor PANR member Sydney NSW
Dr Clarence Hardy ANA Sydney NSW	Stephen Altree-Williams Radiation Safety Officer Australian National University Canberra ACT
Jonathon Thwaites Radiation and Safety Officer University of WA Perth WA	James Courtney Nuclear Campaigner Greenpeace Australia Pacific Sydney NSW
M Mifsud People for Nuclear Disarmament Sydney NSW	Glen McPhee CSIRO Canberra ACT

Note: An additional 37 form letters from individuals were received that did not have name or address details. These submissions are not listed above but were included in the public submissions statistics and the issues raised have been taken into account in this response paper.

APPENDIX 2

SITE SELECTION THEMES

The site selection themes, while associated with safety, are essentially a planning tool for the Australian site selection study for the national store. The physical conditions of the final site and the facility design will be considered together to ensure public and environmental safety while also facilitating the safe long-term storage of the radioactive waste.

THEMES

GEOLOGY – VOLCANISM, RECENT VOLCANIC ROCKS

Source:
Geology dataset, 1:2,500,000 scale; AGSO, 1999.

Ranking:

1. Suitable:	Non-volcanic and extremely old volcanic rocks.
2. Intermediate:	Not used in this theme.
3. Unsuitable:	Recent volcanics (2 – 0 million years).

Rationale:
Given there are no active volcanoes on the Australian continent this theme will be used to help identify areas where volcanic activity has occurred in the recent past and thus areas of possible future activity. It should be noted that it is widely considered that there is a very low probability of the resumption of volcanic activity on mainland Australia.

REGOLITH — WEATHERED SURFACE MATERIAL

Source:
Regolith Terrain Map of Australia, 1:5,000,000 scale; BMR, 1986.

Ranking:

1. Suitable:	Erosional, low-moderate relief, weathered, fine-grained materials.
2. Intermediate:	Erosional/depositional, moderate-high relief, variably weathered, stony.
3. Unsuitable:	Erosional, mountains, minor weathering; or depositional, plains with water courses, flood plains, coastal plains, salt lakes, alluvial plains, swamps, dune fields; or bare rock.

Rationale:
Analysis of regolith or weathered surface material will be used to indicate whether the present landscape is erosional or depositional, and thus to infer whether a site may be subject to regional flooding.

EARTHQUAKE RISK

Source:
Geohazard Risk Contour Map, 1:1,000,000 scale; AGSO, 1998.

Ranking:

1. Suitable:	Low frequency; acceleration less than 0.05 metres per second squared.
2. Intermediate:	Intermediate frequency; acceleration greater than 0.05 metres per second squared and less than 0.10 metres per second squared.
3. Unsuitable:	High frequency; acceleration greater than 0.10 metres per second squared.

Rationale:
The earthquake risk theme will be used to identify areas where earthquake activity could result in damage to normal buildings and thus complex engineering would be required to develop a national store. The earthquake hazard maps represent the best estimates for maximum ground acceleration possible sometime in the next 500 years, with a ten per cent probability of this happening within 50 years.

FAULTS

Source:
The Geology of Australia – 1976, 1:2,500,000 scale, BMR 1976.

Ranking:

1. Suitable:	Greater than 2.5 km from a major fault.
2. Intermediate:	Not used in this theme.
3. Unsuitable:	Less than 2.5 km from a major fault.

Rationale:
This theme will be used to help identify areas close to major faults that should be avoided in order to ensure the integrity and simplify the design of the national store.

RELIEF AND LANDFORM

Source:
Relief and Landform Map of Australia; 1:5,000,000 scale, CSIRO, 1969.

Ranking:

1. Suitable:	Areas of low relief; or moderate relief dissected plateaus; or scattered linear dunes.
2. Intermediate:	Moderate relief; or high relief dissected plateaus.
3. Unsuitable:	High relief; or tidal zones; or densely spaced linear sand ridges.

Rationale:
This theme will be used to help define areas that maybe subject to flooding and landslides and thus require costly, complex engineering to ensure the integrity of the national store.

CREEKS/STREAMS/LAKES

Source:
Hydrography dataset, 1:2,500,000 scale, AUSLIG, 1987.

Ranking:

1. Suitable:	More than 2.5 km from water feature.
2. Intermediate:	Not used in this theme.
3. Unsuitable:	Less than 2.5 km from water feature.

Rationale:
The creeks, streams and lakes theme will be used to highlight areas close to major drainage systems that would require extensive earthworks to ensure the integrity of the storage facility.

CITIES AND TOWNS

Source:
1:2,500,000 scale Master Names File (1987), Census 96 figures, ABS and 1:250,000 scale Built-Up Areas, AUSLIG, 1999.

Ranking:

1. Suitable:	Greater than 1.5 km from the nearest existing permanent residence at the time of site selection.
2. Intermediate:	Not used in this theme.
3. Unsuitable:	Less than 1.5km from the nearest permanent residence at the time of site selection.

Rationale:
This theme addresses several overarching issues that need to be considered in the siting of a store, including 'operational considerations', 'environmental and social impacts', and 'security'. The theme will be used to help define areas with adequate existing infrastructure to support the operation of the store and sites that can be easily monitored to ensure security.

TRANSPORT ROUTES

Source:
Roads, 1:250,000 scale, AUSLIG, 1999.

Ranking:

1. Suitable:	Less than 25 km from an all-weather road.
2. Intermediate:	Between 25 and 100 km from an all-weather road.
3. Unsuitable:	Greater than 100 km from an all-weather road.

Rationale:
This theme addresses several issues that need to be considered when selecting a site for the national store, including 'security' and 'operational considerations'. The theme will be used to help define areas that have transport infrastructures that will simplify store operations.

HERITAGE

Source:

National Estate Registered Areas, 1:100,000 and 1:250,000 scale, AUSLIG, for the Australian Heritage Commission, 1999.

Ranking:

1. Suitable:	Greater than 1.5 km from a registered area.
2. Intermediate:	Not used in this theme.
3. Unsuitable:	Less than 1.5 km from a registered area.

Rationale:

This theme will be used to help identify areas of special environmental, cultural or historical significance that should be avoided when selecting a site for the national store.

LOCATION OF RARE OR THREATENED PLANTS

Source:

Rare or Threatened Australian Plants, scale unknown but derived from point data, ERIN, 1992.

Ranking:

1. Suitable:	No rare or threatened plants.
2. Intermediate:	Not used in this theme.
3. Unsuitable:	Known rare or threatened plants.

Rationale:

This theme will be used to help identify areas that contain rare or threatened plants.

LANDUSE

Source:

1996/97 Landuse of Australia, version 2 dataset, 1:1,000,000 scale; NLWRA 2001.

Ranking:

1. Suitable:	Other.
2. Intermediate:	Not used in this theme.
3. Unsuitable:	Urban, water bodies, national parks.

Rationale:

This theme will be used to help define areas with current, adjacent and likely future land use that is not compatible with the national store.

APPENDIX 3

GLOSSARY

Conditioning

The processes that are carried out to change the characteristics of the waste so as to produce a safe and convenient waste package for handling, transport, storage or disposal. The process of producing a solid waste form may involve a matrix material such as concrete or glass, incineration or compaction to minimise the waste volume.

Cyclotron

A machine used to accelerate charged atomic particles to high energies by the application of electromagnetic forces. These particles can be used to bombard suitable target materials to produce certain types of radioisotopes.

Disposal

Placement of radioactive waste in a purpose-built facility in a manner such that there is no intention of retrieval and no need for any further actions to ensure future safety.

Geographic information system (GIS)

A computer-based suite of software and hardware used to organise and manage spatial information.

Geological repository for intermediate level radioactive waste

An engineered facility underground facility at depth for the disposal of intermediate level radioactive waste. Disposal at depths of typically several hundred metres is an internationally accepted method of geological disposal.

High level radioactive waste

Waste containing high levels of beta and gamma radiation emitters and significant levels of alpha emitters, and generating significant amounts of heat (>2 kW/m^3). Such waste requires careful handling, substantial shielding, provision for dissipation of heat generated by the decay of radionuclides, and long-term immobilisation and isolation from the biosphere. No high level radioactive waste is generated in Australia. This category of waste corresponds to the high level radioactive waste as defined in the IAEA Safety Guide, number 111-G-1.1, 1994.

International Atomic Energy Agency (IAEA)

The IAEA, an autonomous intergovernmental organisation founded in 1957 in accordance with a decision of the General Assembly of the United Nations. Its statutory mandate is to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world and to ensure, so far as it is able, that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purpose. Its activities include, issuing safety standards for the management and disposal of radioactive waste, application of safety standards through advisory services, assistance missions on request of member states, and the coordination of research and development and special projects that have regional or global interest.

Institutional control period

The institutional control period is the length of time following the closure of a facility for which land use restrictions are applied.

Intermediate level radioactive waste

Waste that contains significant levels of beta and gamma and possibly alpha emitting radionuclides. Intermediate level radioactive waste is not suitable for near-surface disposal. Australian intermediate level radioactive waste consists of historical waste from mineral sands processing, disused sealed sources and industrial gauges, reactor components, irradiated fuel cladding, and waste from the processing of spent fuel and ion-exchange resins and filters (for example, as a result of reactor operation). This waste sometimes requires shielding during handling and transport. This category of waste corresponds to the long-lived low and intermediate level radioactive waste as defined in the IAEA Safety Guide, number 111-G-1.1, 1994, and Category S waste in the NHMRC Radiation Health Series, number 35, 1992 (*Code of Practice for Near-surface Disposal of Radioactive Waste in Australia*).

Isotope

Atoms of an element having the same number of protons but different numbers of neutrons in the nuclei. Different isotopes of the same element have the same chemical properties but different physical properties. There are several hundred naturally occurring isotopes.

Low level radioactive waste

Waste containing short-lived beta and gamma emitting radionuclides and normally very low levels of alpha emitting radionuclides. Low level radioactive waste is waste that is suitable for disposal in the national repository. Shielding is not normally required for handling and transport. It includes items such as wrapping material and discarded protective clothing and laboratory plant and equipment. Disposal in near-surface structures is commonly practised overseas. In some cases, the level of radioactivity is below the limit that regulations set as radioactive material. This category of waste corresponds to Categories A, B and C waste in the NHMRC Radiation Health Series, number 35, 1992 (*Code of Practice for Near-surface Disposal of Radioactive Waste in Australia*) and, broadly, to short-lived low and intermediate level radioactive waste as defined in the IAEA Safety Guide, number 111-G-1.1, 1994.).

Monitoring

The methodology and practice of measuring levels of radioactivity and radiation.

National repository

An engineered near-surface underground facility for the disposal of Australia's low level radioactive waste.

National Store

A purpose-built above-ground store for the safe storage of Australia's intermediate level radioactive waste. The store will be designed to operate for a period of up to at least 50 years until a national geological repository or alternative disposal facility has been established.

Neutron

An uncharged particle with a mass slightly greater than a proton, found in the nucleus of every atom except ordinary hydrogen.

National Health and Medical Research Council (NHMRC)

The principal function of the NHMRC is to advise the Australian community on matters relating to the achievement and maintenance of high standards of individual and public health through appropriate legislation, administration and practices, and to encourage health and medical research to achieve those standards.

Proton

An elementary particle with a single positive electric charge and a mass approximately 1,837 times that of the electron. Also, the nucleus of an ordinary or light hydrogen atom. Protons are constituents of all nuclei.

Radioactive waste

Materials that contain radioactive substances at concentrations above exempt levels and for which no further use is envisaged.

Radioactive waste management

All activities, administrative and operational, that are involved in the handling, treatment, conditioning, transportation, storage and disposal of radioactive waste.

Radioisotope

See "isotope" and "radionuclide".

Radionuclide

Species of unstable atoms with characteristic atomic numbers and masses and which are prone to breakdown and radioactive decay.

Radiopharmaceuticals

Pharmaceutical compounds containing a radionuclide.

Reprocessing

The process of removing uranium and plutonium from spent fuel so that it can be reused and the disposal of the wastes facilitated.

Retrieval

Includes the recovery of waste packages from storage either for inspection purposes or for subsequent disposal.

Spent fuel

Irradiated fuel not intended for further reactor service but which still contains useful material.

Storage

The emplacement of waste in a facility with the intent and in such a manner that it can be retrieved and disposed of at a later time. The intention of storage is to isolate the radioactive waste, provide environmental protection and facilitate control.

ABBREVIATIONS

AINSE	Australian Institute of Nuclear Science and Engineering
ANSTO	Australian Nuclear Science and Technology Organisation
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
COGEMA	Compagnie Générale des Matières Nucléaires
CSIRO	Commonwealth Scientific and Industrial Research Organisation
EIS	Environmental Impact Statement
EMA	Emergency Management Australia
EPBC Act	*Environment Protection and Biodiversity Conservation Act* 1999
ESD	ecologically sustainable development
GIS	geographic information system
HIFAR	High Flux Australian Reactor
IAEA	International Atomic Energy Agency
NHMRC	National Health and Medical Research Council
NSAC	National Store Advisory Committee
PER	public environment report
RRR	replacement research reactor
WIPP	Waste Isolation Pilot Plant