PARLIAMENT OF NEW SOUTH WALES

Joint Select Committee on the Transportation and Storage of Nuclear Waste

INQUIRY INTO THE TRANSPORTATION AND STORAGE OF NUCLEAR WASTE

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Terms of Reference

A Joint Select Committee has been appointed to consider and report upon proposals by the Commonwealth Government to transport nuclear waste through and potentially store nuclear waste within New South Wales, with specific reference to the following matters:

(a) logistical arrangements associated with the proposals, including sourcing, transport and storage of waste;

(b) health and safety risks associated with the transportation and storage of nuclear waste in New South Wales;

(c) extent of possible resource implications associated with the transportation and storage of nuclear waste within New South Wales; and

(d) any other relevant matter.

Chair's Foreword

This inquiry provided a forum for the community to have its say on proposals to deal with nuclear waste. The committee appreciates the efforts of all those who made submissions and would like to make particular reference to the efforts of the local government sector in articulating the concerns of its communities.

In addition to this important consultative function, the committee had two expectations for its report.

The first was to provide information on the proposals by the Federal Government to store and transport radioactive waste. The committee has also included general background information on radioactivity and radioactive waste management that it hopes will assist in better informing the public. This has been presented, hopefully, in as simple and understandable a way as possible.

The second was to assess these proposals and develop appropriate recommendations. The committee approached this task unashamedly as well-intentioned amateurs. At no time did the committee expect to produce a highly technical report that would somehow find a miracle solution to the problem of radioactive waste that would satisfy one and all.

Rather the committee took a broad policy approach to the issues. The resulting recommendations provide a long-term policy framework to manage radioactive waste in the best interests of all the community.

The committee was often confronted with contradictory, polarised views. In evaluating all the varying points of view, the committee has "let the evidence speak", by presenting in considerable detail the arguments and views in the words of the witnesses or the details of the submissions.

In the end, the best way forward – as reflected in the major recommendations - was really self-evident. This is indicated by the general consensus and unanimity amongst committee members with these recommendations. Furthermore, the recommendations were in accord with many of the suggestions put to the committee in submissions and articulated in the evidence taken.

In conclusion I would like to thank committee members for their efforts and their co-operative approach and the staff – Ian Thackeray, Natasa Tosic and Kylie Rudd – for their assistance and hard work.

Peter Primrose MLC
Chair

Executive Summary

We are all subject to ionising radiation both from the earth and space and this natural (or background) ionising radiation can be harmful.

Similarly, artificial ionising radiation - the product of various operations of nuclear technology – can affect human health and the environment.

Natural radiation makes up approximately 80 percent and artificial radiation approximately 20 percent of the ionising radiation received.

The measurement of the impact of ionising radiation on living matter is the "dose" and its unit is the sievert. Doses levels are usually described in millisieverts (that is one thousandth of a sievert).

There is general agreement that high level doses (greater than about 500 millisievert) can have serious health consequences. However there is considerable controversy about the impact of ionising radiation at low levels (less than say 10 millisieverts).

Currently the internationally accepted dose standards from artificial radiation is 1 millisievert per annum for the general public and 20 millisieverts for workers in the industry.

Radioactive waste is the biggest problem facing the nuclear industry. Since the industry's inception, waste has continued to stockpile without satisfactory solutions being found.

Radioactive waste by its nature produces ionising radiation and is therefore a potential health problem. In order to ensure protection from it effects, a complex regulatory regime has evolved. An important feature of this regime is the classification of waste, into three categories:

- Low level (and short-lived intermediate) waste
- Long-lived intermediate level waste
- High level waste

Management of the waste varies according to the classification. Of significance here is that shielding or other protection for transport and storage methods will reflect the particular waste classification. The committee found that these classifications were not helpful for the general public in understanding the hazard levels involved. It recommended that an Australian classification system incorporate dose ranges so that the public has a much clearer idea of any potential hazard from the material.

Most of the waste in Australia is produced by ANSTO at Lucas Heights and this is where most of the waste is currently stored. A much smaller amount is stored in "dispersed" locations, such as hospitals, universities and industry.

ANSTO, in line with International Atomic Energy Commission definitions, does not regard spent fuel as waste. The NSW Department of Conservation and Environment, on technical grounds, regards the material as waste and in "everyday" terms this material can only be

regarded as waste. ANSTO should acknowledge it as such. While this is a somewhat semantic point – the important issue is that this highly hazardous material is managed with considerable care - ANSTO's determination to avoid the term "waste" can only continue the mistrust that exists between it and the public.

Radioactive waste is regulated by both state and federal governments and the committee was advised that there is uncertainty about the constitutional power relating to nuclear technology.

The Proposals

In order to manage the existing stockpile and future waste, the Federal Government is proposing to build two new radioactive waste storage facilities.

The **repository** in South Australia, near Woomera, will collect low level waste and short lived intermediate waste (half life less than 30 years) for 50 years. It will then be closed (subject to a review at that time) and the site will be "controlled" for a further 200 years by which time the waste will have decayed to background levels.

At the commencement of its operations, an initial transport campaign (to shift the backlog of existing waste) of over 170 trucks will move low level and short-lived intermediate level waste to the Repository. (The road option was identified by the EIS as the best). Most of this backlog (some 130 truck loads) is located in Sydney, at ANSTO, over 1,500 km from the repository. This initial transfer will be followed by intermittent smaller transport movements when enough waste has accumulated to justify the transportation, estimated to be four or five truck loads every two to five years.

The federal regulator, ARPANSA, is currently considering an application from the Department of Education Science and Training for a licence to operate the repository.

The **Store** will hold, on a temporary basis of 50 years, long-lived intermediate level waste until a permanent (deep geological) repository can be developed.

The site for the store has not been identified although the Federal Government has ruled out South Australia. The Federal Government is currently considering a short list of eight sites but will not make the list public.

It was suggested that New South Wales is a likely target with Jervis Bay being a particularly likely location.

As this proposal is not as well advanced as the repository, there are no formal transport plans to consider. However, the core issues would be similar to the repository proposals.

There has been considerable public concern raised about these Federal Government proposals both in New South Wales, particularly about the transport aspects, and other states. South Australia and Western Australia have passed, or are passing, legislation opposing the siting of waste facilities in their states.

The New South Wales Government should clearly indicate its opposition to the siting of any new storage facility in New South Wales by amending the Uranium Mining and Nuclear Facilities (Prohibition) Act accordingly. This would be a clear statement of principle in line with action taken by Western Australia and South Australia on behalf of their residents.

Public Consultation

The most dominant theme before the Committee, both in submissions and evidence, was the failure to consult and provide information about the proposals. Not all the complaints rejected the proposal outright but wanted to be effectively consulted and reliably informed. Local councils and their peak organisations were particularly disturbed by this lack of consultation.

The social and psychological aspects of nuclear energy and radioactive waste make it a unique issue for many people. Governments and the nuclear industry overseas are beginning to realise this and develop consultation process commensurate with the community concern. (The IAEA says that "gaining the trust of the public appears to be a very important element in successfully progressing in the repository siting process").

Finland and Sweden are two countries that have achieved site selection on the basis of community consent, through a process of public participation and involvement going-well beyond the traditional report and respond approach.

This realisation has not trickled through to Australia.

Consultation is much more than seeking submissions to an EIS on a site already selected or holding a single meeting in a town along a transport route. A good example of the failure of the Federal Government to follow a consultative, transparent approach is the current site selection process for the Store. It refuses to make public the final short list of sites. This secretive approach is but a continuation of the discredited, antagonistic policy of Decide Announce and Defend, where sites appear to the public to be plucked out of the air and imposed on communities.

The Committee is of the view that the storage and transport of radioactive material is so problematic with the general public that it requires sophisticated consultation processes. These have been lacking to date.

The Need for the New Waste Facilities

ANSTO's operations at Lucas Heights are the largest generators of radioactive waste in Australia, producing almost 90 per cent of the radioactive waste. It will be the main contributor of waste to these two new waste facilities.

The rationale for the two depositories is to strengthen radioactive waste management in Australia by rationalising and centralising the unsafe dispersed (non-ANSTO) storage locations across the country (estimated to be in excess of 100) and providing safe containment until the material decays to background levels. Two national sites are preferred on the grounds that the small volumes generated in Australia do not justify separate state facilities.

However, under these proposals, both Lucas Heights and the operational non-ANSTO ("unsafe") sites will continue to be waste facilities as they accumulate waste on a two to five year cycle. This neither reduces nor rationalises the number of operating waste facilities. Rather the proposals actually increase the number of operating facilities by two – the Store and the Repository. This rationalisation is then a curious argument.

It is hard to see how the proposal to move waste to remote areas away from the point of production will increase safety as the transportation of the material actually increases the risk from accident or intervention.

According to the Federal Government, the small volumes generated do not justify separate state facilities but neither can they justify creating two new facilities for ANSTO's waste, at least one of which is in a very remote location.

ANSTO has repeatedly assured the Committee that the storage of the material at Lucas Heights is safe (indeed international best practice) and the Government's own radiation protection regulator has advised that there is capacity to store existing and future waste there (a point confirmed by ANSTO).

The Australian community benefits from the products produced by ANSTO's reactor. But it is hard to see how this justifies imposing the facilities on unwilling communities chosen virtually at random. Furthermore, it is arguable that alternative technologies and strategies can produce these radioisotopes.

The Committee, therefore, cannot support these storage proposals. For the time being, Lucas Heights should continue to be the major national waste facility until a more acceptable resolution of the waste problem is developed.

In this interim it is essential to ensure that the waste facilities at Lucas Heights operate to the highest standards to guarantee the health and safety of the community. But it is just as vital that Lucas Heights does not become a de facto or permanent facility for the storage of nuclear waste.

The Federal Government should as a matter of urgency recommence the site selection process for a waste facility in a genuinely consultative way, in line with more contemporary and democratic approaches being utilised overseas (and outlined in this report) that are based on community acceptance criteria.

The committee does agree with the Federal Government and the NSW EPA that an audit of the dispersed facilities needs to be carried out. The committee believes this should be carried out urgently and upgrading carried out where required.

New Reactor

A new reactor and associated operations will continue to generate radioactive wastes at all levels, exacerbating the existing waste problem.

The committee heard very credible evidence, some from medical professionals, that Australia no longer needs a reactor and that the best way to deal with future waste is by not producing it.

It was argued that NSW (and Australia) could provide all its radionuclides by a combination of importing nuclear-sourced radioisotopes and producing non-reactor radioisotopes from alternative sources here in Australia.

ANSTO and others argued that there were many uses, other than medical, for the radioisotopes and that alternative technologies could not realistically replace the reactor.

There are, however, countries without reactors that are able to utilise nuclear technology to provide a range of community needs to a high standard.

The option of sourcing radioisotopes from overseas offers some advantage in that the material is being sourced from existing operations, such as Canada. Utilising these existing export markets will reduce duplication in reactor operations and could well provide some economic advantage. The disadvantage of this approach – that it will also contribute to the production of radioactive waste at the point of production - needs to be acknowledged, however.

This option and the current changeover from HIFAR to the RRR (for which an operating licence has not yet been issued) provides the opportunity to take a renewed look at the potential for alternative technologies. Such technologies have the potential to be a lucrative business opportunity, possibly for NSW.

The McKinnon Report concluded that, in 1993, the "jury was still out" on non-reactor sources for radioisotopes and that a better informed and supported decision would only be possible in the future.

Clearly, the benefits of the reactor decrease and the disadvantages increase as more alternatives become available. The evidence on this issue was so compelling that it justifies further investigation and careful consideration.

The Committee recommends that, in conjunction with a new site selection process, the Federal Government should investigate the viability and practicality of alternative technologies for radioisotope production in Australia.

During this time, the operating licence for the Replacement Research Reactor should be deferred and the Federal Government inquire into the need for and possible uses of the RRR. The HIFAR would continue to operate in its place.

Transport

There is no doubt that the transportation of radioactive waste increases the risk of accident or incident (including some form of terrorist intervention).

By continuing the storage of waste at Lucas Heights on an interim basis, there is no need to transport most of the waste and any risks associated with that transport are avoided.

However, should the transport proposals proceed (due to the Federal Government rejecting the committee's findings), the transport implications of the proposals will need to be addressed. Local councils and their representative organisations (the Local Government and the Shires Associations) provided considerable material to the committee regarding the possible impacts of the Federal Government's transport plans along the proposed routes.

The management of the transport of radioactive waste is regulated by legislation and various Codes. This regulatory regime aims to package, shield and transport the waste under the appropriate conditions for the activity and hazard to ensure safety.

There is clearly a need for ANSTO and ARPANSA to provide the public with better information on the activity of the waste to be transported. ANSTO's database of its low level radioactive waste should be used to provide the effective dose rates (in sieverts/hour) for the waste and its packaging for public information. This would be of much more use to the public than the current waste definitions.

The inventory of waste proposed for transport to the Repository includes some long-lived intermediate level waste. This does not appear to comply with the definition of the repository for low level and shorted lived (30 year half life) intermediate waste. ARPANSA, in finalising the waste acceptance criteria, should ensure that no long-lived intermediate level waste is accepted in the Repository.

Proponents of the proposals claimed that the radioactive waste was not as dangerous as other hazards, such as petrol. The committee rejects these arguments. The community accepts these goods and associated risk because of a justifiable, demonstrable benefit. Generally this is not the case with radioactive waste.

In addition to general uncertainty mentioned above, there were specific concerns about the risk of accident and the consequences of such an accident. Much of this centred around the choice of road over rail as the transport mode.

The increased risk of a road accident would endanger public health through a spill or even a release of radioactive material, it was argued. In particular the route over the Blue Mountains was identified as a "black spot" for truck accidents.

Another consequence of a road accident was the implication for local economies such as the effects on tourism (the Blue Mountains is a World Heritage Area) and on "clean and green" agricultural products. Even if there were no spill or release in an accident, the concern the general public has regarding nuclear matters could have adverse economic impacts.

The proponents of the proposals claimed the risk of accident was small but, even in the event of an accident, the conditioning and packaging would ensure the material did not escape. In the unlikely event that the packaging was breached, the nature of the material meant that with appropriate instruments the waste could be simply located and retrieved.

The Fire Brigade Union contradicted this view stating that everything burns under the right conditions and that an accident, particularly with a fuel tanker, could generate enough heat to burn concrete and steel containers and vaporise the waste. This would transform the waste into a form in which it presents the greatest risk to human health.

This scenario in the committee's view, is unlikely, although the consequences of such an event would be extreme. On the evidence available to it, the committee agrees with the views of both the Environment Protection Agency and State Emergency Management Committee/Fire Brigade that the transport proposals for low level waste can be safely managed.

However, both the EPA and SEMC have indicated that these proposals need further risk assessment. The Committee supports this, stressing again, however, that no matter how low the risk, these transport proposals represent an unnecessary risk.

The assessment should be carried out, in consultation with the Commonwealth, by state agencies including Police, NSW Fire Brigades, NSW Health, and the Department of Environment and Conservation and should include consideration of the risk of potential terrorist activities.

As most of the burden of costs are likely to be emergency services related, all of which are state functions, there are potentially significant cost implications for New South Wales in the proposals. New South Wales agencies, again in consultation with the Commonwealth, should detail and cost the emergency services requirements to best manage the transport proposals.

It is important that local government peak representative bodies and any directly affected local council be consulted in both these processes.

This agreement should be based on the principle that the Federal Government bears the full costs incurred by the community (including local councils) of any transport and storage proposals.

The committee supports the recommendation of the EPA that there should be a formal agreement between the State and the Commonwealth to cover these transport proposals.

Regardless of the transport proposal adopted, it should be the subject of independent review (by the IAEA's Transport Safety Appraisal Service), as recommended by the Environment Protection Agency.

The committee was told that insurance was not available for the transport of radioactive waste. It is unreasonable for individuals to carry any such costs or be forced to the courts for compensation. The Federal Government should indemnify the community against accidents with radioactive waste.

The new reactor as with HIFAR will continue to produce the most radioactive of materials – spent fuel. This material is enormously more radioactive than other waste material and is stored on the reactor site for some years until it cools and initially decays. Currently the spent fuel is sent overseas to be reprocessed after which the reprocessed intermediate level waste is returned. This material is earmarked for the Store.

Doubts were expressed about the long terms viability of these overseas reprocessing options. Should the options disappear, Australia will have to manage its own spent fuel stock. One option is to place it temporarily in the Store awaiting new reprocessing arrangements. Under

this proposal this high level waste would be transported twice, to the Store and back. In addition to the community concerns that are likely to be generated, the increased worry about terrorist intervention make this proposal very unsatisfactory. Should these circumstances ever arise it would be much more acceptable to keep the material at Lucas Heights and avoid unnecessary travel and handling.

List of Recommendations

RECOMMENDATION 1: The current Federal Government proposals for the Repository and the Store cannot be justified and should be abandoned. (p100)

RECOMMENDATION 2: The current transport proposals to the Repository (and the Store) should, therefore, also be abandoned. (p100)

RECOMMENDATION 3: In the interim, Lucas Heights should continue to act as a waste facility, subject to a public inquiry into the storage facilities on site to identify operating conditions which will ensure world's best practice. (p100)

RECOMMENDATION 4: Consequently, during the interim period of storage at Lucas Heights (100-1):

a. a new site selection process based on contemporary overseas models should be undertaken as a priority, incorporating community acceptance criteria.

b. a public inquiry should be instigated by the Federal Government to consider the viability and practicality of alternative technologies and sources for radioisotope provision in Australia. Issues for consideration would include:

   i. whether or not medical and industrial isotopes can be produced from alternative sources and whether this can be achieved before the current facility has expired;

   ii. the economic and industry impact of importing medical isotopes; and

   iii. whether or not it is necessary for research funding to be allocated to the development of alternative sources for radiopharmaceutical production.

c. the operating licence for the Replacement Research Reactor (RRR) should be deferred. An inquiry should be undertaken by the Federal Government into the need for and possible uses of the RRR. Issues for consideration would include:

   i. a review of the licensing processes and conditions applied to the reactor;

   ii. security issues relating to the reactor site;

   iii. the impact on jobs and Australian nuclear research of not proceeding with the replacement reactor;

   iv. whether an effective solution to the problem of the final management of nuclear waste has been identified;

   v. emergency management and response implications of the new facility; and

   vi. whether there has been adequate consultation with the community, local government and the NSW Government.

RECOMMENDATION 5: The Federal Government should accept liability for radioactive waste and indemnify state and local government, and the public against the impacts of any radioactive waste incidents. (p141)

RECOMMENDATION 6: The NSW Department of Environment and Conservation should complete the inventory of non-ANSTO storage sites as a matter of urgency identifying, in particular, those sites where upgrading of facilities is required. (p101)

RECOMMENDATION 7: The NSW Department of Environment and Conservation should liaise with the Sydney Water Corporation to ensure a proper risk assessment be carried out at the Cronulla Sewerage Outfall. In addition to emission levels in the ocean, reporting should cover environmental, human health and biophysical impacts, similar to that carried out at other Sydney Water facilities. (p78)

RECOMMENDATION 8: The Minister for Utilities should direct the Sydney Water Corporation to provide a copy of the ANSTO Trade Waste Agreement to Sutherland Shire Council. (p77)

RECOMMENDATION 9: ANSTO should acknowledge that spent fuel is waste, and in dealing with the Australian public, should identify it as waste. (p34)

RECOMMENDATION 10: ARPANSA should supplement the current Australian (NHMRC Code) waste classifications, Categories A, B, and C, with an equivalent range of effective dose rates (sieverts/hr) for each classification. (p111)

RECOMMENDATION 11: ARPANSA should develop a quantitative definition for Category S waste (NHMRC Code), to include effective dose rates thus doing away with the current "definition by exclusion". (p111)

RECOMMENDATION 12: ARPANSA should liaise with ANSTO and DEC to identify and properly secure any intermediate level waste considered suitable for use in "dirty bombs". (p132)

RECOMMENDATION 13: The New South Wales Government should formally forward a copy of this report to ARPANSA. (p141)

RECOMMENDATION 14: That the federal government identify any proposed road transport routes through Sydney. (p105)

RECOMMENDATION 15: ARPANSA should set waste acceptance criteria for any near-surface burial repository to exclude all long-lived intermediate level waste. (p70)

RECOMMENDATION 16: ARPANSA should require ANSTO to provide effective dose rate (sievert/hour) information for all waste containers. The dose rate will be provided for waste before conditioning as well as being measured on the outside of the container. (p111)

RECOMMENDATION 17: Risk assessments should be carried by New South Wales Agencies (including Police, NSW Fire Brigades, NSW Health, and the Department of Environment and Conservation), in consultation with the Commonwealth for any transport proposals. This assessment should include consideration of the risk of potential terrorist activities. (p140)

RECOMMENDATION 18: NSW Agencies including Police, NSW Fire Brigades, NSW Health, and the Department of Environment and Conservation should, in consultation with the Commonwealth, detail and cost the emergency services requirements to best manage any transport proposals. (p140)

RECOMMENDATION 19: A formal agreement should be negotiated between the NSW Government and the Federal Government on any proposals to store and transport radioactive waste in New South Wales, based on the above risk assessments. This agreement would include:

- The Commonwealth to arrange an assessment of the transport proposals by the IAEA's Transport Safety Appraisal Service,
  - This assessment should consider all possible modes of transport, including sea, depending on the site location being assessed;
- Clearly defined roles and responsibilities (clarify jurisdictional uncertainties);
- Tracking of waste material;
- Emergency services requirements (resourcing, training, responses);
- Risk minimisation;
- Prevention of accidents;
- No liquid wastes to be transported;
- Community acceptance criteria; and
- Independent monitoring by NSW to certify or ensure that the relevant codes are adhered to (pp140,1).

RECOMMENDATION 20: Any agreement be based on the principle that the Federal Government bear the full costs incurred by the community (including local councils) of any transport and storage proposals. (p141)

RECOMMENDATION 21: The NSW State Government should obtain legal advise on the Federal Government's constitutional power relating to nuclear technology. (p45)

RECOMMENDATION 22: In the event the Federal Government fails to adopt the committee's recommendations 1 to 4:

The NSW Government should amend the Uranium Mining and Nuclear Waste Facilities (Prohibition) Act to prohibit:

- the construction and operation of nuclear waste facilities in New South Wales (with the exception of an interim waste facility at Lucas Heights), and
- the transportation of reactor sourced radioactive waste (with the exception of stocks of existing spent fuel). (p101)

Chapter One - Introduction

BACKGROUND TO THE INQUIRY

1.1 In February 2003, in the lead up to the New South Wales state election, the Premier announced that, if re-elected, the Government would set up a parliamentary inquiry to look into the federal government's plans for transporting and storing of nuclear waste in New South Wales. The Government was responding to wide-ranging concerns in New South Wales about the plans.

1.2 The Premier stated that New South Wales already carried the burden of Australia's nuclear waste due to the presence of the nuclear reactor at Lucas Heights. He also said that residents of the state had a right to know if the federal government planned to locate a waste storage facility in New South Wales but the lack of information provided by the commonwealth surrounding the proposals denied them this right.

1.3 The Ministers for the Environment and Emergency Services (Ministers Debus and Kelly respectively) reiterated these points in May, declaring that the federal government had "ignored community concerns" about the siting of the proposed waste facilities and had failed to "consult with NSW communities who will be affected most seriously by these proposals".

1.4 The Select Committee on the Storage and Transportation of Nuclear Waste was formally constituted on 22 May 2003.

CONDUCT OF THE INQUIRY

1.5 The Committee sought submissions to the Inquiry through advertising in the press, including Sydney metropolitan and country NSW papers.

1.6 The Committee received over 500 responses, most of which strongly opposed the proposals. Approximately half of the responses were "form letters". In the view of the Committee this does not undermine the credibility of this responses. Many people find it difficult to make detailed contributions to formal proceedings such a parliamentary committee. The fact that over 200 people were prepared to sign (often adding additional comments) and forward the material is, in the view of the Committee, an indication of their concern.

1.7 Many submissions were, on the other hand, lengthy detailed documents both supporting and opposing the proposals. These submissions highlighted the complexity of the issues and the difficulty of the task confronting the Committee.

1.8 The committee held public hearings over five days in various locations around New South Wales.

1.9 The material gathered from submissions and in hearings was supplemented by the committee's own research.

1.10 Some issues raised during the inquiry fell outside the terms of reference, for example, reactor accidents at Lucas Heights. Accordingly, the committee did not report on them. On the other hand, not all matters raised that fell within the terms of reference were able to be addressed in the time available. The Committee prioritised the matters before it, focusing on what it saw as the main issues.

THE REPORT

1.11 As well as looking at two "formal" proposals for waste depositories the federal government has underway – the Repository and the Store – the committee also considered sources of radioactive waste, as provided for in the terms of reference. The committee has, therefore, commented on role of new Replacement Research Reactor as a generator of radioactive waste.

1.12 The committee has not considered very low level waste (classified as "exempt") nor waste from mining operations in this Inquiry.

1.13 In the course of the Inquiry, the committee was often confronted with diametrically opposed "expert opinions" and polarised positions.

1.14 There was no expectation that this inquiry would unearth a single, technical solution to the matters at hand. Rather the committee approached the report as group of non-experts trying to get a layperson's understanding of the issues and problems inherent in the management of nuclear waste.

1.15 Where necessary, when clear solutions were not achievable, issues that would benefit from further investigation have been identified.

1.16 A key element of the report has been to provide background information for the community not just on the proposals but on radiation and health. Based on the committee's own experience it has to be said that the nuclear industry does not seem to appreciate just how difficult it is for the general public to understand the material it produces.

1.17 In some ways the Committee has followed in the footsteps of other inquiries, in particular, the Report of the Research Reactor Review 1993 (known as the McKinnon Report) and the Report of the Senate Select Committee on the Dangers of Radioactive Waste, 1996. The committee's findings often echoed these reports

1.18 A complicating factor in this inquiry is that this committee, a committee of the New South Wales State Parliament, is making recommendations relating to the activities of the federal parliament. In the Australian federal system the states have little or no power over the government. Regardless the committee has endeavoured to come up with what it thinks are the most appropriate recommendations.

1.19 Proponents of reactor based nuclear technology seem baffled by the public concern about their activities. They see the issue as simply a risk based assessment. However, the issues under consideration here are, contrary to the premises of some of the material put before the committee, not simply a matter of rational, technical and scientific precision.

1.20 As Dr Holland told the Committee

> **Dr HOLLAND:** ...I think the issues for this Committee ...are largely... social, cultural, risk issues, they are legal and they are economic much more than some parties claim they are scientific and technological...This Committee should be focussed on the social, economic and policy issues.... I am not saying that the risks are not real or significant. I am saying that the risks need to be understood socially and culturally, ...[particularly] in

> an area as technologically and scientifically uncertain and pioneering as all nuclear matters.[1]

1.21 The relationship between nuclear science and technology and human society is complex. Some of these issues reside not in textbooks but in the human psyche and social attitudes. There is nothing wrong with this nor is it irrational. But the issue is much more than simply a risk assessment.

1.22 In this regard it is worth remembering Einstein's comment on hearing of the dropping of the atomic bomb on Hiroshima:

> "If I knew they were going to do this, I would have become a shoemaker instead of a physicist".[2]

1.23 In the next chapter the Committee provides background information on radiation and radioactive waste.

[1] Transcript of Evidence, 19 September 2003 p79
[2] Arianrhod R, Einstein's Heroes, UQP, 2003, p136

Chapter Two - Radiation and Radioactive Waste

RADIOACTIVITY

2.1 Radiation is a fact of everyday life. There are many forms of it in our environment, including light, ultraviolet, soundwaves, microwaves, radiowaves and ionising radiation.

2.2 Many naturally occurring elements are radioactive. That is, they are unstable and continue to lose energy (or decay) until they eventually form a stable element. When radioactive atoms decay they release their extra energy in the form of ionising radiation.

2.3 Isotopes are different forms of the one element. Each isotope has the same number of protons in the nuclei but a different number of neutrons. Thus Uranium 235 and Uranium 238 are isotopes of the uranium element. As a radioactive isotope (also known as a radioisotope or radionuclide) decays it can change into another isotope. This new isotope can be a different element which itself might still be radioactive. This in turn will decay, the process continuing until a stable element is formed. This process is called the decay chain. In the Radium-226 decay chain, for example, nine successive and different radioactive elements are created until the chain ends with the formation of the stable nuclide lead-206.[3] Radioactive decay has been ongoing since the formation of the planet.

2.4 Radioactivity decreases over time as isotopes decay into non-radioactive ones. The rate of decay (or disintegration) of radioisotopes is measured in half-lives, which is the time it takes for half the atoms of a radioisotope to decay. Each radioisotope has a characteristic half-life.

2.5 Half-lives of the various isotopes vary enormously, ranging from a fraction of a second to billions of years. For example, Iodine-131 (an isotope used in medical applications) has a half-life of eight days; Cesium-137 (an isotope found in spent fuel) 30 years; and Carbon-14 (the isotope used in carbon dating) has a half-life of 7,370 years. Plutonium-239, which is found in spent fuel, has a half-life of 24,400 years, uranium-235 710,000 years, while the half-life of uranium-238 is 4.5 billion years.

2.6 "The rate of decay of an isotope is inversely proportional to its half-life"[4], so the more active an isotope, the shorter is its half-life as it decays more rapidly to a stable state. As a rule, the longer the half-life the more stable the nuclide. As an ANSTO representative explained to the Committee at hearings:

> **Mr McINTOSH:** Uranium is present in the earth's crust and it was there when the earth was created. The reason it is still there is that it has an exceedingly long half-life. One consequence of an exceedingly long half-life is that it decays very slowly and that is why it has a long half-life. The fact that it decays slowly means that it is not very radioactive. If it decayed quickly there would not be any in the earth's crust. [5]

2.7 Some argue that it is important to consider the hazardous life of radioactive material. This (the hazardous life) they define as 10-20 times the half-life. This is how long it

[3] The Nuclear Waste Primer, Revised Edition, The League of Women Voters Education Fund, no other details
[4] www.uic.com.au
[5] Transcript of Evidence 11 September 2003 p 46

will take for a given quantity of the radioactive element to decay to undetectable levels.[6]

2.8 When ionising radiation passes through material it can knock electrons out of their orbits forming "ions". These ions can damage living tissue and hence are a particular and real health concern. Ionising radiation cannot be detected by the senses but, because it is electrically charged, it can be detected by electronic equipment even at extremely low levels.

2.9 Ionising radiation occurs in three main forms: alpha, beta and gamma rays. Although all three forms are potentially harmful, "they differ in their penetrating power or energy and in the manner in which they affect human tissue".[7]

Alpha Radiation

2.10 Alpha radiation is the most dense but least penetrating ionising radiation. Alpha particles are high energy, large subatomic particles that travel short distances. These particles can be stopped by a sheet of paper or skin. Although they do not easily penetrate the skin they are highly dangerous within the body. Some are extremely long lived and include heavy elements such as uranium, thorium, radium and plutonium.

Beta Radiation

2.11 A beta particle is an electron (or positron) not attached to an atom. Beta particles are much smaller than alpha particles, travel further and are more penetrating. A centimetre of Plexiglas or water shielding can generally stop beta particles. External exposure can result in beta penetration through the surface of the skin (particles can pass through one centimetre of human tissue). Strontium 90 and Tritium are two beta-emitting radionuclides.

Gamma Radiation

2.12 Gamma radiation (in the form of gamma rays) is a high-energy electromagnetic energy wave. It has the highest penetrating power of the ionising radiations and can pass right through the human body. It requires more shielding, such as lead or steel, than alpha and beta particles. The high penetrating power of gamma rays means that external sources of gamma radiation can damage critical organs in the body, although damage to tissues is less than that caused by alpha particles.

MEASUREMENT OF IONISING RADIATION

2.13 The radioactivity of a radioactive source is defined by its level of activity, which is the number of nuclear disintegrations (its decay) per unit of time. The unit of activity is the Becquerel (Bq) where one Becquerel is one disintegration (i.e. one radioactive decay) per second.

2.14 The exposure rate is the amount of radiation energy that reaches the surface of an object in a given time.

[6] www.nirs.org. What is Radiation
[7] Nuclear Waste Primer p14

2.15 As any damage caused by ionising radiation depends on the amount of energy absorbed by the living tissue, the impact that exposure to ionising radiation has on living matter is specified in terms of the radiation dose.

2.16 There are two aspects to the measurement of radiation dose. The first is the absorbed dose. This is a measure of the energy deposited on an object (including the human body) by the ionising radiation. The gray (Gy) is the unit of absorbed dose, being the amount of radiation absorbed per gram of matter. A gray is regarded as a large dose ("a uniform dose of three to five Gy to the whole body will kill 50 per cent of people exposed in one to two months"). Therefore, the milligray (mGy), one thousandth of a gray, is more commonly used.

2.17 The second aspect is the equivalent dose. The absorbed dose itself does not tell the whole story because the impact of the radiation varies according to both the type of radiation involved and the parts of the body affected. For example, "alpha rays are 20 times more effective than beta and gamma rays at causing tissue damage". Accordingly, the equivalent dose has been developed. This is a weighted measure of the absorbed dose which takes into account the type of radiation and the parts of the body affected.

2.18 The unit of the equivalent dose is the sievert (Sv).[8] For example, a one-milligray dose of alpha rays is equal to a 20 millisievert (mSv) equivalent dose, while a one-milligray dose of beta rays is equal to one mSv equivalent dose.[9]

SOURCES OF IONISING RADIATION

2.19 Ionising radiation comes from two sources, background (or natural) radiation and artificial (or "man-made") radiation. The latter might also be termed exposure due to human activities.

Background Radiation

2.20 As observed above, ionising radiation is a fact of everyday life. Radioactive decay is a natural process to which all living material is subjected on a daily basis. This is background radiation. It comes from cosmic rays and naturally occurring radioactive substances existing in the Earth itself and in the human body.

2.21 Terrestrial radiation represents two thirds of the background radiation dose. A significant contributor to background radiation is radon gas, which emanates from the soil. It represents almost half of all the radiation exposure received by individuals annually. It may also concentrate in dwellings.

2.22 Background radiation is location dependent. The level of natural exposure varies around the globe, usually by a factor of about three. Cosmic rays are more intense at higher altitudes while terrestrial radionuclides, such as uranium and thorium in soil, can be elevated in localised areas. However, levels of natural radiation exposure can exceed average levels by a factor of 10 and sometimes 100.[10]

[8] UN Report p4
[9] Ohio State University, Extension Research, Information Sheets: www.ag.ohio-state.edu/~rer/rerhtml; conservation council of south Australia: www.ccsa.asn.au/nuclearsa/a4.html; No Time To Waste Report
[10] UN Report p3

2.23 The human body itself is naturally radioactive due to the presence of elements such as radioactive potassium. It is estimated that a 70kg person would contain about 3,500Bq.[11]

2.24 While figures vary, it is generally accepted that background (ie natural) radiation accounts for between 82 and 89 per cent of the annual radiation exposure of individuals.[12]

2.25 The Australian Radioactive Protection and Nuclear Safety Agency (ARPANSA) reports that the total annual exposure to natural radiation in Australia is in the order of 1.5mSv, while ANSTO puts it at 2.0mSv.[13]

Man-Made/Artificial Radiation

2.26 Ionising radiation can be produced artificially by the production of radioactive materials in the nuclear industry. For example, the production of nuclear weapons, the operation of nuclear reactors, and the production of radiopharmaceuticals.

2.27 Radioactive materials have various medical applications, including nuclear medicine (diagnosis and treatment of disease), the sterilisation of medical supplies, and the common x-ray, which most people will have had at some time in their lives.

2.28 Sometimes radioactive materials take the form of components in consumer products. For example, Americium-124 is used in some types of smoke detectors. Some photocopiers use Polonium-210 to minimise paper jams by controlling static electricity. Self-illuminating emergency exit signs on aircraft are another example of quite common products, which have radioactive material as a component.

2.29 Isotopes have many industrial applications. Some sources of radiation, for example, have characteristics, which make them an excellent tool for measuring and testing. Thus, they are widely used in continuous process operations such as paper or sheet metal production (where radioactive materials and radioactive detectors are used in tandem to measure thickness). Similarly, isotopes are used to measure the height of liquids in containers. They also have widespread application in testing the quality of welds in structures such as bridges and buildings, and checking oil and gas pipelines.

2.30 Radiation is also used to sterilise many common consumer goods (e.g. medical supplies, cosmetics, nappies).[14]

2.31 People can also be subject to radiation through activities such as smoking cigarettes, using natural gas for heating and cooking, using phosphate fertilisers and watching colour television.[15]

2.32 Again estimates vary, but exposure to ionising radiation due to human activities is between 11 and 18 per cent of radiation exposure and is significantly less than exposure from background radiation.

[11] www.arpansa.gove.au/is_rad.htm
[12] www.iaea.org
[13] [#www.arpansa.gov.au/is_rad.htm/ www.lbl....15/3] [# ANSTO Managing Radioactive Wastes and Spent Fuel, undated, p5]
[14] www.ag.ohio-state.edu/!rer/rerhtml/rer_11.html, p1
[15] www.ag.ohio-state.edu/~rer/rerhtml/rer_22.html p3

2.33 One source estimates that, on average, Americans receive 0.1mSv per year from consumer products and 0.5mSv from medical sources for a total of 0.6mSv per year.[16]

2.34 According to ANSTO, the dose rate to members of the public from its operations is "less than 0.01mSv per year".[17]

2.35 At the hearings, the EPA told the Committee:

> **Mr SMITH:** ...Depending on where one lives that can vary from between 1.5 and 10 millisieverts, or possibly more in some places. By comparison a chest x-ray is 0.025 millisieverts and a CAT scan can be around 10 millisieverts. The annual limit of exposure for workers in the industry is 20 millisieverts, and the limit generally applied for exposure by members of the public who are not involved in a radiation related activity is 1 millisievert.[18]

HEALTH IMPACTS OF RADIATION

2.36 There is no disputing that ionising radiation poses a health risk.

2.37 In 1996 the Senate Select Committee Inquiry into nuclear waste (No Time To Waste) concluded that the long-term management of the radioactive waste from these human activities needs to be addressed.[19]

2.38 The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) plainly states the case:

2.39 "Radiation exposure has been associated with most forms of leukaemia and with cancers of many organs, such as lung, breast and thyroid gland".[20]

2.40 The first evidence that ionizing radiation could do harm came within months of the discovery of x-rays, when an early x-ray worker developed injuries to his skin.[21] Madam Curie herself became a casualty of radium poisoning in 1934. So, too, did factory workers who painted luminescent dials on wristwatches.[22]

2.41 Ionising radiation can be harmful to life because it acts at the molecular level on cells. Even though the radiation acts on cells randomly, the absorbing of energy from ionising radiation may result in changes to the molecules, destruction of cellular elements, and altered function or death of the cell."[23]

2.42 When a cell absorbs radiation, there are four possible outcomes:[24]

- There may be no adverse impact on the cell.
- The cell may suffer enough damage to cause loss of proper function, causing the cell to die.

[16] www.ag.ohio-state.edu/~rer/rerhtml/rer_22.html p3
[17] ANSTO, Managing Radioactive Wastes and Spent Fuel, undated, p5
[18] Transcript of Evidence 11 September 2003 p67
[19] *No Time to Waste*. Report of the Senate Select Committee on the Dangers of Radioactive Waste April 1996. Parliament of the Commonwealth of Australia
[20] UNSCEAR 2000 Report p3
[21] www.lbl.gov/abc/wallchart/chapters/15/1.html
[22] www.abc.net.au/quantum/info/radiotx.htm p2
[23] Aduchem p2-1] [# www.ag.ohio-state.edu/~rer/rerhtml/ree_24.html
[24] www.ag.ohio-state.edu/~rer/rerhtml/rer_24.html

- The cell may lose its ability to reproduce.
- The cell's genetic code (i.e. the DNA) may be damaged such that future copies of the cell are altered, which may result in cancerous growth.

2.43 The biological effects of high level radiation are well known, and depend on the amount of an individual's exposure. Very high exposures can damage or kill enough cells to destroy organs and cause a breakdown in vital body functions, leading to severe disability or death within a short time.[25]

2.44 The most studied low level health effect is cancer. Genes within a cell determine how that cell will function. If these genes are damaged it is possible for a cancer to occur. This means that the cell has lost the ability to control the rate at which it reproduces. Radiation can cause this and "at low doses (these cancers are) the only known deleterious health effect."

2.45 However, the study of radiation induced cancer is complicated because not all cancers are caused by radiation. Exposure to a particular dose may cause cancer in one person and not another and often cancer does not appear until many years after exposure. It is therefore "impossible to determine which cancers are caused by radiation and which are caused by other carcinogens in our environment".[26]

2.46 Susceptibility to radiation-induced cancer depends on a number of factors such as the site of exposure in the body, sex, and age. Sites in the body where cells rapidly grow and multiply, and those where radioactive materials tend to concentrate, are more susceptible to cancer than others. For example, the breast and thyroid gland have relatively high susceptibilities to radiation-induced cancer, while the kidney and nerve cells have lower susceptibilities.[27]

2.47 Potentially, radiation exposure can cause hereditary effects, but none have as yet been detected in human populations "although they are known to occur in other species".[28]

2.48 In summary then, it is well established that ionizing radiation has both prompt and delayed effects. At very high radiation exposures, death will occur within several months or even less. At moderate levels, radiation exposure increases the chance that an individual will develop cancer, with a time delay of 10 or more years for most cancers. At low levels, the cancer risk decreases, but the relationship between cancer risk and the magnitude of the exposure is uncertain.[29]

Radiological Events

2.49 From the public's perspective, the dropping of nuclear bombs on Hiroshima and Nagasaki at the end of the Second World War, "the accidents at the Three Mile Island (TMI) and Chernobyl nuclear reactors have triggered particularly intense concern about radiation hazards" and their health implications.[30]

[25] www.iaea.org/worldatom/Press/Booklets/Development/devsix.html
[26] www.ag.ohio-state.edu/~rer/rerhtml/ree_24.html
[27] www.ag.ohio-state.edu/~rer/rerhtml/ree_24.html
[28] UNSCEAR 2000 Report p3
[29] www.lbl.gov/abc/wallchart/chapters/15/1.html
[30] www.lbl.gov/abc/wallchart/chapters/15/7.html

2.50 These nuclear occurrences have been studied in detail to try and gain some insight into the harm from ionising radiation.

2.51 At Three Mile Island, very little radioactivity escaped into the outside environment despite severe damage to the nuclear fuel within the reactor.

2.52 As Mr McIntosh, from ANSTO, advised the Committee in relation to the Three Mile Island accident:

> **MR MCINTOSH:** ... there were no significant consequences for the public. Payouts by insurers related to things like lost wages for people who did not go to work for a few days. There have been no awards for damages for personal injury arising from the Three Mile Island accident. And this is in the United States, where there are plaintiff-friendly courts.[31]

2.53 The Chernobyl accident was far more serious for there was "a very large release of radionuclides to the environment".

2.54 According to the US Department of Energy's Lawrence Berkeley National Laboratory at the University of California, "there is strong evidence of a substantial increase in thyroid cancers among children living in the vicinity". Workers directly involved with the accident were affected by radiation, but "no other health effects from Chernobyl have been convincingly established. However, it is too soon for them to have been fully manifested". The Berkeley Lab reports that one early study estimated 47,000 eventual casualties across Europe. But given the uncertainty in the assumptions and the low involved, "any estimate of predicted deaths from Chernobyl is highly speculative".[32]

2.55 A UN study reported that, "apart from a significant increase in the incidence of thyroid cancer in children, the great majority of the population are not likely to experience serious health consequences as a result of the radiation from the accident:

> "There is no scientific evidence of increases in overall cancer incidence or mortality or in non-malignant disorders that could be related to radiation exposure. The risk of leukaemia, one of the main concerns owing to its short latency time, does not appear to be elevated, not even among the recovery operation workers".

2.56 In an article for Medical & Global Survival, Dr David Rush, nevertheless sounded a note of caution:

> "We should not be easily reassured, however, about out ability to estimate other possible health consequences [of Chernobyl]. Increases in other forms of cancer ... could occur and yet be undetectable even with extensive investigation ... Further, the latency period from exposure to detectable symptoms of cancer can be many decades."[33]

2.57 Whatever the health consequences of the Chernobyl disaster, it certainly, caused serious social, psychological and economic losses.[34]

2.58 Studies of Hiroshima have found that the radioactivity was "not as deadly as first thought". According to the Radiation Effects Research Foundation, distance from the

[31] Transcript of Evidence 22 October 2003 pp 76-77
[32] www.lbl.gov/abc/wallchart/chapters/15/7.html
[33] Letter from Kiev and Moscow: Nuclear Realities Ten Years After Chernobyl, Medical & Global Survival, www.ippnw.org/MGS/V3RushKiev.html
[34] UNSCEAR 2000 Report p4

blast was critical so that, "if you moved another 600 m closer, [radioactivity] was increased by another factor of ten. So the dose basically changes by a factor of ten every 600 m you moved closer to the hypocentre."[35]

2.59 As a result of this study, it was concluded that "the public has a very strong concern about radiation: there is some risk, but that risk is quite small."[36]

2.60 Another significant finding relates to genetic effects, where it has been found that "no statistically significant genetic effects have been found among the extensively studied children of survivors of the Hiroshima-Nagasaki bombings".[37]

PRINCIPLES OF RADIATION PROTECTION

2.61 The realisation that ionising radiation has the potential to cause harm has led to the development of standards by international organisations such as the Internatioanal Atomic Energy Agency (IAEA), the International Commission on Radiation Protection (ICRP) and the World Health Organisation (WHO) for the protection of humans and the environment from artificial radiation.

2.62 The most basic framework of protection identifies three principles:

Justification – the use of radiation should produce a benefit to the exposed individual or to society to offset the harmful effect it causes; "doing more good than harm;

Optimisation – maximising the good over the harm - exposures to ionising radiation should be kept as low as reasonably achievable (ALARA), taking into account economic and social factors.

Dose limits and constraints – adequate standard of protection - exposures of individuals to radiation should be subjected to dose limits and constraints.

2.63 In practice, then, these approaches to radiation protection aim to reduce the radiation doses and the risks of receiving a significant radiation dose to the lowest possible levels that are reasonably achievable.

2.64 According to ARPANSA, with regard to radiation doses, ALARA is applied as follows:

> "Radiation protection is considered to be optimised when the level of protection needed to further decrease radiation exposure cannot be achieved without an unreasonable social or economic cost. The upper bound for optimisation is the dose constraint, which is the highest acceptable level of dose for a particular source or practice. Exposures may be reduced to a level where the associated risk is broadly acceptable to the general population without additional protection. At radiation doses below this level, called the ALARA objective, it is not considered necessary to demonstrate that the ALARA principle has been satisfied. ANSTO's ALARA objective for the public is 20 μSv per year, which is 2 per cent of the NHMRC limit and is about one hundredth of the dose that a person receives from natural background radiation. This corresponds to a calculated risk of fatality of one chance in 1 million per year, in accordance with the NSW Department of Urban Affairs and Planning recommendations for hazardous industries."[38]

[35] www.abc.net.au/quantum/info/radiotx.htm, 1997 p7
[36] www.abc.net.au/quantum/info/radiotx.htm, 1997 p10
[37] www.lbl.gov/abc/wallchart/chapters/15/1.html
[38] www.arpansa.gov.au/new_fct3.htm

2.65 In practical terms, protection from external radiation is secured by means of three elements: time, distance, and shielding.

2.66 *Time*

The dose of radiation a person receives depends on how long that person is near the radiation source. The shorter the time spent near the source, the smaller the dose. Radiation protection procedures are therefore designed to keep the time people spend near a source of radiation as short as possible.

2.67 *Distance*

Similarly, the radiation dose a person receives depends on how close the person is to the source. The greater the distance between the person and the source of radiation, the smaller the dose. In fact, the dose decreases with the square of the distance. A person 10 feet from the radiation source receives only one one-hundredth as much radiation as a person one foot from the source.

2.68 *Shielding*

The third element to minimise the amount of radiation that reaches people is shielding placed between the radiation source and people. When the radiation strikes the shielding, it begins to create ions in the shield. Each time an ion is created, the radiation uses some of its energy. If the shield is thick enough, the radiation will use up its energy before it gets through the shield.

2.69 When radionuclides are ingested, inhaled or absorbed through the skin, internal radiation exposure occurs.[39] Major damage can follow.

Dose Levels

2.70 There is considerable debate about what, if any, dose level is safe for humans.

2.71 The International Commission on Radiological Protection has directed that the general public shall not be exposed to more than 1 mSv per annum (over and above natural background).[40]

2.72 While there is little disagreement about the impacts of large doses of radiation, there are certainly differences of opinion about the impacts of radiation at low levels of exposure (generally regarded as being at background level). However, despite much study, these effects are not known, being too small to see unambiguously.[41]

2.73 So, whether there is a safe level of radiation is a controversial subject which has not yet been scientifically resolved.[42]

High Level Doses

2.74 If the number of cells damaged by the radiation is large enough there will be observable damage to organs which can lead to death. This occurs in individuals who

[39] Laurenc Aduchem pp 2-3 – 2-5
[40] www.arpansa.gov.au/is_rad.htm
[41] www.lbl.gov/abc/wallchart/chapters/15/5.html
[42] Dept of Environment and Heritage, Sept 2003, www.deh.gov.au/ssd/faqs/radiation.html

are exposed to radiation above a threshold level.[43] Threshold effects occur when levels of radiation exposure are tens, hundreds, or thousands of times higher than background (say 2millisieverts or 0.002 sievert), and usually when the exposure is over a very short time, such as a few minutes.

2.75 One source lists the following the doses levels and observed threshold effects:[44]

Dose (Sieverts)	Effects
0.05 to 0.2	Possible latent effects (cancer), possible chromosomal aberrations
0.25 to 1.0	Blood changes
More than 0.5	Temporary sterility in males
1.0	Double the normal incidents of genetic defects
1.0 to 2.0	Vomiting, diarrhoea, reduction in infection resistance, possible bone growth retardation in children
2.0 to 3.0	Serious radiation sickness, nausea
More than 3.0	Permanent sterility in females
3.0 to 4.0	Bone marrow and intestine destruction
4.0 to 10.0	Acute illness and early death (usually within days)

2.76 According to the EPA, "the lowest dose that has been shown to cause human health impacts is 500 [mSv]; although [it suspects] lower doses could cause longer-term harm. A lethal dose is over 5,000 millisieverts [ie 5 Sieverts].[45]

Low Level Doses

2.77 As noted earlier, there is considerable uncertainty—and therefore controversy—about the extent of harm or damage from ionising radiation at low levels of exposure.

2.78 As the United Nations Scientific Committee on the Effects of Atomic Radiation reported in 2000: "… the potential risks from low level radiation exposure, that is exposure to radiation comparable with natural background radiation, are the causes of lively debate and controversy".[46]

2.79 ARPANSA defines high doses as being above 1 sievert and these "can result in massive cell death, organ damage and possibly death to the individual". On the other hand, at low doses (less than 50 mSv) the situation is more complex".[47]

2.80 Another source states that for doses below 1 Sv, there is little likelihood of radiation sickness, and the main danger is an increased cancer risk.[48]

2.81 According to ARPANSA, a dose of one millisievert corresponds to a chance of six in 100,000 of contracting a cancer, and to a loss of life expectancy equalling 17 years. The normal incidence of cancer is 269 cases per 100,000.[49]

[43] UNSCEAR 2000 Report p2
[44] www.ag.ohio-state.edu/~rer/rerhtml/ree_24.html
[45] Transcript of Evidence 11 September 2003 p67
[46] UNSEAR Report 2000 p2
[47] ARPANSA www.arpansa.gov.au/is_rad.htm
[48] www.lbl.gov/abc/wallchart/chapters/15/6.html

2.82 The IAEA maintains that, at these very low level doses of radiation,

> "related health effects cannot be identified since they would occur principally as cancers late in life, leading to premature death by several years. They would be an undetectable fraction of the anticipated 20 per cent of populations that die of cancer due to other causes—the 20 per cent value itself varying by several percentage points for differing populations as a result of specific environmental, dietary and genetic influences".[50]

2.83 In responding to the health risks of low level exposures, at least three views can be identified. These are:

- linear no threshold
- hormesis
- zero risk.

Linear No Threshold

2.84 The most widely accepted assumption is the so-called *linearity hypothesis,* according to which the cancer risk is directly proportional to the magnitude of the dose, down to zero dose.

2.85 In this scenario for low level radiation (generally assumed to be in the order of tens of mSv or less) it is "assumed that the risk of developing an adverse effect (such as cancer) scales proportionately with the amount of radiation". That is, "doubling the amount of radiation is assumed to lead to a doubling in the chance of developing an effect.".[51]

2.86 The United Nations Scientific Committee on the Effects of Atomic Radiation in its 2000 Report concluded that "a small addition of radiation exposure (eg about the global average level of natural radiation exposure) would produce an exceedingly small increase in the chances of developing an attributable cancer".[52]

2.87 This method assumes a risk based approach, as Dr Keith Lokan, a consultant to the federal Department of Education Science and Training (DEST) argued on the ABC:

> "The risk at 1 mSv, as best we can estimate, is about one in 20,000. That is, there's one chance in 20,000 that an exposure to that 1 mSv will at some point in the future give rise to a fatal cancer. But you compare that with the fact that there's one chance in 25 that we're all going to die of cancer anyhow, so it's a very small risk in comparison."

2.88 He went on to say that "it's not a matter of being absolutely safe, it's a matter of being one of the risks of being alive but it's a fairly small risk compared to a lot of other risks."[53]

2.89 In this position he argued that we have been "overly cautious" and that we will be unlikely to "see the limits being pushed any lower".[54]

[49] www.arpansa.gov.au/is_rad.htm
[50] www.iaea.org/worldatom/Press/Booklets/Development/devsix.html
[51] www.deh.gov.au/ssd/faqs/radiation.html
[52] UNSCEAR 2000 Report p3
[53] www.abc.net.au/quantum/info/radiotx.htm p11, 15
[54] www.abc.net.au/quantum/info/radio2tx.htm p19

Hormesis

2.90 A number of studies have suggested the possibility that small increases in radiation dose do not create any additional cancer risk.

2.91 This approach depends very much on determining a "threshold" dose level below which people are not adversely affected. While there is considerable support for this approach, it is still very much a controversial issue.[55]

2.92 The IAEA notes that some scientists conclude that "a natural threshold exists for radiation effects, with very small incremental doses above a significantly larger natural background exposure posing no risk at all".[56]

2.93 Dr Keay spoke in favour of this theory in evidence:

> **Dr KEAY:** … research over the last couple of decades [shows] that… Moderate doses of radiation—that is, up to 100 times the natural exposure—can be positively healthy to human organisms. Of course, that flies directly in the face of the claims by the antinuclear people, but it is emerging as a fact…
>
> [Professor Parsons] concludes that the LNT premise, which is the one that has been held for many years, that danger is proportional to dose—in other words, there can be no health-giving effect—is quite wrong…
>
> In the light of what we know about the effects of radiation, I would say that one would hardly notice it [low level radiation], from the point of view of radiation danger to the surrounding people. In my view it could be dumped there pretty safely because the radiation levels in the vicinity would be no greater than those that the inhabitants of Glen Innes and Armidale enjoy every day.

2.94 According to Dr Keay the residents of Sutherland had nothing to worry about with low level waste, for "even if they made their bed on it and slept on it, I think it would still add to their health, or contribute to their health".[57]

2.95 However, this is still a controversial issue within the scientific community.[58]

Zero Risk

2.96 A third view rejects both of these approaches to low level dose risk.

2.97 This position rejects the notion that there is some acceptable level or risk and asserts that there is no safe dose of artificial radiation. The risk of exposure should be zero.

2.98 The Nuclear Information and Resource Service (NIRS) sums up this position stating that "ionising radiation causes increases in cancer and birth defects. The greater the dose the greater the danger. There is no dose below which there is no danger". The NIRS maintains that "additional exposure above natural background radiation is cause for concern since it may result in otherwise preventable disease".[59]

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[55] Dept of Environment and Heritage, Sept 2003, www.deh.gov.au/ssd/faqs/radiation.html
[56] www.iaea.org/worldatom…devsix.html
[57] Transcript of Evidence 22 October 2003 pp29/30
[58] www.lbl.gov/abc/wallchart/chapters/15/5.html
[59] Nuclear Information Centre www.ccsa.asn.au /nic/NucHazards/H&Sflyer.htm] [#NIRS Fact Sheet www.nirs.org/factsheets/WhatisRadiation.htm

2.99 Proponents of this position point to the gradual worldwide tightening of the standards for radiation protection as a clear indicator the future research will show that dose levels of artificial radiation should be zero.

2.100 The Conservation Council of South Australia reports that "the recommended allowable exposure to ionising radiation has been steadily decreasing from the earliest days of radiological protection. There has not been a single case where the allowable dose has been increased". On average the limit has been halved every 14 years as the following table for allowable exposure levels for workers shows:

TABLE 2:[60]

Year	Dose Rate mSv/year
1934	500
1950	150
1956	50
1977	50
1991	20

2.101 The International Commission on Radiological Protection (ICRP) sets these radiation standards. The standard for the public in the 1970s was set at 5mSv per year for members of the public, and 50mSv per year for those in the radiation industries. This is in addition to the (2mSv) background radiation.

2.102 The current standards are 20mSv for radiation workers and 1mSv for members of the public. To put this in perspective, a chest X-ray may give around .04 or .02mSv of radiation; a series of kidney X-rays perhaps 1mSv (equal to about 40 chest X-rays); a CT-scan an average of 5-6mSv.[61]

2.103 Proponents point to the following research to support this position:

- United States National Academy of Sciences report in 1990, which unanimously found that all exposure to radiation presents some risk to human health and,
- the World Health Organisation states there is no safe level of exposure to radiation, according to Greenpeace in evidence.[62]

2.104 Dr Williams, representing the Medical Association for Prevention of War (MAPW), told the Committee at a public hearing:

> **Dr WILLIAMS:** Well, it is relative, it is a numbers game. Radiation causes damage to human DNA, so the DNA has to be exposed to that radiation. If it is low level radiation it is not going to be as dangerous to your DNA as intermediate or high level waste, but it is not true to say that there is no danger attached to it. It is simply not true to say that.[63]

2.105 Mr Noonan, of the Australian Conservation Foundation, also raised this issue:

[60] www.ccsa.asn.au/nic/NucHazards/H&Simpact.htm pp1,2
[61] www.abc.net.au/science/slab/radiation/story.htm p5
[62] www.abc.net.au/science/slab/radiation/story.htm p5, Transcript of Evidence 19 September 2003 p12
[63] Transcript of Evidence 19 September 2003 p53

> **MR NOONAN:** ... in the broadest context the health standards recommended for the public and nuclear industry workers are long outdated. The recent findings of the European Committee on Radiation Risk recommended a tenfold reduction in the legal radiation exposure to members of the public from 1 milliSievert a year down to 0.1 milliSievert a year, and they recommended a fourfold reduction in the legal exposure for a nuclear industry worker over a 12 month period from 20 milliSieverts a year down to 5 milliSieverts a year. The trend is an increasing recognition that there is no safe level of ionising radiation exposure and that the nuclear industry has to change its practices and be wound back in terms of the adverse health impact that it is having.[64]

2.106 In a paper prepared for MAPW in May 2003, Dr Williams explained that the report by the European Committee on Radiation Risk (ECRR) "arose out of criticisms of the International Committee on Radiological Protection (ICRP) from the European Parliament". The report not only recommended a reduction in the public's exposure level by a factor of 10 (i.e. down to 0.1 mSv per annum), but Dr Williams stressed that the "most striking" aspect of the report was its "critique of the dubious manner in which these [exposure] limits have been (and continue to be) established by the ICRP".[65]

2.107 In evidence before the Committee, Dr Williams explained it this way:

> **Dr WILLIAMS:** Yes. It goes back to this question to some degree about low level ionising radiation. Historically low levels of ionising radiation have been regarded as being harmless. As we have been able to study the literature, the data, the experimental findings more and more over the past few decades, it has become obvious that low levels of ionising radiation are dangerous....
>
> ...Basically the principles were established following the studies of the Hiroshima bomb victims. The problem with that is that it was a sudden event, different types of isotopes exposure and less long-term isotopes, and the risk models were established on the grounds that the risk was an external radiation risk.
>
> Since then we have discovered DNA. We can actually look at DNA in an electron microscope. We can see the damage, the little double strand breaks in there, the misrepairs, the failure to promulgate new DNA that is of normal type. What we can see now is that ionising radiation, even one alpha particle, can damage DNA.[66]

2.108 The International Commission on Radiological Protection (ICRP) does not see "zero risk" as an option. According to the Commission "the implication of a non-threshold relationship... is that some finite risk must be accepted at any level of protection".[67]

2.109 The Committee is not in a position to adjudicate on this issue. It is mindful of the comment by the Berkeley Lab that, "in a push of the pendulum far to the sceptical side, this creates a temptation to dismiss entirely the hazards of low doses".[68]

2.110 Given the uncertainty still surrounding these matters the common sense approach would be to err on the side of caution and avoid taking obviously unnecessary risks.

[64] Transcript of Evidence 19 September 2003 p67
[65] www.mapw.org.au/nuclear/radiation/2003/05williams-ecrr.html
[66] Transcript of Evidence 19 September 2003 pp 55/6]
[67] ICRP: History, Policies, Procedure, undated, p5
[68] www.lbl.gov/abc/wallchart/chapters/15/9.html

RADIOACTIVE WASTE

2.111 A significant consequence of industrialisation and the development of technology has been the creation of waste, which can be defined as any matter that is unwanted, rejected or no longer of use.

2.112 And like most industrial processes, the manufacture of radioactive materials generates waste – radioactive waste. Radioactive waste is thus the result of the operation of the nuclear industry.

2.113 Because this waste is radioactive it will give off ionising radiation and thus has implications for public health.

2.114 The waste can be generated in various forms: either solid, liquid or gaseous. Activity levels can range from extremely high (associated with spent fuel and fuel reprocessing) to very low (associated with radioisotope applications in laboratories and hospitals etc). The radionuclides present in the waste will depend on the generating process and can include natural, transuranic (created in the reactor) and specific man-made radionuclides. Accordingly, the range of half-lives of the radionuclides in the radioactive waste will also be extremely broad.[69]

Sources of Radioactive Waste in Australia

2.115 Any review of the management of radioactive waste (including its storage and transport) needs to consider the sources of that waste.

2.116 Dr Garnett (CEO of ANSTO) advised the International Atomic Energy Agency that "radioactive waste in Australia is generated by research, industry, medical applications, research reactor operation and radiopharmaceutical production...."[70]

2.117 Australia has neither a nuclear power industry nor nuclear weapons, and so does not generate the substantial amounts of radioactive waste produced in some other countries. However, it is the operation of Australia's only nuclear reactor, (ANSTO's High Flux Australian Reactor (HIFAR) in Lucas Heights, New South Wales, that is easily the largest source of non-mining radioactive waste in this country.

ANSTO RADIOACTIVE WASTE

2.118 According to ARPANSA, ANSTO produces more than 90 per cent of all non-mining nuclear waste in Australia.[71]

2.119 A 1996 Senate Inquiry into radioactive waste (No Time To Waste Report) identified five categories for the waste generated by ANSTO:

- waste produced during operation of the reactor and production of radiopharmaceuticals;
- residue from the reprocessing of the fuel rods and any fuel rods not returned to the country of origin;

[69] IAEA Safety Series, Classification of Radioactive Waste, Vienna, 1994, p21

[70] Address to the 3rd Scientific Forum of the International Atomic Energy Commission, Radioactive Waste Management: Turning Options into Solutions"

[71] Joint Standing Committee on Treaties, Report No 51, Convention on the Safety of Spent Fuel and Radioactive Waste Management, p20

- waste from decommissioning the existing and future reactors;
- emissions to air and sewer; and
- possible remediation of the Little Forest Burial Ground.

2.120 These are detailed below.

Operation of the reactor/radioisotopes production

2.121 The production by the reactor of radioisotopes for use in medicine, industry and research generates radioactive waste. According to the Senate Select Committee in 1996, the production of radiochemical and radiopharmaceuticals accounts by volume for more than 90 per cent of all liquid radioactive waste, and more than 70 per cent of all solid radioactive waste produced at the ANSTO site.[72]

2.122 ANSTO explained its role as follows:

> The High Flux Australian Reactor (HIFAR) is operated by ANSTO (The Australian Nuclear Science and Technology Organisation) on a 70-hectare site at Lucas Heights in southwest Sydney. ANSTO produces radioisotopes for industry, medicine and research. ANSTO operates in "a number of research areas: the application of nuclear physics, advanced ceramics, the processing and utilisation of radioactive materials, biomedicine and health, environmental sciences, research in crystal and molecular structures, and radiopharmaceutical medicines". This research is "directed towards practical utilisation of nuclear science and technology for the benefit of Australia".[73]

2.123 The reactor produces raw materials (i.e. radioisotopes) for a wide range of nuclear medicines. For example, it produces Technitium-99, the world's most commonly used isotope. These isotopes are radioactive, as are the materials used to process them.

2.124 In producing radioisotopes, the operation of the reactor itself generates radioactive material. The fuel for the reactor is radioactive, particularly after it has been used or "spent".

2.125 The operation of the reactor also generates process wastes, which result from treatment, purification and filtration systems of fluids in direct contact with parts of the reactor contaminated by radiation, and technological wastes which arise from necessary maintenance carried out on the reactor.[74]

2.126 Mr McIntosh told the Committee at hearings of the range of uses for radioisotopes produced at Lucas Heights:

> **Mr McIntosh:** …Radioactive materials are transported around New South Wales every day for a variety of purposes. These include radiopharmaceuticals used in nuclear medical procedures; gamma irradiation sources for sterilisation of medical equipment, blood, and products such as cosmetics; industrial radiography of welds; quality-control processors for materials and slurries in the mining industry; element analysis in bore-hole logging; road repairs and resurfacing; and research applications that involve the use of

[72] *No Time To Waste*, Report Of The Senate Select Committee On The Dangers Of Radioactive Waste April 1996, Parliament Of The Commonwealth Of Australia p43
[73] ANSTO History 1948 to 1995, www.ansto.gov.au/ansto/history.html
[74] www.world-nuclear.org/info/info60.htm p4

> radioactive tracers to allow biological processes to be followed in the test-tube, a living organism or the environment.[75]

2.127 According to Sutherland Shire Council:

> The majority of radioactive wastes in Australia are generated from the Lucas Heights Science & Technology Centre and its historic activities. Notwithstanding the routine importation of isotopes for medical and scientific research, the LHSTC and particularly, the reactor, has generated large quantities of low level solid waste and intermediate level solid waste from spent reactor fuel and from solidification of medical isotope liquid by-products.[76]

Spent Fuel

2.128 Nuclear reactors, like any other machines, require fuel to operate. This energy is provided by fuel rods. When this fuel has been irradiated to the point where it is no longer usable due to the depletion of fissile material and the build up of poison or radiation damage, it is removed from the reactor.[77]

2.129 At this stage the fuel rod becomes known as spent fuel.

2.130 Spent fuel generates significant heat when freshly removed from its reactor. Initially it is placed in water to allow it to cool. During this time the shortest-lived fission products also decay. When the fuel has cooled to the point it cannot melt the fuel cladding, it is transferred to dry storage facilities.

2.131 At this point there are essentially two strategies for dealing with the spent fuel: it can be treated as waste or it can be reprocessed.

2.132 Reprocessing the spent fuel means separating it into three components – uranium, plutonium and residual non-fission products. The uranium and plutonium are recycled into fresh fuel with the remainder being directed into the waste stream.

2.133 There is ongoing debate as to whether spent fuel actually constitutes radioactive waste and this is discussed in greater detail below.

Decommissioning of Reactors

2.134 Decommissioning is the process undertaken following the permanent closure of any industrial facility with the aim of leaving a clear, uncontaminated site where the facility once operated.

2.135 Accordingly, when nuclear reactors reach the end of their lives they too must be "decommissioned".

2.136 The International Atomic Energy Agency (IAEA) has identified three options for decommissioning:

- immediate dismantling;
- safe enclosure; and
- entombment.

[75] Transcript of Evidence 11 September 2003 p24
[76] Sutherland Shire Council Submission No. 350 p5
[77] IAEA glossary

2.137 Depending on the option chosen, the decommissioning process can incorporates some or all of the following:

- the safe management of nuclear material held in the facilities;
- the safe management of radioactive and other wastes;
- decontamination
- plant dismantling and demolition, and
- site remediation

2.138 Following the decommissioning process, the regulatory controls covering the facility may be terminated and the site safely released for alternative uses.[78]

2.139 Australia's only two reactors are or soon will be the subject of decommissioning strategies. They are:

2.140 The (100 kW) MOATA reactor commenced operations as "a versatile neutron source used for a wide range of scientific studies" and ceased operations in 1995 (but has not been decommissioned).

2.141 The current HIFAR 10 MW reactor, the principal research reactor, is to be replaced by the Replacement Research Reactor (RRR) currently under construction.[79]

Water and Airborne Emissions

Waste Water

2.142 ANSTO discharges about 90,000 cubic metres of water per annum into the sewerage system, most of which comes "from non-radioactive work areas".

2.143 Some 6,000 cubic metres of this waste water, however, requires treatment prior to discharge. The treatment involves the adsorption of the radioactivity onto a solid followed by centrifuging the solids from the liquid.

2.144 All the waste water, both treated and untreated, goes through the Cronulla Sewage Treatment Plant and then to the ocean outfall at Potter Point on the Kurnell Peninsula.

2.145 The arrangement is the subject of a Trade Waste Agreement between ANSTO and the Sydney Water Corporation.

Airborne

2.146 The operations of nuclear facilities emit airborne radioactivity in the form of gaseous radioisotopes such as xenon and krypton and volatile substances such as iodine.

2.147 Charcoal traps are used to remove most of the volatile radioactivity. As well, the air is passed through high efficiency filters to remove fine particles.

2.148 The ventilation stacks are subject to continuous monitoring. Beyond the ANSTO site, "the levels of radioactivity in air are too low to be measured".[80]

[78] www.world-nuclear.org/wgs/decom/intro1.htm; www.uic.com.au/nip13.htm
[79] www.ansto.gov.au/ansto/history.html
[80] Managing Radioactive Wastes and Spent Reactor Fuel, undated, pp8,12

Remediation of the Little Forest Burial Ground

2.149 Between 1960 and 1968, ANSTO's predecessor, the Australian Atomic Energy Commission (AAEC), used an area known locally as the Little Forest Burial Ground (LFBG) to bury solid waste "with low levels of radioactivity and beryllium oxide (which is non-radioactive). The material originated mainly from the Lucas Heights site.

2.150 Radiological dose assessments are not routinely conducted for the LFBG. The irregular monitoring has included measurement of radioactivity in soil, plants, groundwater and airborne dust sampled from the site, as well as surface water from creeks draining the area.

Other Institutions and Organisations

2.151 As noted above, most of the radioactive waste in Australia is produced by ANSTO. However, there is some radioactive waste held by organisations other than ANSTO. The wastes relate essentially to medical and industrial/commercial operations which have made use of ANSTO-produced or imported radioisotopes. The 1996 Senate Select Committee Report *No Time To Waste* identified these wastes:

Medical

2.152 The four types of radioactive waste generated in significant quantities in medicine are unused radiopharmaceuticals; used sealed sources; contaminated equipment or other materials such as syringes and bed-linen; and bodily excretions of patients following diagnostic or therapeutic procedures. The first three categories produce approximately 30 per cent of the waste while the fourth category produces the remaining 70 per cent.

2.153 Radioactive isotopes used for diagnostic purposes usually have short half-lives and the quantities are small. The short-lived waste is disposed of in the normal waste stream after storing for a short period to allow it to decay.

2.154 Sources with higher activity used for therapeutic purposes are generally not suitable for immediate disposal. These sources are surplus to hospital needs but require longer-term storage. For example, St Vincent's Hospital Sydney Ltd has a number of caesium-137 tube sources from an obsolete technique.

2.155 Teaching hospitals, in particular, generate radioactive waste which is difficult to deal with because it is in toxic or flammable liquids. The Committee was told that many hospitals have conducted waste audits in order to reduce the volumes of radioactive waste being generated and to look at issues such as the management of radioactive putrescent materials.[81]

Industrial/Commercial

2.156 As of 1996, a number of companies were storing radioactive materials pending a decision on a national repository site. Penrice Soda Products Pty Ltd stores obsolete sealed radioactive sources on site as the cost of disposal overseas is considered prohibitive. Coca Cola Amatil has a radiation gauge which was taken out of service in

[81] *No Time To Waste,* Report Of The Senate Select Committee On The Dangers Of Radioactive Waste April 1996, Parliament Of The Commonwealth Of Australia p46

1986. BHP has eighty radioactive sources, mainly cobalt-60 or caesium-137, and would be interested in disposing of twelve in a national repository. Other industrial sources include compasses used by geologists, which contain tritium, and radioactive sources used to detect water levels in bore holes. Roads authorities also use radioactive sources routinely for quality control in manufacturing road beds.

Research

2.157 CSIRO produces radioactive waste through biological and other experiments such as the beneficiation of ore experiments and sealed sources from analysis and measurements. The CSIRO waste from Fishermans Bend which has already been transported to Woomera is slightly contaminated soil which is stored in 9726 drums of 207 litre capacity.

Defence/CSIRO

2.158 The annual amounts of radioactive waste generated by the Department of Defence are minor, mostly comprising equipment containing radioluminescent material or tritium gas and waste from the research activities of the Defence Science and Technology Organisation. Sources received from Arnersham International in the United Kingdom can be returned to it.

2.159 The Australian Defence Industries material from St Marys, now stored at Woomera, is approximately half low level material and about half intermediate level waste. This material originated from sources within the Commonwealth and State and Territory governments, universities, hospitals and from medical practitioners. The Department of Defence accepted responsibility because of the wide range of sources. About half of this waste, in terms of radioactivity, is cobalt-60.[82]

THE RADIOACTIVE WASTE PROBLEM

2.160 Radioactive waste has been an ongoing problem for the nuclear industry.

2.161 Generally, nuclear technology applications commenced before plans for the disposal of the resulting waste were well developed. As waste arose, it was most often frequently stored in various types of engineered containment on the surface and at sites with controlled access. As yet no disposal facilities are in operation for high level waste (although formal decisions to proceed have been made in two countries) and "the waste material continues to accumulate in storage facilities".[83]

2.162 Indeed, the management of radioactive waste was identified as the "most perplexing topic in nuclear technology today" and no country has demonstrated long-term safe management of those [high level] classes of waste.[84]

2.163 The unavailability of permanent disposal facilities for radioactive waste has caused problems in managing waste so that "stores originally intended as temporary facilities

[82] *No Time To Waste,* Report Of The Senate Select Committee On The Dangers Of Radioactive Waste April 1996, Parliament Of The Commonwealth Of Australia pp45-6

[83] IAEA, Long Term Storage of Radioactive Waste: Safety and Sustainability, 2003, p1

[84] 3rd Scientific Forum of the International Atomic Energy Commission, Radioactive Waste Management: Turning Options into Solutions", Opening Statement, Dr Shirley Ann Jackson p2

have had their lifetimes extended and serious consideration has been given, in some countries, to the use of storage as a long term management option".[85]

2.164 As the McKinnon Report noted in 1993:

> "The handling and storage of [radioactive] waste... is an intractable problem worldwide. The relatively large volumes of low level wastes are not such a problem because the radioactivity is low. The waste can be disposed of safely. Intermediate and, particularly, high level waste disposal is, perhaps, the biggest single problem of the whole nuclear field".[86]

2.165 This problem has adverse implications for future generations, something acknowledged by the IAEA[87] and raised by the Southern Sydney Regional Organisation of Councils in evidence:

> **Ms GIBBS:** ...The opposition is based mainly on the grounds that the reactor creates an unresolved waste problem, which is obviously a particularly nasty legacy to leave future generations, and one that is clearly not in the interests of ecologically sustainable development.[88]

2.166 Dr Holland told the Committee

> **Dr HOLLAND:** I think it is easy to look at it and say it was and it remains foolish and, on one level, I am going to go along with that. I think continuing to generate nuclear waste materials when, after decades of work on this, we do not have any solutions that are serious contenders for that label does not make that much sense.[89]

2.167 While acknowledging that waste presents a major problem there is confidence on the part of the nuclear industry that it can be managed and solutions found. According to the IAEA:

> "Research and development work on waste disposal has shown that, in principle, all types of radioactive waste can be disposed of in a manner that provided protection for the health and safety of people and the environment. For high level and long lived radioactive waste, the consensus of the waste management experts internationally is that disposal in deep underground engineered facilities – geological disposal – is the best option that is currently available or likely to be available in the foreseeable future".[90]

2.168 The IAEA states that "the importance of the safe management of radioactive waste for the protection of human health and the environment has long been recognised".[91]

2.169 The Federal Department of Industry, Science and Resources was confident that waste can be managed, stating in a discussion paper for a national store for intermediate waste:

- the beneficial uses of radioactivity inevitably generate radioactive waste;
- with careful scientific planning radioactive waste can be safely managed and disposed of without placing an undue burden on future generations.[92]

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[85] IAEA, Long Term Storage of Radioactive Waste: Safety and Sustainability, 2003, Foreword
[86] McKinnon Report p207
[87] IAEA Safety Standards Series, Predisposal of Low and Intermediate Level Waste p5
[88] Transcript of Evidence 11 September 2003 p59
[89] Transcript of Evidence 19 September 2003 pp83-4
[90] IAEA, Long Term Storage of Radioactive Waste: Safety and Sustainability, 2003, p1
[91] IAEA Predisposal Management of Low and Intermediate Level Radioactive Waste, Safety Guide, Vienna 2003, p1

MANAGEMENT OF RADIOACTIVE WASTE

2.170 The health risks posed by the waste have given rise to a complex system for its regulation and management. Indeed a whole industry has evolved to deal with radioactive waste.

2.171 "National and international standards and guidelines dealing with radiation protection and radioactive waste management, including disposal, have been developed and are continuously being improved".[93]

2.172 Because of the variability and diversity of the radionuclides, representing as it does waste from a range of facilities, "particular and constant attention has to be given to all stages of the management of waste".[94]

2.173 Two underlying principles in the management of the waste are that the producers of radioactive waste have the prime responsibility for its safe management, and that waste minimisation is an essential objective.[95]

2.174 The objective of a waste disposal facility is to isolate radioactive waste in ways that ensures there is no unacceptable health risk to humans and no long-term detriment to other biota and the environment.[96] In other words, the material is controlled until it decays into a stable or "safe" form. For some radionuclides this can take a very long time.

2.175 One of the critical factors in resolving radioactive waste problems is that the public's view sits at odds with that of much of the scientific community.

2.176 A point acknowledged by the IAEA:

> The solution generally proposed [for higher level wastes] is the use of deep geological repositories, with a combination of natural barriers and engineered systems to provide physical and chemical waste containment. In most countries siting a repository has proven difficult. The public continues to have fears about safety, lack of confidence in the technology and lack of knowledge about the options. Other hurdles include locating sites with the appropriate geological make-up establishing appropriate statutory and regulatory mechanisms, and sustaining the political support necessary for progress.[97]

2.177 In addressing the 3rd Scientific Forum at the IAEA General Conference in 2000, the Director-General stated:

> "The development of *publicly agreed solutions* [emphasis added] to radioactive waste management is an issue central to the future of nuclear technology. Despite the agreement among most experts that geological disposal is safe, technically feasible, and environmentally sound, the public at large remains sceptical"…

2.178 This view is supported by the Canadian Nuclear Safety Commission:

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[92] Department of Industry, Science and Resources, *Safe Storage of Radioactive Waste: The National Store Project: Methods for choosing the right site*, Public Discussion Paper July 2001, p11
[93] IAEA, Radioactive Waste Management, Status and Trends – Issue #3, August 2003, p72
[94] IAEA Safety Standards Series, Predisposal of Low and Intermediate level Waste p2
[95] The IAEA International Conference on the Safety of Radioactive Waste Management 2000, Report of the Board of Governors, Attachment p2 and IAEA Safety Standards Series, Predisposal of Low and Intermediate level Waste 11
[96] NHMRC Codes p9
[97] www.iaea.org/worldatom

> "...lack of credibility of waste management organisations and regulators seems to reflect a lack of credibility in governments and "big business" as a whole. For waste management implementers and regulators, this translates not to a lack of confidence in their competence, but to scepticism about their integrity and intentions."[98]

CATEGORIES OF RADIOACTIVE WASTE

2.179 An important element in the management of radioactive waste has been the development of an internationally accepted classification system.

2.180 The radioactive wastes are classified according to the amount and types of radioactivity in them to ensure that they are "handled, stored and disposed of in ways that are appropriate to [their] characteristics".[99]

2.181 Although there is a "public perception that all nuclear waste is a singular material...",[100] it is more accurate to say that "radioactive waste can exist at levels from the trivial to the extremely hazardous".[101]

2.182 Thus different categories have been developed, based on the types of hazard and requiring an appropriate type of management, to ensure that no one receives more than a permitted dose of radiation.[102]

2.183 According to the IAEA, member states classify radioactive waste "based on both qualitative and quantitative criteria in which wastes are commonly grouped according to their origin, radioactivity content, radiotoxicity and thermal power. There is often a substantial overlap between the various waste classes".[103]

2.184 Mr Smith, representing the NSW Environment Protection Authority, summarised the classifications for the Committee at public hearings:

> **Mr SMITH**: ...The Committee would be interested in the three classifications of radioactive waste and the internationally accepted best means of managing those. Low level wastes, such as contaminated laboratory clothing and glassware, smoke alarms or luminous instrument dials, comprise the bulk of the waste proposed for transport. That is planned for shallow burial in the proposed national repository in South Australia.
>
> Intermediate waste has high levels of radiation and comprises reprocessed fuel elements from reactors, sealed sources previously used in gauges and in medical therapy devices. Those wastes will be placed in the proposed store, where they will be kept above ground in sealed containers. As the Committee would know, the Commonwealth is proposing to construct such as store, but has not yet revealed where that might be.
>
> High level wastes include very radioactive sources from the reactor. They are not proposed for long-term storage in Australia but will be sent overseas to be reprocessed down to intermediate levels.[104]

Low Level Waste (LLW)

[98] *Public Information, Consultation and Involvement in Radioactive Waste Management: An International Overview of Approaches and Experiences*. Nuclear Energy Agency, OECD, 2003, p17
[99] www.radioactivewaste .gov.au/australia/categories.htm
[100] Duncan AATSE p1 F4
[101] Transcript of Evidence 7 October 2003 pp46, 7
[102] *No Time To Waste*, Report Of The Senate Select Committee On The Dangers Of Radioactive Waste April 1996, Parliament Of The Commonwealth Of Australia p3
[103] IAEA, Radioactive Waste Management, Status and Trends – Issue #3, August 2003, p22
[104] Transcript of Evidence 19 September 2003 pp66/7

2.185 Low Level Waste is radioactive waste that contains enough radioactive material to require action for the protection of people, but not so much that it requires shielding during handling, storage or transportation. DEST confirmed this in its submission, stating that "special shielding is normally not required for the transport and handling of this material".[105]

2.186 This type of waste is largely generated by ANSTO in its radionulclide production as well as in hospitals, laboratories and industry. It can comprise papers, rags, tools, protective clothing, wrapping material filters, etc.

2.187 In its submission to this inquiry, DEST states that this low level waste contains low levels [without defining what is meant by "low levels"] of beta and gamma emitting radionuclides and normally very low levels of alpha emitting radionuclides.[106]

2.188 This waste is the least dangerous of the classes of radioactive waste; according to one source, "worldwide it comprises 90 per cent of the volume but only 1 per cent of the radioactivity" of all radioactive waste. It is often compacted as part of its management.[107]

2.189 As part of the management of its low level waste, ANSTO measures, by means of a scanning system, the radioactivity in each of its waste drums. Each drum is then bar coded and "the radionuclide content of each drum entered into a database to enable a complete record of ANSTO's radioactive wastes to be compiled".[108]

Intermediate Level Waste (ILW)

2.190 In its submission, DEST advised that intermediate level waste is radioactive waste that contains "significant levels" of beta and gamma emitting radionuclides and could also contain "significant levels" of alpha emitters. The waste sometimes requires shielding during handling and transport.[109]

2.191 The World Nuclear Association states that intermediate level waste "contains higher amounts of radioactivity and normally requires shielding.

2.192 This waste needs little or no provision for heat dissipation.

2.193 Intermediate Level Waste has been further categorised into two subcategories– Short-Lived Intermediate Level Waste (SLILW) and Long-Lived Intermediate Level Waste (LLILW).

Short Lived ILW

2.194 Short-lived radioactive materials have a half-life of less than 30 years and "typically include gauges and sealed sources used in industry and medicine and small items of contaminated equipment".[110]

[105] DEST Submission No. 367 p6
[106] DEST Submission No. 367 p6
[107] www.uic.com
[108] ANSTO Managing Radioactive Wastes and Spent Fuel, undated, p6
[109] DEST Submission No. 367 p6
[110] EIS Summary p5

2.195 According to Barnaby, quoting "official documents", long lived intermediate level, "which must be shielded", contains more than 4 kilo-Bequerels per gram of radionuclides that emit alpha particles."[111]

Long Lived ILW

2.196 DEST advises in its submission that Long Lived Intermediate Waste

2.197 "consists of historical waste concentrates from mineral sands processing, some types of disused sealed sources and industrial gauges, reactor components, irradiated fuel components, ion-exchange resins and filters (e.g. the result of reactor operation), and items that contain radium such as gauges and paint. In the future it will also include solid waste arising from the reprocessing of research reactor fuel from ANSTO, which will begin to be repatriated to Australia in glass or cement from around 2015.[112]

2.198 It has half lives in excess of 30 years.

High Level Waste (HLW)

2.199 High Level Waste contains "highly radioactive fission products and some heavy elements with long-lived radioactivity". These large concentrations of both short and long-lived radionuclides are sufficiently radioactive to require both shielding and cooling. "If spent reactor fuel is not reprocessed [the process which removes the enriched uranium and the plutonium], all the highly radioactive isotopes remain in it and so the whole fuel assemblies are treated as high level waste".

2.200 "High level waste contains high levels of beta and gamma radiation emitters and significant levels of alpha emitters and generates significant amounts of heat (greater than 2kW/cubic metre, or about the same as an electric kettle)".

2.201 High level radioactive waste may be the spent fuel from a reactor or the principal waste derived from this, by means of reprocessing. "Both high level waste and spent fuel are very radioactive and people handling them must be shielded from their radiation. Such material is shipped in special containers" which are designed to prevent radiation leaking out and rupture in case of an accident.[113]

2.202 High level waste represents 3 per cent of the volume of all radioactive waste but holds 95 per cent of all the radioactivity.[114]

2.203 Spent fuel "after it has been used is highly radioactive and is dangerous to living things. It will remain radioactive for thousands of years..."[115]

National Health and Medical Research Council Code of Practice for Near-Surface Disposal of Radioactive Waste (NHMRC Code)

2.204 The Code established in 1992 an Australian classification system for radioactive waste. Its aim was to encourage uniform practice for the near-surface disposal of radioactive waste in Australia.[116]

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[111] Sutherland Shire Council Submission No 350, Attachment No1 p3
[112] DEST Submission No. 367 p6
[113] www.uic.com.au
[114] www.uic.com.au
[115] ActewAGL, www.actewagl.com.au/education/electricity/generation/nuclear.cfm

2.205 The Code contains provisions for the development of "qualitative and quantitative waste acceptance criteria" based on "primary dose limitation and safety assessments" including

- Derived activity concentration limits for radionuclides in the waste, and
- A restriction on the total activity of radionuclides to be disposed of.

2.206 It identified four categories of waste, categories A, B, C and S and defined them by the activity concentration limits for the various radionuclide groups. The activity concentration limits are measured in Bq/kg. (A copy of these can be found in Appendix 5)

Usefulness of the Classification System

2.207 The senate select committee radioactive waste observed in 1996 that:

> "Because the definitions are qualitative rather than quantitative, problems can arise over different views about the category in which a particular material belongs. The Committee heard claims that the nuclear industry may try to reduce problems of handling waste by reclassifying it to a lower level. The Committee believes it is essential that problems relating to definitions and categories be addressed as a matter of urgency because of their significance in developing a long-term plan for managing radioactive waste".[117]

2.208 Seven years later the Committee concurs with this comment and endorses it.

2.209 The current classifications provide little assistance for the public in understanding just what to expect within each classification. In fact they are generally meaningless.

2.210 The nature of these definitions has made it difficult to come to a good understanding of, or feel for, the risks and possible impact on health and safety for the community.

2.211 The Committee finds it curious that the broad scientific discussion on the health effects of ionising radiation utilises equivalent dose as a key tool but the categorisation of waste ignores such a measure.

2.212 The central concern to the public from radioactive waste is the potential health hazard. The public is not concerned so much with the volume of the waste but the effects of its radioactivity. The equivalent dose (in sieverts) is an easily understood measure of that hazard.

2.213 It is hard to understand then, why categories of radioactive waste are not classified by a dose range (in addition to the existing classifications).

2.214 The NHMRC Code provides the basis for such classification by setting identifying the radionuclide group and activity concentration limits. This is discussed further in chapter six.

Spent Fuel and High Level Waste

2.215 As the Committee noted above, there is some disagreement as to whether spent fuel constitutes high level radioactive waste. While the Committee agrees in principle with

[116] National Health and Medical Research Council Code of Practice for Near-Surface Disposal of Radioactive Waste (NHMRC Code) p1

[117] *No Time To Waste*, Report Of The Senate Select Committee On The Dangers Of Radioactive Waste April 1996, Parliament Of The Commonwealth Of Australia p3

the conclusion of the *No Time to Waste* Report that "correct management of these fuel rods is the issue", it is necessary to decide if the material constitutes waste and falls within the terms of reference of this inquiry.

2.216 Essentially there are two strategies for dealing with spent fuel:

- Reprocessing to extract potentially valuable fissile material for recycling and the management of the resulting reprocessing waste (generally known as the 'closed fuel cycle'); and
- The direct disposal of the spent fuel, if it is declared a waste (generally known as the 'once through fuel cycle').

2.217 In other words, if spent fuel is not reprocessed it can be considered waste. If it is reprocessed, only the residue after extracting the uranium and the plutonium for recycling into fresh fuel is considered waste.

2.218 According to DEST, "Australia does not produce high level [radioactive] waste".[118] ANSTO in public documents states that it "has no high level radioactive wastes".[119]

2.219 Representatives from ANSTO reconfirmed these positions at the public hearings:

> **Dr HARRIES:** When it comes out of the reactor it is not radioactive waste.

2.220 And likewise Mr McIntosh,

> **Mr McINTOSH:** They do not meet the definition of high level radioactive waste because they are not radioactive waste, as I said earlier.[120]

2.221 The reason for this is simply a matter of an agreed international definition:

> **Mr McINTOSH:** I referred earlier to my role in the negotiations of the International Atomic Energy Agency Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management. That clearly defines spent fuel and radioactive waste as two different substances. I am not sure how a "Commonwealth definition of convenience" can be derived from that. Certainly, a similar distinction appears in the Commonwealth Environment Protection and Biodiversity Conservation Act but that is based on an international standard.[121]

2.222 The IAEA supports this position in an approach that does sound strangely arbitrary, stating that high level waste includes "spent fuel, if it is declared a waste".[122]

2.223 ANSTO also asserts that even if spent fuel were categorised as waste it would not be regarded as high level waste:

> **Mr McINTOSH:** … The other point I would make is that the definition of short-lived [sic] waste includes a certain prescribed amount of heat generation. The spent fuel that is moved off site from Lucas Heights does not generate that sort of heat, so even if you were to ignore the distinction between spent fuel and radioactive waste you still would not come up with high level waste.[123]

[118] www.radioactivewaste.gov.au/australia/categories.htm
[119] Managing Radioactive Wastes and Spent Reactor Fuel, p5
[120] Transcript of Evidence 11 September 2003 pp43/4
[121] Transcript of Evidence 11 September 2003 p32
[122] IAEA Classification of Radioactive Waste Safety Guide 1994 p8
[123] Transcript of Evidence 11 September 2003 p32

2.224 But ANSTO's own description of the handling of the spent fuel indicates a significant level of heat generation that requires cooling:

> **Mr IAN COHEN:** Immediately after irradiated nuclear fuel has been removed from the HIFAR reactor, does it meet the heat criterion and other criteria to be classified as high level radioactive waste?...
>
> **Mr McINTOSH:** But it does not leave the reactor building for some considerable time. It is stored in the reactor storage block. With the replacement reactor it will be moved under water and stored in a service pool adjacent to the reactor pool. It does not leave the reactor building until the heat levels have decayed... They will generate heat, but they will be stored in that pool inside the reactor building, which will have the same physical protection in place as the reactor itself. It will not be moved off site while it is generating that sort of heat.
>
> **Mr IAN COHEN:** None of it will be sent to the national store for long-lived intermediate level waste?
>
> **Mr McINTOSH:** No. Once the fuel has cooled sufficiently to allow it to be moved safely and securely it will be sent overseas for reprocessing. The waste arising from the reprocessing will be returned to the national store for intermediate level waste.[124]

2.225 The NSW Environment Protection Authority (now part of the Department of Environment and Conservation), provided the Committee with supplementary information on this matter concluding that:

> "From its radioactivity, heat production and other physical characteristics, it is the view of the DEC that spent fuel should be considered high level radioactive waste"[125] [See Appendix 6]

2.226 Dr Frank Barnaby, a nuclear physicist, agrees:

> When removed from the HIFAR reactor, spent fuel elements are stored on site at ANSTO until sent abroad for reprocessing (mainly to Cogema in France). The spent elements are stored for several years under water, to allow them to cool as some radioactive decay occurs, and then moved to a dry storage facility (steel-lined holes drilled into rock) at ANSTO. When removed from the HIFAR, the elements are so radioactive (and generate so much heat) that, if they were classified as waste, they would be HLW.

2.227 The ostensible reason for not classifying the HIFAR elements as waste is that they will eventually be reprocessed. After reprocessing, however, the radioactivity in the elements will be returned for storage in Australia. The real reason for not classifying the spent fuel as HLW is presumably to avoid triggering public opposition to the government's plans for dealing with the disposal of radioactive waste.[126]

2.228 When asked if he regarded spent fuel rods as nuclear waste, Dr Loy, CEO of ARPANSA, told the Committee: "No, it is spent fuel."

2.229 However, there seemed little doubt that he regarded it as high level material

> **Dr LOY:** ... Whether you choose to call it spent fuel, high level waste or whatever I do not find particularly enlightening." But he did concede that it "is a highly hazardous material, inherently, no question".[127]

[124] Transcript of Evidence 11 Sept 43/4
[125] DEC Correspondence p3
[126] Sutherland Shire Council Submission No 350 Attachment 1 p3
[127] Transcript of Evidence 26 September 2003 pp23/4

2.230 The 1993 Report of the Research Reactor Review, Future Reaction (known as the McKinnon report) concluded that "the spent fuel at Lucas Heights can only sensibly be treated as high level waste".[128]

2.231 The NSW EPA supported this position:[129]

> **CHAIR:** Mr Cohen mentioned spent fuel elements going to Port Botany, which we discussed earlier today. Do you classify those spent fuel elements as nuclear waste?
>
> **Mr SMITH:** Yes.

2.232 The decision as to whether spent fuel should be defined as waste, in accordance with the IAEA definition, appears to be left to each member state.

2.233 The Australian National Report to the Joint Convention of the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management in July 2003 (under the auspices of the IAEA) notes:

> "Commonwealth legislation and ARPANSA's licensing system require that where spent fuel has been designated for disposal, it will be handled as radioactive waste from the point in the nuclear fuel cycle where it is no longer regarded as spent fuel. Currently, it is anticipated that all spent fuel managed in Australia by ANSTO will be transported overseas for either reprocessing or long-term storage and/or disposal, and thus will be regarded as spent fuel until it enters the off-shore jurisdiction."[130]

2.234 While such discretion probably makes sense in the European context with its large volumes and complex management of spent fuel and radioactive waste, in the Australian context it seems to be arbitrary. While the Committee does not see this approach as devious, as some have argued to this inquiry, it does appear obdurate.

2.235 ANSTO advised the McKinnon report in 1993 that rather than being a "problem", "spent fuel rods were an asset" because "they had value for reprocessing even if Australia did not want them".

2.236 ANTSO's financial statements for 2002/03 note that the Federal Government is providing over $98million to remove spent fuel rods from Lucas Heights and to meet the cost of reprocessing offshore. In accounting terms, this is not at the moment a liability for ANSTO but it is certainly a liability for the taxpayer and hardly fits the definition of an asset.[131]

2.237 As well as these technical arguments there is also a more philosophical argument about waste being quite simply something you no longer require, a point raised at the public hearings by Professor Allen:

> **Professor ALLEN:** … I have worked in the nuclear field virtually all my professional life, but it is a very big field. One has limited knowledge or acquaintance with many aspects but it is a little bit of semantics about spent fuel. I think you said the EPA recognise spent fuel as being waste. Normally in a kitchen you use stuff and what you do not use is waste, and that gets recycled or whatever. So I think in normal everyday parlance spent

[128] Report of the Research Reactor Review, Future Reaction. The McKinnon report, 1993 p216
[129] Transcript of Evidence 11 September 2003 p76
[130] Australian National Report to the Joint Convention of the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, July 2003 p23
[131] ANSTO Annual Report 2002/03 p124 note (a)

> reactor fuel would be regarded as waste: it cannot be used again, it cannot be recycled unless it goes somewhere and undergoes treatment for recycling.[132]

2.238 Dr Loy conceded that in the generic sense it is waste:

> **Dr LOY:** It is fuel that has been used in a reactor and is not able to be used effectively any more. It contains the original fuel as well as higher quantities of fission products and it is those fission products in particular that make it highly radioactive and, therefore, hazardous. The purpose of the next stage in its life is for it to be reprocessed into a waste form that is much more manageable, and that is the aim of it being transported to Port Botany and, hence, to France.[133]

2.239 To take the household analogy, what goes into the recycling bin is waste because it is surplus and cannot or will not be re-used by the householder. It is made up of paper, glass, steel, but the householder deems it waste. Just because it is of commercial value to someone else does not mean it is not waste to ANSTO.

2.240 The Committee supports the conclusion of the McKinnon report that "the pretence that spent fuel rods constitute an asset must stop".[134]

2.241 For the purposes of this inquiry, the Committee regards ANSTO's spent fuel as waste. The Committee cannot understand why ANSTO cannot acknowledge this point at least when dealing with the public. If it chooses or needs to continue dealing with the material as spent fuel (eg contractual or technical reasons) then it is free to do so.

RECOMMENDATION 9: ANSTO should acknowledge that spent fuel is waste, and in dealing with the Australian public, should identify it as waste.

[132] Transcript of Evidence 22 October 2003 p14
[133] Transcript of Evidence 26 September 2003 p24
[134] Report of the Research Reactor Review, Future Reaction (known as the McKinnon report) 1993 p216

Chapter Three - Regulatory Framework for the Management of Radioactive Waste in Australia

CONSTITUTIONAL POWERS

3.1 Traditionally, the Federal Government has played a very active role in nuclear technology in Australia, mainly through the Australian Atomic Energy Commission and its successor organisation, ANSTO.

3.2 However, control of radioactive materials has generally rested with the States and Territories.[135]

3.3 This sharing of responsibilities is not surprising given there is no clearly designated constitutional power in relation to the regulation of nuclear technology in Australia, as Mr Nolan explained at the public hearings:

> **Mr NOLAN:** ...it seems to me there is no obvious head of Commonwealth power. As you will appreciate, the Commonwealth has specifically allocated powers given to it by the Federal Constitution ... There it is not an explicit power that confers upon the Commonwealth the right to regulate in respect of nuclear technologies. Indeed, although they were not completely unheard of, nuclear technologies were virtually unheard of at the time the Constitution was formed ...
>
> I imagine that it is related to the defence power. It is an implied power that relates to the defence power; but I may be wrong about that. Otherwise it is regarded as being the exercise of a power that the Executive Government might be expected to exercise as a national government, because of the public interest in nuclear medicine in such matters... I would be very surprised, given the history, that there would be any substantial revisiting of the power. In other words, if the matter was challenged I would be very surprised if the High Court would decide that there is no power here at all and that somehow this activity is unconstitutional...[136]

3.4 Councillor Rankin from Sutherland Shire confirmed the role of the defence power in the Federal Government's activities.

> **Ms RANKIN:** The High Flux Australian Reactor [HIFAR] was built under the Defence Act, so historically the defence powers were relied on...[137]

3.5 However, there is no direct defence role today as confirmed by ANSTO representatives:

> **Dr HARRIES:** To follow up on that, when HIFAR was built we were called the Australian Atomic Energy Commission, which is a different organisation. At present we are under ANSTO, which is a different Act with different requirements. It no longer has that Defence capacity.[138]

3.6 Dr Holland, who has written a chronology on radioactive waste, stated that "defence historically has been important... but that importance has diminished since around

[135] *No Time To Waste*, Report Of The Senate Select Committee On The Dangers Of Radioactive Waste April 1996, Parliament Of The Commonwealth Of Australia p19
[136] Transcript of Evidence 11 September 2003 p8
[137] Transcript of Evidence 11 September 2003 p9
[138] Transcript of Evidence 11 Sept p29

about 1977 significantly… so I would say, in a contemporary context, defence is not a significant motivation".[139]

JURISDICTIONAL OVERVIEW

3.7 While the Federal Government has exercised a very direct role in nuclear technology, control of radioactive materials and radioactive waste has in principle been the responsibility of the States and Territories. All States and Territories have laws that explicitly control the use of radioactive materials.

3.8 Prior to February 1999, there was no Commonwealth legislation comparable with the State laws controlling the use of radioactive materials. The creation and use of radioactive materials by Commonwealth bodies was, therefore, not subject to external monitoring or legal control because the Commonwealth is generally not bound by State laws. In practice, this applied to ANSTO. which (in 1996) was responsible for about 90 per cent of Australia's radioactive waste (excluding mining and milling operations).[140]

3.9 The unique nature of ionising radiation has seen the evolution of a specialised regulatory regime to manage it.

FEDERAL LEGISLATION

3.10 There are two major pieces of federal legislation relevant to this inquiry, the ARPANS and the ANSTO Acts.

ARPANS Act

3.11 The Australian Radiation Protection and Nuclear Safety Act commenced on 5 February 1999. The object of the ARPANS Act is to "protect the health and safety of people, and to protect the environment from the harmful effects of radiation".[141] The Act established the statutory agency of ARPANSA and the statutory office of the Chief Executive Officer of ARPANSA.

3.12 The ARPANS Act filled a gap in the regulation of radioactive material at the Commonwealth level. Essentially, the Act applies to Commonwealth-related activities. Non-Commonwealth agencies and activities continue to be regulated by applicable State or Territory radiation protection and environment legislation.[142]

3.13 Specifically, ARPANSA is responsible for:

i) regulating all Commonwealth entities (including departments, agencies and bodies corporate) and Commonwealth contractors either dealing with radioactive material or apparatus or undertaking conduct in relation to nuclear installations or prescribed radiation facilities;

[139] Transcript of Evidence 19 September 2003 p85
[140] *No Time To Waste*, Report Of The Senate Select Committee On The Dangers Of Radioactive Waste April 1996, Parliament Of The Commonwealth Of Australia p7
[141] Submission No. 456 p2
[142] Guide to the Australian Radiation Protection and Nuclear Safety Licensing Framework, Edition 1, March 1999, p3

ii) providing advice to Government and the community on radiation protection and nuclear safety;

iii) undertaking research and providing services in relation to radiation protection, nuclear safety and medical exposures to radiation; and

iv) promoting uniformity of radiation protection and nuclear safety policy and practices across jurisdictions of the Commonwealth, the States and the Territories.

3.14 The ARPANS Act prohibits a Commonwealth *controlled person* from dealing with radioactive sources unless authorised by a source licence issued by the CEO of ARPANSA. "Dealing with" includes transporting a source.

3.15 A controlled person means any of the following: a Commonwealth entity, a Commonwealth contractor, a person in the employee of a Commonwealth contractor, a person in a prescribed Commonwealth place.

3.16 Similarly, the Act prohibits a controlled person from preparing a site for, constructing or operating a controlled facility unless authorised by a facility licence issued by the CEO of ARPANSA.

3.17 The Commonwealth's proposals for a national low level radioactive waste repository (NRWR) and the national store for long-lived intermediate level waste (National Store) would each be a controlled facility and would require a facility licence. Transport of materials may also be regulated through source licences issued by the CEO of ARPANSA.[143]

ANSTO Act

3.18 This Act established the Australian Nuclear Science and Technology Organisation (ANSTO) in 1987 to replace the Australian Atomic Energy Commission.

3.19 ANSTO is Australia's national centre for research and development in nuclear science and technology. Its activities include operating nuclear facilities, scientific research, producing radioactive materials and other irradiation services for medical use on a commercial basis, providing advice to Government, and assisting industry to develop new or improved products and processes. ANSTO supplies about 85 per cent of the radioisotopes in Australia.

3.20 According to ANSTO material, its mission is to provide expert advice, nuclear services and nuclear-based products on demand and to identify, develop and promote innovative solutions through the application of nuclear-based research and development.

3.21 ANSTO is the major radioactive waste generator in Australia. However, as it is a Commonwealth statutory authority and is specifically exempt from State legislation, this creates significant jurisdictional issues for the state in influencing the management of radioactive waste in New South Wales.

3.22 ANSTO' s functions most relevant to this Inquiry are

[143] Submission No. 456 pp2,3

- to condition, manage and store radioactive materials and radioactive waste, arising from:
- the organisation's activities (including the production of radioactive materials for other persons); or
- the activities of companies in which the organisation holds a controlling interest (including the production of radioactive materials for other persons); or
- the use by other persons of radioactive materials produced by the organisation or such companies; or
- the activities of other persons who are specified in the regulations.

3.23 The function to manage radioactive material not produced by ANSTO was added in 1992 to neutralise "a decision of the New South Wales Land and Environment Court forbidding ANSTO from storing radioactive materials owned by CSIRO". Sutherland Shire Council had taken legal action because of concerns that Lucas Heights would become the national waste repository "even though the ANSTO Act specifically prohibits this".

3.24 As Dr Perkins from the federal Department of Education, Science and Training outlined for the Committee:

> **Dr PERKINS:** The ANSTO Act was amended in the early 1990s to the effect that waste which was not generated at Lucas Heights could only be stored at Lucas Heights if there was a regulation to allow it. So essentially the storage at Lucas Heights of waste not generated at Lucas Heights is prohibited unless there is a regulation.[144]

3.25 Following this court case, the Act was amended to specifically exempt ANSTO from State laws including those relating to land use, environment protection, radioactive materials and dangerous goods.

3.26 ANSTO told the 1996 Senate Select Committee that "it [complied] with all Commonwealth requirements and conforms to NSW norms" and that:

> The policy of successive Commonwealth Governments is that such instrumentalities (i.e. ANSTO) are to operate consistently with all State laws where there is no existing, parallel, Commonwealth law and where those laws do not directly conflict with the existing ANSTO Act.[145]

NEW SOUTH WALES LEGISLATION

3.27 There are two acts of interest in this context.

Radiation Control Act

3.28 Radioactive substances and radiation apparatus are regulated in NSW through the application of the *Radiation Control Act 1990* and its Regulations, managed by the Environment Protection Authority. The aim of the Act is to "secure the protection of persons and the environment from exposure to harmful ionising and non-ionising radiation to the maximum extent that is reasonably practicable taking into account

[144] Transcript of Evidence 7 October 2003 p57

[145] *No Time To Waste*, Report Of The Senate Select Committee On The Dangers Of Radioactive Waste April 1996, Parliament Of The Commonwealth Of Australia pp21/24

social and economic factors and recognising the need for the use of radiation for beneficial purposes".[146]

3.29 The EPA summarised this in evidence as setting out "an extensive regulatory and guidance framework with the aim of protecting people and the environment from possible harmful effects of radiation".[147]

3.30 This Act regulates radioactive material in New South that is not covered by Commonwealth legislation.

Uranium Mining and Nuclear Facilities (Prohibition) Act

3.31 The other NSW legislation of interest here is the Uranium Mining and Nuclear Facilities (Prohibition) Act 1986. This Act, which is administered by the Department of Mineral Resources, prohibits the prospecting for, or mining of, uranium and its ores, and the construction of any nuclear facility in New South Wales.

3.32 The Act contains a number of exemptions in Sec 8(3). The most significant exemption relates to Commonwealth activities.

3.33 Specifically, section 8(3) states:

> Nothing in this section prevents –
>
> (a) the construction or operation, under an Act of the Commonwealth, of a nuclear facility by the Atomic Energy Commission or by any authority of the Commonwealth that replaces that Commission;
>
> (b) the construction or operation of a facility for the storage or disposal of any radioactive waste material resulting from the use of nuclear materials for research or medical purposes or for any other purpose authorised under the Radioactive Substances Act 1957; or
>
> (c) the operation of a nuclear powered vessel.

3.34 The Act does not prevent the removal, transportation and disposal of nuclear materials and waste from research and medical uses. As well, the safe use of nuclear materials, which are important to medical and industrial applications, are exempted.[148]

3.35 A number of witnesses and submissions urged the state government to amend this legislation to remove this exemption in favour of the Federal Government.

3.36 They argued that, firstly, this would be a declaration of the state's position by the state government on behalf of is citizens and secondly, it offered some practical advantages if the state government wished to oppose the Federal Government's plans.

3.37 In the words of one Blue Mountains resident, "it sends a strong message that New South Wales is serious and does not accept the Commonwealth proposals as a fait accompli".[149]

3.38 Mr Priceman from the Sutherland Shire Environment Centre stated in evidence:

[146] Submission No. 474 p7
[147] Transcript of Evidence 11 September 2003 p66
[148] Hansard LA 1 December 1986, p7365
[149] Transcript of Evidence 26 September 2003 p37

> **Mr PRICEMAN:** ... It [the Uranium Mining and Nuclear Facilities (Prohibition) Act] is often quoted as being legislation that prohibits the dumping of nuclear waste in New South Wales. But that Act specifically excludes the activities at Lucas Heights. If the New South Wales Government is really serious about opposing the transport and dumping of nuclear waste in this State then the Act must be amended without delay.[150]

3.39 Mr Noonan from the Australian Conservation Foundation expanded on this theme:

> **Mr NOONAN:** ACF believes that there are a number of significant advantages to State legislation against nuclear waste transport and dumping... [E]ssentially your legislation does not even attempt to prevent the Commonwealth proceeding, it actually invites the Commonwealth to proceed, it gives them an immunity in a sense because they are provided for through subsection 8(3) of that Act.
>
> ...An example of how the legislation can have significant legal capacity is that the Commonwealth has always said that the nuclear waste transport and dumping will be authorised under the ARPANS Act. However, that Act works in a legal sense by listing in the regulations, the State Acts, that it overrides... but it does not override more recent State legislation unless they have been listed in the regulations and the South Australian and the pending Western Australian Nuclear Prohibitions Act have not been listed under the ARPANS Act, so they are not overridden as yet by the Federal Government in a legal sense...[151]

3.40 Dr Holland on the other hand saw this approach, "quite legitimately", as a "forceful political strategy more than it is a legal strategy".[152]

3.41 Minster Debus' view on this was that "the possibilities of legal action are extremely restricted".[153]

LEGISLATION IN OTHER STATES

3.42 All other States have legislation regulating radioactive material. Like NSW, they are subject to qualifications and limitations imposed by Commonwealth powers and legislation.

3.43 Of particular interest in this inquiry is legislation in Western Australia and South Australia that aims to prevent the Federal Government establishing radioactive waste storage facilities in those States.

Western Australia

3.44 In 1999, the Western Australian Government passed the Nuclear Waste Storage Facility (Prohibition) Bill. The Bill was introduced by the then Leader of the Opposition in response to a proposal by Pangea Resources Australia to establish an international waste disposal facility in outback Western Australia. The Bill specifically excluded nuclear waste generated in Australia from its definition of "nuclear waste". The Bill was passed as the Nuclear Waste Storage (Prohibition) Act.[154]

3.45 The WA Premier introduced the Nuclear Waste Storage (Prohibition) Amendment Bill in August 2003. The Bill seeks to extend the application of the Act to the storage of

[150] Transcript of Evidence 11 September 2003 p51
[151] Transcript of Evidence 19 September 2003 pp64,5
[152] Transcript of Evidence 19 September 2003 p86
[153] Transcript of Evidence 26 September 2003 p11
[154] www.anawa.org.au, Nuclear Waste Prohibition Act

all nuclear waste, including that generated in Australia. In addition, it would make it an offence to transport nuclear waste in or through Western Australia. The Bill provides for exemptions for storage or transportation of waste in an emergency.

3.46 The Liberal Party has indicated it will support the Bill, while the Nationals have given it their in-principle support. The Bill was still under consideration when the WA Legislative Assembly adjourned for 2003.

South Australia

3.47 In 2000, the Coalition Government in South Australia brought in the Nuclear Waste Storage Facility (Prohibition) Act. As in Western Australia, this legislation was a reaction to the Commonwealth's continued search for a medium to high level storage facility within the State. The then Minister introducing the Bill, the Hon IF Evans, Minister for Environment and Heritage, stated that South Australia had no problem in principle with storing low level waste. At the same time, however, he felt that the State might become the site of the medium to high level waste storage facility. The SA Government therefore introduced the Nuclear Waste Storage (Prohibition) Bill, preventing the construction or operation of a facility to store or dispose of certain types of nuclear waste, including Category S waste (NHMRC Code), as well as the transportation of such waste in the State.

3.48 Clause 13 of the Act prohibits public money from being used "to encourage or finance construction or operation of a nuclear waste storage facility. This clause prohibits the appropriation, expenditure or advancement of any public funds for the purpose of encouraging or financing any activity associated with the construction or operation of a nuclear waste storage facility in South Australia".[155]

3.49 In 2002, following the Federal Government's announcement of the siting of the lower level radioactivity waste facility near Woomera in South Australia, the Labor Government introduced amendments to the Act which extended the ban on nuclear waste storage and transportation to include Category A, B and C waste. (Existing facilities were given exemption.)

RELEVANT INSTRUMENTS

3.50 In addition to legislation, a number of other instruments are pertinent:

- Regulations for the Safe Transport of Radioactive Material 1996 Edition (Revised) drawn up under the auspices of the International Atomic Energy Agency (IAEA);
- Code of Practice for the Safe Transport of Radioactive Material 2001 (the Code). This Code, which is being accepted by Australian jurisdictions, applies the above regulations. This is referenced in the NSW Radiation Control Regulations
- National Health and Medical Research Council Code of Practice for the Near Surface Disposal of Radioactive Waste 1992 (NHMRC Code).

[155] South Australian Hansard, 31 May 2000

3.51 Radioactive waste is currently excluded from the National Environmental Protection Measure for the tracking of movement of controlled wastes between the States and the Territories.[156]

3.52 The EPA explained to the Committee in correspondence that "this separation of legislative provisions governing radioactive material from legislation governing other hazardous substances is a general acknowledgement of the significant differences between hazards posed by radiation and other hazardous materials". The Committee was advised though that as part of a current review, "the inclusion of radioactive materials is being given consideration".[157]

National Health and Medical Research Council Code of Practice for Near-Surface Disposal of Radioactive Waste (NHMRC Code)

3.53 The Code and its classification of radioactive waste was briefly described in the previous chapter.

3.54 Dr Loy, CEO of ARPANSA, has stated that in developing waste acceptance criteria for the Repository (see Chapter 5) he would be guided by this code.

3.55 According to the Code, waste within Category S (i.e. that which does not meet the specifications of Categories A, B or C) shall be unacceptable for near-surface disposal).

EMERGENCY SERVICES LEGISLATION

3.56 Relevant emergency services legislation is entirely State (NSW) based, being in the main the State Emergency and Rescue Management Act and Fire Brigades Act.

3.57 As Major-General Howard, Chairman of the State Emergency Management Committee, explained to the Select Committee:

> **Mr HOWARD:** ...An incident or any emergency involving nuclear materials would be dealt with under the New South Wales hazardous materials subplan, for which the New South Wales Fire Brigades is the legal combat agency, and they are supported by the Environmental Protection Authority. I think I should comment at this stage that in respect of security for transport of this type or other types of material, the primary responsibility here rests with the New South Wales Police. ...the emergency management arrangements outside the fence are the decision of the State Government. Obviously we have to be guided by certain information which we receive from them, but what we do outside the fence in terms of protecting the community of New South Wales is our business.[158]

3.58 The State has no jurisdiction on Commonwealth land therefore the NSW Fire Brigade has no responsibilities regarding storage on the Lucas Heights site. This is regulated through ARPANSA.[159]

3.59 However, there are arrangements between ANSTO and the New South Wales emergency services to respond to any emergencies at the Lucas Heights site:

[156] Submission No. 474 p7
[157] EPA Correspondence 03/11/03 p4
[158] Transcript of Evidence 19 September 2003 pp 18,28
[159] Transcript of Evidence 19 September 2003 p20

3.60 "ANSTO's Response Plan for Accidents and Incidents at ANSTO/LHSTC, developed in close consultation with the emergency services agencies, covers all possible events at the ANSTO facility, including test fuel and radioactive waste management facilities."[160]

3.61 Sutherland Shire Council's evidence argued that a potentially much more complex arrangement existed that could be tested by the Federal Government's proposals, particularly as they related to emergency services, as Dr Nolan explained in evidence:

> **Mr NOLAN:** ...some examples might suffice to indicate the potential seriousness of this legal minefield. That includes reference to the use of contractors for the movement of radioactive waste and the extent to which a Commonwealth contractor is controlled in a highly prescriptive manner, and the extent of the prescription insisted upon by the regulatory authority at the Commonwealth level, to see to it that safe transportation procedures are adopted. This is not just a matter of law and regulation alone. One needs the resources to back up the legal regulatory regime and we, in the legal part of the submission, point to recent research undertaken of the regulatory regime in the United States of America, where a number of mishaps and accidents have been identified.
>
> References to the material are contained in the submission. The point is made that in many of these cases it transpired that there was no clear line of legal responsibility...
>
> As I have said, it is not good enough to think that somehow these issues will be sorted out after some calamity occurs, because one has enough experience of jurisdictional disputes within a Federal system like Australia to know full well that the first thing to happen will be that each of the regulatory agencies involved will endeavour to sheet home the blame to somebody else. That is hardly a satisfactory position for the victims of any accident to be in, with the dilemma and difficulty they would have encountered having been involved in an accident, let alone the long time that one might expect would be involved working out well after the event who had the legal responsibility.[161]

NUCLEAR-FREE ZONES (NFZ)

3.62 Over the years a number of Councils have declared themselves to be a Nuclear Free Zone as a means to express opposition to radioactive material being transported through or stored in their areas. The first council nuclear-free zone was established in Melbourne in 1977 and others have followed.

3.63 While the councils that came before the Committee acknowledged that their nuclear-free tag had little or no legal status, most saw it as a reflection of their communities' views:

3.64 Holroyd Council:

> **Mr TULLOCH:** The nuclear-free status of Holroyd is only a recent occurrence. We have a situation where we have gone through the consultation process, we have advertised and we have had no negative responses from the community...[162]

3.65 Liverpool Council:

> **Ms ANTHONY**: Liverpool council and Liverpool as an area has been a nuclear- free zone for I think about 15 years, so we have what has become a reasonably historical stand on this. We are well aware that we have no legal rights to enforce what is basically a policy

[160] IAEA, Joint Convention, p17
[161] Transcript of Evidence 11 September 2003 pp4,5
[162] Transcript of Evidence 19 September 2003 p43

> decision at the council level, which we believe generally reflects the views of our community... but this is something our community feels very strongly about.[163]

3.66 The "declaration of a nuclear-free zone is more a statement of principle" according to the President of the Local Government Association but a declaration made "because that is what the community wants".[164]

3.67 They were therefore unhappy that the Federal Government would override their communities' views, the Mayor of Fairfield declaring that "...the Federal Government takes absolutely no notice of any of those signs and transports this material through our city willy-nilly, whenever they feel like it".[165]

3.68 The President of the Shires Association of NSW summed up the situation when she told the Committee:

> **Cr MILLER:** Councils that declare a nuclear-free zone have consulted their community and made that decision because that is what the community wants. There should be some respect for that... If areas all over the State are declared as nuclear-free zones, the Commonwealth Government has a serious problem with the way it has communicated, wrongly or rightly, about nuclear waste.[166]

3.69 Some councils are now re-evaluating the policy to be less absolute in the recognition of the beneficial applications of radioisotopes, as the Mayor of Holroyd explained to the Committee:

> **Mr TULLOCH:** ...Given that there are useful purposes, medical purposes for some of these, there may be some sort of distinction between those purposes as opposed to high level and intermediate level waste being transported through communities and the volume of that waste.[167]

3.70 The Australian Local Government Nuclear Free Zones and Toxic Industries Secretariat has been established but the structure and organisation remains essentially ad hoc. The Committee had trouble locating the secretariat and establishing a list of councils that had declared themselves to be nuclear-free. The Local Government and Shire Associations could not provide a comprehensive, up-to-date list councils that have passed that resolution.

3.71 It would seem that 22 Council of 172 councils within New South Wales can be confirmed through the secretariat or the Local Government and Shires Associations as being nuclear-free zones.

3.72 According to the Local Government Association and the Shires Association, these figures do not necessarily mean that there is not general support for the nuclear-free zone position among councils in this State. The peak organisations are in the best position to represent the views of councils as expressed at annual meetings of all NSW councils. Recently the associations formed a reference group on the issue of radioactive waste. The views expressed in the organisations' submissions to this inquiry, and in evidence from their respective Presidents, reflect the concerns of a large number of councils and are in accord with the nuclear-free status philosophy. In

[163] Transcript of Evidence 19 September 2003 p43
[164] Transcript of Evidence 22 October 2003 pp11,2
[165] Transcript of Evidence 19 September 2003 p42
[166] Transcript of Evidence 22 October 2003 p12
[167] Transcript of Evidence 19 September 2003 p43

this regard their policy is clear. (For a list of councils that are declared nuclear-free zones see Appendix 7)

CONCLUSIONS

3.73 As with so many issues in a federal system such as Australia's, commonwealth-state relations can be a tangle. This certainly seems to be the case with the regulation of radioactive waste.

3.74 The Uranium Mining and Nuclear Facilities (Prohibition) Act is a practical means for the state government to formally express its and the public's opposition to all or part of the proposals.

3.75 The potential jurisdictional maize that could emerge in the event of an accident during the transportation of the radioactive material is a concern.

3.76 Sutherland Council's legal expert opined that, while there is uncertainty regarding the precise constitutional powers surrounding nuclear technology, the High Court would be unlikely to conclude the commonwealth exercised no power in the area.

3.77 Should the state government consider action to oppose the proposals under consideration then the Committee feels that this avenue should not be ruled out.

RECOMMENDATION 21: The NSW State Government should obtain legal advice on the Federal Government's constitutional power relating to nuclear technology.

Chapter Four - Public Consultation

PUBLIC/INDUSTRY RELATIONS

4.1 One of the critical factors in the management of radioactive waste has been the relationship between the general public and the nuclear industry.

4.2 There is a widely, but not totally, accepted belief that radioactive material can be managed safely. The industry does not understand — or chooses to ignore — the public's concern about nuclear waste management.

Perception Gap

4.3 The public's view about nuclear technology has been moulded largely by events such as the deployment of nuclear weapons on Hiroshima and Nagasaki during WWII, and more recently the headline-generating accidents at Chernobyl and Three Mile Island, which, though used for peaceful purposes, produced no less trepidation in the public mind, regardless of the radiological consequences of the events. In addition to these has been the long-running fear of mutual nuclear destruction during the era of the cold war.

4.4 As Dr Murray, President of the NSW Local Government Association, observed, "it is a psychological and fear-driven issue".[168]

4.5 The public's mistrust of the nuclear industry has been exacerbated by a lack of openness by the both industry and supportive governments. Mr Smith, from the NSW EPA, told the Committee at a public hearing:

> **Mr SMITH:** ... The history is that the Commonwealth operator has not been open and clear about its activities. Hence, the community is rightly very concerned. How does the community know whether they are being adequately protected?"[169]

4.6 This view that the nuclear industry and its host governments operate in secret is widespread. It was starkly illustrated by Lord Winston during a debate in the House of Lords on a report on nuclear waste:

> "Very pertinent to that [public mistrust] was the measure of secrecy and deception practised in the early development of nuclear weapons. It has been pointed out that not even the Cabinet was fully notified at the time that a British nuclear bomb was being developed."[170]

4.7 While this level of secrecy surrounding the development of a nuclear bomb during wartime is not surprising, this comment nevertheless serves to illustrate the public's mistrust of the motives of the nuclear industry. As Lord Winston noted:

> "The problem with nuclear engineering, power and waste is that the risk is seen as being imposed rather than a matter of individual choice. The nuclear industry has not been viewed by the public as being lily white. There have been examples of unsatisfactory record-keeping, and, in some cases, monitoring. There have also been undocumented releases into the environment."[171]

[168] Transcript of Evidence 22 October 2003 p10
[169] Transcript of Evidence 11 September 2003 p68
[170] House of Lords Hansard, 29 Oct 1999, Column 485
[171] House of Lords Hansard, 29 Oct 1999, Column 485-6

4.8 The lack of openness with which the nuclear industry operates does nothing to allay the public's fear of the ramifications of a mishap involving nuclear waste. While that fear may not always be well-founded, it is nevertheless understandable:

> **Dr Smith:** ...Even during the passage of that low-grade material when some water, reportedly rainwater, got on to the drums and then fell off, there were a number of public reports or people rang the Minister, the media and various other people concerned that the radioactivity was leaking. There was major public alarm about that event. That is just with that low level of soil. When we are talking about shipping the higher level waste, the low-level stuff and the intermediate-level stuff, there will be these concerns that are raised by the public and that is why we have raised these jurisdictional issues. If something as low risk as that can cause concern, then the other issues must be much better planned and managed.[172]
>
> While the scientists and other experts in the industry assure the public that they can manage waste safely, and this may well be true, the person in the street remains sceptical. As one resident from the Blue Mountains observed, " there is quite a bit of fear of the unknown..."[173]

4.9 This fear has been called the perception gap, the difference between what the experts say, and what the public believes. As was noted during the Lords' debate, "it is not perverse of people to be unpersuaded by the cold facts of science".[174]

Industry Attitudes

4.10 The Inquiry heard various claims of secrecy, a lack accountability and trivialising by the nuclear industry.

4.11 The Member for Menai, Alison Megarrity MP, told the Committee of the problems the state government had in having the Federal Government "to publicly release more detailed information" during the new reactor EIS. Ultimately "Sutherland Council was forced to go to extraordinary lengths to obtain information about the proposal". A similar situation is occurring with the transportation and storage proposals.[175]

4.12 She went on to state "I really do take exception when the community is not considered sufficiently"... when there is uncertainty and concerns" a lack of information this simply feeds that uncertainty and concern".[176]

4.13 The Greenpeace representative reported claims that "Lucas Heights was a quasi-military facility". He claimed that "the level of secrecy surrounding ANSTO and its activities is, including the storage and transportation of nuclear waste, poses a real and significant threat to the health of the people of Sydney and a threat to the natural environment" and later that ANSTO is "almost hidden behind an impenetrable wall of secrecy".[177]

4.14 These claims echo a conclusion of the Senate Select Committee looking into the contract for the new reactor at Lucas Heights reported as:

[172] Transcript of Evidence 11 September 2003 p15
[173] Transcript of Evidence 26 September 2003 p44
[174] House of Lords Hansard, 29 Oct 1999, Column 497
[175] Transcript of Evidence 19 September 2003 p87
[176] Transcript of Evidence 19 September 2003 p91
[177] Transcript of Evidence 19 September 2003 pp3,8

> "The Committee is highly critical of ANSTO's approach to providing documents. Its attitude seems to stem from a culture of secrecy so embedded that is has lost sight of its responsibility to be accountable to Parliament".[178]

4.15 Councillor Rankin described how possible incidents are trivialised, for example, "when there is an accident on site ANSTO will issue a statement saying that there is a "teacup" of radiation instead of specifying how much [radiation] it is".[179]

4.16 These criticisms were not just limited to ANSTO. Mr Noonan from the ACF criticised the Commonwealth Government for its secrecy on "their nuclear expansion plans in Australia", the "radiological consequences analysis", and the "reactor plan" as well as preventing "this parliamentary committee from being privy to the sites of the transport corridor they intend to use for the high level waste".[180]

4.17 Not surprisingly, the community becomes sceptical of the relationship that evolve between governments, public sector organisations and specialist industry. Often the lines between them blur. This goes a long way to explaining why the public is reluctant to take industry representatives at their word.

4.18 At the public hearings, Mr Courtney, representing Greenpeace, advised the Committee of the following arrangement at ANSTO:

> **Mr COURTNEY:** … There are some companies that operate out of Lucas Heights, for instance Becquerel Laboratories - interestingly the CEO of Becquerel Laboratories is the husband of the CEO of ANSTO. Becquerel Laboratories has mineral allowances that are mostly for the uranium industry."[181]

4.19 Mr A Dr David Garnett is indeed listed as the company's general manager.

4.20 A Friends of the Earth representatives also expressed concern over what he saw as a lack of appropriate distance between industry and regulator, and which some might consider a 'cosy club':

> **Mr GREEN:** A very different situation pertains in Australia. ARPANSA was set up in the late 1990s. How would you deliberately and fatally compromise ARPANSA's independence? You would get the head of the Lucas Heights nuclear agency and give that person a direct role in the selection of the head of ARPANSA. That is precisely what happened. The CEO of ANSTO was one of three people who involved candidates for the appointment of the CEO of ARPANSA, and ARPANSA's independence was fatally, and deliberately, compromised from the very start. ARPANSA also has six former ANSTO employees working for it. … [This] is unacceptable. We need an independent regulator regardless of the outcome of these debates over the reactor and the dump.[182]

4.21 Clr Rankin, from Sutherland Shire, told the Committee that when the Federal Government set up the regulator "half the regulation branch consisted of previous ANSTO staff". Consequently, the community did not see the regulator as being at arm's length from the operator.[183]

[178] Transcript of Evidence 19 September 2003 p11
[179] Transcript of Evidence 22 October 2003 p54
[180] Transcript of Evidence 19 September 2003 p62
[181] Transcript of Evidence, 19 September 2003, p 13
[182] Transcript of Evidence, 7 October 2003, p.40,1
[183] Transcript of Evidence 22 October 2003 p64

4.22 Dr Holland outlined the need to have system of regulations had to have credibility so that "the community will trust the regulator and trust the organisation of its system". In this he identified historical problems in the nuclear sector worldwide "between the people who regulate this sector and the people who are actually the operators of the sector. It is difficult to get transparent and regulated regulation and I think that is one of the sources of doubt in this kind of thing.[184]

4.23 Dr Murray, President of the Local Government Association of New South Wales, argued that "the Commonwealth, as proponent and regulator, has a clear conflict of interest on this issue, and should put in place genuine transparent independent assessment and consultation processes".[185]

4.24 The Committee notes here that the *Not Time To Waste Report* recommended that the industry regulator "maintain an arm's length relationship with the industry as far as possible having regard to international best practice.[186]"

CONSULTATION PROCESSES

4.25 The climate of mistrust and suspicion that so surrounds the relationship between the industry and the community underscores the need to establish positive community support in dealing with radioactive waste.

4.26 Even opponents of all things nuclear acknowledge that waste must be stored somewhere; it cannot be wished away. Proper consultation with the community is therefore essential in winning support for any proposal.

4.27 Speakers during the House of Lords debate admitted "there was a real need for public understanding and for the Government to accept public concerns".[187]

4.28 Indeed, Lord Winston was brutally frank about tendency for governments to impose their decisions on the public:

> "I readily admit that for too long I have accepted unquestioningly that if the science clearly points to a solution, and if the overwhelming body of scientific opinion accepts that that solution is the best one, it only remains to inform the public in order to be able to proceed."[188]

4.29 A number of the Technical Sessions at the IAEA 2000 Conference on Waste Management discussed the need "to involve all interested parties in the decision-making processes related to radioactive waste management.

4.30 Technical Session 1 reported that:

> "Gaining the trust of the public appears to be a very important element in successfully progressing in the repository siting process. Such trust is gradually gained through sustained communication, but also, importantly, through actions. A siting process that provides interested parties an opportunity to participate early in a well-defined and transparent process would afford greater chance of success…

[184] Transcript of Evidence 19 September 2003 p81
[185] Transcript of Evidence 22 October 2003 p3
[186] *No Time To Waste*, Report Of The Senate Select Committee On The Dangers Of Radioactive Waste April 1996, Parliament Of The Commonwealth Of Australia p xvii
[187] House of Lords Hansard, 29 Oct 1999, Column 486
[188] House of Lords Hansard, 29 Oct 1999, Column 491

> Indeed, people are often reluctant to accept any risk from waste disposal because they do not perceive a need for or benefit from it.
>
> Increasing public confidence at the local level is an important step in any disposal siting process".

4.31 The conference declared that as, part of the development of a national radioactive waste management policy, "the effective implementation of disposal options requires the clear definition, at the national level, of a step-by-step and transparent approach that enables the different interested parties, including the general public and public institutions, to **participate in the decision-making process**".[189] (emphasis added)

4.32 Dr Holland teased out some of these issues from an ethical perspective in hearings. He told the Committee that one key ethical question is a "fair distribution of benefits and burdens in any situation". He also observed that "voluntarism is better than coercion"... and "it is better for people to freely engage in something than to be forced ..."[190]

4.33 The Federal Government has outlined its community consultation process in the Main Report on the National Radioactive Waster Repository Draft EIS. The Select Committee notes that this section runs to a mere half dozen paragraphs in a document of hundreds of pages.

4.34 The draft EIS report notes that a series of group discussions were held with communities along the proposed route with representatives from Port Augusta, Mildura, Broken Hill and Dubbo. According to the authors, the communities' concerns were largely allayed when key aspects of the transport proposals — such as infrequent shipment, the routine nature of the movement of radioactive materials in Australia, the codes in place to ensure safe packaging, etc. — were pointed out to them.[191]

4.35 Interestingly, at the public hearings, the Mayor of Dubbo City Council advised the Committee:

> **Mr MATTHEWS**: They [DEST] named Dubbo as a town that had community consultation. None of the staff of our council that I have had time to talk to are aware of any community consultation in Dubbo. That goes to the argument that lack of consultation is the main issue for us.[192]

4.36 The mayor of the Blue Mountains acknowledged that Minister McGauran had written offering to send an "expert" to explain what was to be transported and that some meetings had been held locally by DEST.[193]

4.37 DEST responded to the comments from the Mayor of Dubbo in hearings:

> **Dr PERKINS**: I wish to clarify one issue. Earlier the Mayor of Dubbo was talking about consultation in Dubbo. What we actually state in chapter 7 of the EIS is that we had a focus group discussion in Dubbo—I think it was in 2000—at which we were trying to get a feeling for the views of people in the community. That is clearly described in the EIS. I also note that Dubbo council has not made a submission to the EIS. Earlier this

[189] The IAEA International Conference on the Safety of Radioactive Waste Management 2000, Report of the Board of Governors, Attachment pp2,4
[190] Transcript of Evidence 19 September 2003 p84
[191] Main Report, EIS, p18
[192] Transcript of Evidence, 7 October 2003, p4
[193] Transcript of Evidence 26 September 2003 p51

> year the Minister for Science, Peter McGauran, wrote to all regional councils that are on the transport routes offering consultation and offering to send Keith Lokan to visit them. I understand that Keith also addressed Dubbo council at a meeting a year or so ago.[194]

4.38 Dr Perkins also pointed out that "from 1992 when the project first started there has been extensive consultation. In 1992, 1994 and 1998 the Government put out three discussion papers. In each discussion paper it called for public submissions and it responded to issues that were raised in those submissions." In addition the EIS for the Repository was advertised nationally and locally.[195]

4.39 The presidents of the local government and the shires associations were asked if they considered three discussion papers a fair and appropriate way of seeking feedback. They responded "no". They argued that simply seeking responses through advertisements was an inadequate means of consulting.

4.40 Whatever the case, there appears to be a worrying lack of communication here. And while a city council might be expected to have the resources to make submissions to complex technical documents such as an EIS, members of the public might well find it much more difficult. Indeed, many would find the prospect daunting.

4.41 A number of councils also placed on the record their dissatisfaction with the Federal Government's approach to consultation:

4.42 Holroyd Council:

> **Mr TULLOCH:** No, and that is the other issue, the clandestine way that the Federal Government has gone about this particular issue. I first heard about it through the Local Government Association at a special meeting that was convened… the Federal Government has neglected to consult with its community first before they get into the planning stages of where a repository might be and how it might get transported to it.[196]

4.43 Blacktown Council:

> **Mr PENDLETON:** … Blacktown council has never been consulted in relation to transportation of any nuclear material.[197]

4.44 Fairfield Council:

> **Mr LALICH:** …Fairfield council also has never been informed and we do not think we ever will be. The Federal Government should take care of all this waste and they should pay for the disposal of this waste, wherever they wish to take it to. I agree with the Mayor of Blacktown that it should not go over the Mountains, it should take the shortest and quickest possible route to Woomera.[198]

4.45 Liverpool Council:

> **Ms ANTHONY:** … about consultation, we may as well have not been consulted as a council in terms of our community response. We also have not been consulted as a council in terms of whether we have a response team or the ability to create and train a response team.[199]

[194] Transcript of Evidence, 7 October 2003 p51
[195] Transcript of Evidence 7 October 2003 p51
[196] Transcript of Evidence 19 September 2003 p40
[197] Transcript of Evidence 19 September 2003 p41
[198] Transcript of Evidence 19 September 2003 p41
[199] Transcript of Evidence 19 September 2003 p42

4.46 This is a small cross section of the comments from local councils. Almost all councils repeated this message. But as a number also pointed out, they do not totally oppose the proposals, they simply want to be a genuine part of the process.

4.47 Mr Garafolow from Blue Mountains City Council observed that "we do not feel like we are informed and we do not feel like the community has been informed. We want to see exactly what the proposals are in detail and exactly what the risks are". He summarised for the Committee the sort of information the community requires – "a clear overview of waste categories, the physical forms of the waste, be it solid, liquid or airborne, and the implications for a low-level repository and intermediate store should be prepared".[200]

4.48 The Mayor Dubbo told this committee that "we believe that without proper and balanced information it is difficult to make an informed decision... Dubbo, on the whole, is not opposed to the safe transportation of low-level nuclear waste, but is very much concerned with the lack of consultation".[201] In evidence, the Local Government and the Shires Associations told the Committee that "we accept that the waste needs to be transported. However, we are not reassured by the way the manner in which the process has been undertaken... We are not saying it should not be transported, but we want to be reassured".[202]

4.49 Dr Loy advised that ARPANSA had a good record in terms of public information, putting out "a great deal of material". Information regarding the proposals will be sent to libraries along the route and CDs are available on request and information is placed on its web site.[203]

4.50 In a special supplement on nuclear waste, the New Statesman recounts public outrage over proposed nuclear and nuclear waste facilities all over the developed world:

> "Despite differences in environmental and political contexts, these conflicts have some common features. They were all, in various ways, protests at the way decisions were taken. Sites were seemingly plucked out of the air and imposed on local communities without so much as a by-your-leave, examples of the now discredited Decide, Announce, Defend (DAD) approach."

4.51 The Federal Minister for Science, Mr Peter McGauran, at a press conference announcing on the national repository, refused to say which states the Government had identified as potential hosts for the site. The Minister's refusal to 'speculate', as he put it, on which States were on the short list, can only have added to the ongoing disquiet among the community.[204]

4.52 Such an attitude can be contrasted with the enlightened approach to community consultation taken by several European governments. Finland has the distinction of being the first country to select a site for a repository approved not just by its Parliament but by the community involved. Sweden is investigating two sites that communities have volunteered:

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[200] Transcript of Evidence 26 September 2003 pp1,3
[201] Transcript of Evidence 7 October 2003 p4
[202] Transcript of Evidence 22 October 2003 p8]
[203] Transcript of Evidence 26 September 2003 p21
[204] www.dest.gov.au/ministers/mcg/may_03/transcript_120503.htm

> "These successes in Sweden and Finland were achieved through a process of public participation and involvement going well beyond the traditional report-and-response style of consultation."

4.53 Britain and Germany have set up processes of public debate to "break the political impasse". The British model involves a host of participative techniques such as consensus conferences, interactive panels, citizens juries and opinion polls.[205]

4.54 The failure to have genuine consultative processes can lead to unwanted outcomes such as civil disorder, according to Mr Courtney from Greenpeace. He was of the opinion that the "community has little option but to stand in front of proposals that are undertaken without consultation".[206]

CONCLUSIONS

4.55 There is no doubt that the Federal Government has, in progressing these proposals, engaged in a form of community contact. Discussion papers have been released along with an EIS and responses from the community sought.

4.56 However, these actions cannot be classed as genuine consultation. For many people these formal processes are unfathomable, intimidating and daunting. For those that do become involved very little changes as a result. They do not feel that their concerns have received serious consideration.

4.57 This process has been called 'report and respond' or 'decide, announce and defend'.[207]

4.58 Certainly the Minister approached councils and made experts and his department available to discuss the transport proposal along the routes but this was not the genuinely consult. The proposals would not have changed as a consequence of the process. This was simply selling the proposal.

4.59 The Ministers refusal to identify the sites under consideration for the intermediate level waste store simply underscores the arrogant and secretive way in which these proposals continue to be developed. The government and its agencies involved in these proposals miss the point on information and consultation. They mistake outlining their proposals directly to local communities for community consultation.

4.60 Based on approaches being developed around the world they are have been sorely inadequate.

4.61 The psychological and social elements involved in nuclear matters require, if not demand, a more refined, sophisticated and genuinely democratic approach.

4.62 It also requires a cultural change in the way the nuclear industry operates.

4.63 In a liberal democracy, decisions of this magnitude — decisions which have direct impact on local communities — should not be imposed.

4.64 It is time, particularly with issues such as radioactive waste, to look closely at the approaches being successfully developed overseas. ANSTO has been keen to advise

[205] *New Statesman*, 'What happened when DAD met LULU", 29 September 2003
[206] Transcript of Evidence 19 September 2003 p14
[207] *New Statesman*, 'What happened when DAD met LULU", 29 September 2003

this inquiry that it operates at international best practice. Perhaps it is time to introduce international best practice community consultation – with genuine dialogue and give and take.

4.65 The committee can only conclude that the consultation approaches by the Federal Government have been totally inadequate for the significant matters that are the subject of the proposals.

Chapter Five - Radioactive Waste Storage Proposals

BACKGROUND

5.1 Australia does not utilise nuclear technology for the generation of energy. Its only operating reactor produces radioisotopes.

5.2 The Australian Nuclear Science and Technology Organisation (ANSTO) operates the HIFAR nuclear reactor at Lucas Heights to produce radioisotopes for medical, industrial or research purposes, producing approximately 350,000 patient doses of radiopharmaceuticals annually. The operation of the reactor and the production of the radioisotopes generates some 90 per cent of the radioactive waste in Australia by volume and all of the most radioactive of wastes – spent fuel.

5.3 As well as the radioactive waste produced by ANSTO, end users of the radioisotopes generate radioactive waste. Currently the management of radioactive waste is the responsibility of each producer or end-user. According to ARPANSA, in NSW "long-lived wastes are currently stored at their place of generation until a repository or storage facility becomes available".[208]

5.4 Dr Perkins, representing the Department of Education Science and Training (DEST), outlined the background of the proposals to the Committee:

> **Dr PERKINS:** ... Australia generates a small quantity of low-level and intermediate-level radioactive waste from the beneficial use of radioactive materials in medicine, industry and research. It is strongly in the interests of public security and safety, both in Australia and internationally, that this material be disposed of or stored in facilities especially designed for that purpose. Until we have purpose-built facilities, radioactive waste will continue to be stored under ad hoc arrangements at hundreds of locations around Australia, including in New South Wales, much of it in buildings that were not designed for the long-term storage of radioactive material and that are nearing or have reached their capacity. Storage locations include hospitals, research institutions, industry and government stores.[209]

5.5 ARPANSA has described current developments in radioactive waste management in Australia as follows:

> "Planned future actions to improve safety include the construct and operation of facilities for centralised management of the range of radioactive waste produced nationally. These facilities will be a national repository for the dispersal of low-level and short-lived intermediate-level radioactive waste and a national store for the storage of long-lived intermediate radioactive waste. All spent fuel from current and future reactor operations at Lucas Heights will eventually be shipped overseas for long-term storage or reprocessing. The wastes arising from the reprocessing will be repatriated to Australia and stored in the national store".[210]

5.6 Under this rationalisation of waste proposed by the Federal Government, two depositories are planned:

- A Repository in South Australia for the permanent disposal of lower level waste, and

[208] ARPANSA Joint Convention p8
[209] Transcript of Evidence 7 October 2003 p49
[210] ARPANSA, Joint Convention p33

- A Store, at a yet to be identified site, for the temporary storage of intermediate level waste.

5.7 Dr Perkins:

> **Dr PERKINS:** ...In the low-level repository, what we are doing is putting the waste there until it decays for permanent storage and disposal. So we are shielding the waste from the environment permanently until it decays to an acceptable and safe level. What we are doing in the national store is building a purpose-built building which would protect and shield the material until we undertook a different siting study for so-called deep geological repository... It would not be suitable to dispose of in that form in the national repository. Obviously the store is a different sort of facility to the low-level repository. It is an above-ground structure.[211]

5.8 The final destination (after the Store) for intermediate level waste is deep geological disposal because under current thinking there is a "need to dispose of the long-lived intermediate-level waste at depths of several hundred metres". However, this is proving to be a difficult problem overseas. The Store will hold this material while this solution to the problem is pursued.

Chronology

5.9 A brief background chronology on the Repository and Store proposals is provided below:

- 1978 - The Commonwealth is asked by the State and Territory Health Ministers to "co-ordinate a national approach to the management of radioactive waste and the development of relevant codes and practices".
- 1980 - A Commonwealth-State Consultative Committee on Radioactive Waste Management is established.
- 1984 - The Australian Science and Technology Council, in a report to the Commonwealth Government, supports the identification of "sites suitable for disposal of low level radioactive waste and ...the development of facilities for interim storage of disposal of low and intermediate level radioactive waste".
- 1985 - The Commonwealth-State Consultative Committee recommends the commencement of a national program "to identify potentially suitable sites for a national near-surface radioactive waste repository".
- September 1991 - The Federal Minister for Primary Industries (the Hon Simon Crean) announces his intention to involve all governments in a search for a single national radioactive waste facility. All but the West Australian Government agree to participate.
- From October 1992 - A range of documents, Site Selection Studies and Discussion Papers, focusing on the establishment of a National Radioactive Waste Repository Site appears. The Repository is intended to handle low level and short-lived intermediate waste.

[211] Transcript of Evidence 7 October 2003 p72

- **1997** - The Consultative Committee reaches "in-principle agreement on the need for a national intermediate level waste store". It also endorsed "the co-location of the intermediate level waste store with the low level repository".[212]
- **August 2000** – The then Minister for Industry Science and Resources, Senator Minchin, announces the Federal Government's decision to commence the search for the site for the storage of intermediate level radioactive waste. This National Store would be established on Commonwealth land to "responsibly manage intermediate level radioactive waste produced by Commonwealth agencies and departments".[213]
- **February 2001** - Senator Minchin announces the Government's decision not to co-locate the national intermediate level radioactive waste store with the national low level repository.[214]
- **2002** – SA passes legislation banning storage and transportation of low level waste in SA
- **August 2003** – Bill introduced into the WA Parliament to make it an offence to transport nuclear waste in or through WA.

5.10 In addition to the decision to develop these two radioactive waste facilities, one other decision of the Federal Government is relevant to this discussion of radioactive waste.

5.11 In 1997, the Minister for Science and Technology, the Hon Peter McGauran, announced the construction of a new reactor at Lucas Heights to replace the existing HIFAR reactor. Called the Research Replacement Reactor (RRR), its life span is estimated to be 50 years.[215] This reactor has received its construction licence and is currently being built. It will need to receive an operating licence, from ARPANSA, before commencing planned operations in 2005.

5.12 The plan to continue the operation of a reactor in New South Wales means that radioactive wastes of all levels will continue to be generated and require management within the State.

5.13 In addition to the proposals for the two waste facilities, the Committee is of the view that the commissioning of the new reactor warrants its attention as it will be a source radioactive waste for some time.

5.14 Accordingly, the Committee proposes to report on the following as they relate to radioactive waste:

- The Repository for low level waste in South Australia
- The Store for intermediate waste in a location yet to be announced
- The on-going radioisotope production at Lucas Heights through the construction of the new reactor and
- The management of spent fuel.

5.15 The storage issues are discussed in this chapter and the transport aspects in the next.

[212] Radioactive Waste Chronology p15
[213] Safe Storage of Radioactive Waste, The National Store Project: Methods for Choosing the Right Site, A Public Discussion Paper, July 2001, p3
[214] Radioactive Waste Chronology p15
[215] Transcript of Evidence 11 September 2003, p44

NATIONAL RADIOACTIVE WASTE REPOSITORY (THE REPOSITORY)

5.16 The Repository as proposed by the Federal Government is a permanent near-surface disposal facility for *low level waste* and *short-lived intermediate level waste* (categories A, B and C in NHMRC Code).

5.17 Its aim is "to provide a safe containment of radioactive waste until such time as the radioactivity in the waste has decayed to background levels.[216] This, then, is a disposal facility—not a storage facility—and the waste will stay there permanently to decay.

5.18 In January 2001, Senator Minchin announced that a preferred site for the Repository had been selected near Woomera in South Australia. The preferred site (known as Site 52a) and two other sites were subjected to environmental assessment.

5.19 The Draft Environmental Impact Statement was released for public comment in July 2002, with the Final EIS being released in January 2003. In May, the Federal Government announced that Site 40a, one of the alternative sites, had been chosen over Site 52a.[217]

5.20 The site is situated some 400 kilometres north of Adelaide and is thus approximately 1,500 kilometres by road from Sydney.

5.21 ARPANSA is now considering the Department of Education Science and Training's application for a licence for the operation of the Repository.

Disposal Arrangements

5.22 The method of disposal of the waste to be used at the Repository is called "shallow burial".

5.23 The overall Repository site will be approximately 1.5 x 1.5 km, bounded by a secure fence.

5.24 The conditioned waste packages of low and short-lived intermediate level waste, once transported to the site, will be buried within the central part of the site (approx 100m x 100m) in trenches or bores.

5.25 It is expected that the trenches will be about 12 m wide with the base about 15-20m below ground level. The boreholes will be about two metres wide and similarly 15-20m in depth. A cover will be placed over the waste to minimise rainwater infiltration and prevent the entry of people, animals and plants.

5.26 The NHMRC 1992 Code requires a two-metre depth of cover for Category A waste and five metres for Categories B and C. For the Repository, a five-metre cover is proposed.

5.27 The existing stockpile of waste earmarked for the Repository, totalling some 3,700 cubic metres, will be disposed in an initial campaign to the Repository. This is estimated to be some 171 trucks from around Australia, of which 136 will come from NSW and the ACT.[218] Based on the "low" generation rate of radioactive waste in Australia, it is expected that further waste disposal campaigns will occur every two to

[216] Department of Education, Science and Training, *EIS for the national repository – summary*, p1
[217] Radioactive Waste Chronology p15
[218] Submission No. 367 p9

five years, requiring approximately four or five trucks.[219] With each such disposal campaign, the filled trenches and boreholes would be covered and secured. Here, the waste will be left to decay to background levels.

5.28 According to DEST, shallow burial is the usual approach world-wide for LLW and SLILW, being "waste [that] does not need to be isolated from the human environment for periods longer than a few centuries".[220]

5.29 A number of witnesses and submissions asserted that near surface disposal did not necessarily represent current best practice, generally arguing in favour of dry storage above ground, so that the waste is retrievable and easily monitored.

5.30 Friends of the Earth told the Committee that "DEST gave a glowing account of overseas dumps [repositories] in its draft EIS but later acknowledged in the supplement to the EIS that three dumps in the United States of America have been closed because of environmental impacts and there has certainly been other dumps closed for similar reasons in other countries.[221]

5.31 Sutherland Shire Council said in its submission:

> An increasingly common approach to radioactive waste storage is to store it at the site where it is produced, to minimise the risks of accident, sabotage, terrorist attacks, and spills. It also minimises the need for transportation, and the associated risks. There is also a tendency to argue in favour of dry storage above ground, so that the waste is retrievable and easily monitored.[222]

5.32 A witness from the Blue Mountains area told the Committee:

> **Ms CARROLL:** ...world's best practice and international best practice recommend storage of radioactive waste in aboveground, on site facilities. It is worth noting that the 1996 report of the Senate Select Committee recommended a system meeting these standards for storage of even lower-level waste. The advantages of adopting a system consistent with international best practice are outlined in our submission. Thus, we find the proposed storage method far from acceptable.[223]

5.33 Certainly, the International Atomic Energy Agency (IAEA) appears not to rule out the use of other approaches:

> "Although near surface disposal is used in many countries, other approaches exist or are being considered, e.g. surface storage pending the construction of geological repository for several types of waste. Such variations are very dependent on national circumstances, and it was observed that public acceptance played a larger role than cost in such decisions".[224]

5.34 Dr Green, representing Friends of the Earth, explained that waste "...should be above ground" but he concedes that "it is not so much of an issue for low-level waste" but for higher levels it should be above ground. Monitoring is simpler if stored above

[219] Transcript of Evidence 7 October 2003 p55
[220] DEST Submission No. 367 p6
[221] Transcript of Evidence 7 October 2003 p36
[222] Sutherland Shire Council Submission No. 350 Attachment No1 p7
[223] Transcript of Evidence 26 September 2003 p38
[224] The IAEA International Conference on the Safety of Radioactive Waste Management 2000, Report of the Board of Governors, Attachment: Report of Technical Session on Near Surface Disposal of RadWaste, p8

ground and, more importantly, the material is accessible "to apply new technologies … if and when they arise".[225]

5.35 The ACF, while generally referring to high level wastes, reported that in Germany "there are developing technologies for assured isolation facilities on site that could readily be applied, we understand, to much improve the standards already undertaken at Lucas Heights".[226]

5.36 A number of witnesses questioned the proposal on transport grounds. For example, Dr Green stated that "the trucking of radioactive waste across New South Wales to the dump in South Australia is unnecessary."[227]

5.37 Dr Barnaby, as part of Sutherland Shire Council's submission to the inquiry, argued that there were advantages in storing the waste where it is produced, "to minimise the risks of accident, sabotage, terrorist attacks, and spills, … the need for transportation, and the associated risks".[228]

5.38 Many submissions argued that the waste should remain on site where it is produced.

5.39 Certainly Dr Loy argued at hearings that conditioning and storage at Lucas Heights would be an acceptable medium term solution.[229]

5.40 The issue of Lucas Heights storage was discussed with ANSTO, particularly the need for the Repository to be isolated. ANSTO explained that isolation was not so much a factor as was the need to centralise disposal facilities:

> **Mr McINTOSH:** The storage in the back of beyond will mean that, let us call them, the small holders well have a disposition route. At the moment they do not have a disposition route in New South Wales and they have to hold onto the material indefinitely. At the conference on security of radioactive sources which was held in Vienna in March—and I can provide you with the paper in question—the representative of the European Commission stated that it was the commission's view that all member states and all candidate member states should have in place central facilities to enable the holders of radioactive material who had no further use for it to deposit it in that facility—whether it is a disposal facility or a storage facility—to minimise the likelihood of that material escaping from regulatory control and posing a hazard either, as has occurred, a safety hazard or the potential deliberate use of such material in a dirty bomb or similar device.
>
> …I come back to the fact that you do not need to have it in a place the back of beyond… The repository in France is in the middle of the Champagne region which I do not think French people regard as the back of beyond.[230]

5.41 There is, obviously, opposition to the proposal in South Australia.

5.42 As observed above, the South Australian Government indicated its opposition to the proposed Repository through the enactment of legislation. The state Government, in an effort to stop the Federal Government, announced its intention to declare the

[225] Transcript of Evidence 7 October 2003 p38
[226] Transcript of Evidence 19 September 2003 p68
[227] Transcript of Evidence 7 October 2003 p34
[228] Sutherland Shire Council Submission No. 350, Attachment No1 p7
[229] Transcript of Evidence 26 September 2003 p16
[230] Transcript of Evidence 22 October 2003 pp72/3

preferred site a public park. The Federal Government pre-empted this by compulsorily acquiring the site in July 2003.[231]

5.43 Like the state Government, the traditional owners oppose the siting of the Repository. In its submission to this inquiry, the Kupa Piti Kungka Tjuta, a council of senior Aboriginal women, outlined their experiences with atomic testing in the 50s and 60s and their fears that "the poison from the radioactive dump will go underground and leak into the water". That underground water is vital for life in the area. The council told Minister Kemp in a letter that "they've got to keep it, the poison, in Sydney. We never told them to bring it here when they were finished with it".[232]

5.44 The ANSTO Act currently prohibits "the storage at Lucas Heights of waste not generated at Lucas Heights… unless there is a regulation [allowing it]".[233]

Institutional Arrangements

5.45 According to the EIS, the Repository is to operate for 50 years. Once the facility ceases operation, an "institutional control period" of 200 years would be instigated.

5.46 The institutional control period is the time, after closure, for which restrictions will apply to the facility. During this time it would be monitored and access restricted. Upon closure, all visible structures would be removed except for fences, signs and drains.

5.47 At the end of the institutional control period, no further control of the site will be required as the low level and short lived intermediate level radioactive waste is expected to have decayed enough so as to not pose a danger to humans or the environment.[234]

5.48 A number of witnesses raised concerns about these arrangements.

5.49 Friends of the Earth argued to the Committee that the Repository would never close:

> **Dr GREEN:** …One final concern is the open-ended lifespan of the proposed dump. Former science Minister Nick Minchin said in 2001 that the dump would have a 50-year working life. The supplement to the environmental impact statement states that the dump will accept waste for at least 50 years. Both Mr McGauran and DEST state in their submissions to this inquiry that the dump will provide "a means for disposal of any future arisings in New South Wales and other States and territories". That indicates that the dump will be operating ad infinitum.[235]

5.50 Dr Perkins advised the Committee that the proposal was to review the Repository operations at the end of the 50 years operating period with the possibility then of operations continuing:

> **Dr PERKINS:** … So in 50 years time people will sit down and assess and look at the waste which has been put in it and make a judgement at that stage to see whether they

[231] Chronology of Radioactive Waste p38
[232] Submission No. 236
[233] Transcript of Evidence 7 October 2003 p57
[234] EIS p118
[235] Transcript of Evidence 7 October 2003 pp37/8

> consider the facility should continue operations or whether an alternative facility should be commissioned.[236]

Volume, Source and Type

5.51 There is not doubt that, compared with overseas where waste is generated by nuclear energy programs, Australian produces very small amounts of radioactive waste.

5.52 By way of comparison, France has disposed of "a total of approximately 650,000 cubic metres of similar waste in near-surface repositories" and "the USA has transported and disposed of almost 4 million cubic metres of low-level waste—again without impact on human health or the environment".[237]

Non Radioactive Waste

5.53 Some argued to the Committee that the radioactive waste generated in Australia had to be seen in perspective. "In volume and weight terms the quantities of radioactive wastes for the whole of Australia are trivial" being 1/260,000 of the volume of non-radioactive waste (domestic and industrial) in Australia.[238]

5.54 The IAEA has pointed out the relative health impacts of fossil fuel and low level radiation:

> "in considering the health effects from nuclear power activities, any postulated risks from low level radiation exposures must be put into perspective with the known risks from the toxic pollutants released from other terms [sic] of energy production. Fossil fuel combustion produces, in addition to CO_2, noxious gases and a wide range of toxic pollutants that are the largest source of atmospheric pollution. Unfortunately the task of comparison is difficult, as there is vastly more scientific information about health effects from radiation than from various toxic pollutants".[239]

5.55 Dr Holland argued that making one mistake did not justify making another:

> **Dr HOLLAND:** … I think continuing to generate nuclear waste materials when, after decades of work on this, we do not have any solutions that are serious contenders for that label does not make that much sense. I suppose the only rider I would put into that is that it is not the first or last time, as a human society, that we have done that. We do this all the time with all sorts of things, so it is not unusual that we develop industries and technologies in our society without always having the capacity to deal with the problems that they produce. Fossil fuels are actually not a dissimilar example. We are heavily reliant on this technology that has emerged over the last 100 to 200 years, but I do not think anyone seriously suggests that we can actually deal with greenhouse gas emissions adequately, even if we had the political will to try, so it is not unusual, but I am not sure, particularly in this industry, I think it is particularly not sensible. We are not heavily reliant on this industry in any way across a global society and so to continue to persist with it seems strange.[240]

5.56 The Committee agrees with Dr Holland and rejects the validity of this type of comparison.

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[236] Transcript of Evidence 7 October 2003 p73
[237] Transcript of Evidence 22 October 2003 p46
[238] Hanna Submission No. 213
[239] www.f40.iaea.org/worldatom/Press/Booklets/Development/devsix.html
[240] Transcript of Evidence 19 September 2003 pp83/4

Existing Waste Holdings

5.57 According to DEST, "Australia [currently] has about 3,700 cubic metres of low and short-lived intermediate level radioactive waste" to be disposed of in the Repository.

5.58 The volume of existing waste by its institutional source is:[241]

SOURCE	TYPICAL WASTE	VOLUME (Cubic Metres)
CSIRO	Contaminated soil from research into treatment of radioactive ores (already located near Woomera)	2,010
ANSTO	Contaminated clothing, paper, glassware	1,320
DEPT OF DEFENCE	Contaminated soils, electron tubes etc	210
STATES AND TERRITORIES	Used sources, including industrial gauges, exit signs, smoke detectors, medical sources etc	160

5.59 In New South Wales there is some 1,355 cubic metres of waste located at a number of sites:

- ANSTO (Lucas Heights) – 1,320 cubic metres
- Other Commonwealth – 8 cubic metres
- Other NSW – 27 cubic metres.

5.60 The following inventory of waste destined for the Repository based on source State clearly indicates that New South Wales is the major producer of radioactive waste, by volume, in Australia:

State	Estimate Volume (cubic metres)
ACT	8
NSW	1,335
NT	16
QLD	45
SA	2,228 (but includes 2,010 cu m of contaminated soil near Woomera)
TAS	15
VIC	33
WA	NA
Total	3,700

5.61 This is no surprise as ANSTO, the major radioactive waste producer in Australia, is located in New South Wales.

5.62 ANSTO'S holdings of waste destined for the Repository (subject of course to the final waste acceptance criteria) are currently stored on site at Lucas Heights. The waste has

[241] Source: Submission No. 367 p8

been conditioned by encasing it in concrete (for some of the short-lived sources) or compaction and placing in 205 litre steel drums.

5.63 These are not generally shielded as low level waste does not require shielding.

5.64 The drums in turn are stacked on pallets and stored in a single large shed. There are approximately 6,000 drums awaiting transport.[242] The drums are transported in standard steel shipping containers.

5.65 The Committee has inspected this site.

5.66 According to DEST, the material will include "various contaminated pieces of equipment that cannot be decontaminated" and consists of "laboratory waste and equipment such as lightly contaminated coats, glassware, paper and plastics, and smoke detectors, exit signs, lightly contaminated soil and industrial gauges" as well as "gauges and sealed sources used in industry and medical diagnosis and therapy and small items of contaminated equipment".[243]

5.67 The continued focus on the apparently harmless physical nature of the waste was criticised:

> **Mr PRICEMAN:** ... The Commonwealth continues to play down the types of waste it wants to move to the dump, describing it as operational waste such as clothing, paper and glassware... You will probably notice that in a lot of ANSTO's material they minimise a lot of subjects and this is one of them. They lay stress on the bits of paper and gloves used in hospitals and universities.[244]

5.68 Both ANSTO and DEST were keen to advise the Committee that it was production of radiopharmaceuticals, not the reactor, that was the biggest contributor to waste:

5.69 Mr McIntosh said that "the majority of ANSTO's radioactive waste comes from radiopharmaceutical production rather than the reactor. Even if you close the reactor and did bulk imports of molybdenum, which is what happens when there is a latent close-down of a reactor; you still have all that radiopharmaceuticals waste". But as Dr Smith pointed out this is only in volume terms not radioactivity. The radiopharmaceuticals produce most of the low level waste – the high volume low radioactivity material.

5.70 This exchange highights the ongoing approaches of the two sides in these issues. One focussing on the volumes and the other the hazard or radioactivity.

Waste Acceptance Criteria

5.71 Some of the NGOs opposing the proposals were not overly concerned with the management of purely low level waste. For example Dr Green observed that

5.72 "My general position in relation to the hazards associated with the dump and transportation to the dump is that I would agree with the Government that it would represent only a modest, minimal risk if it was only low-level waste..."[245]

[242] Transcript of Evidence 26 September 2003 p9
[243] DEST Submission No. 367 p6; Transcript of Evidence 7 October 2003 p51
[244] Transcript of Evidence 11 September 2003 pp52,53
[245] Transcript of Evidence 7 October 2003 p44

5.73 Mr Noonan from the ACF pointed out that most of the radioactivity in the waste was actually in the short lived intermediate waste:

> **Mr NOONAN:** ...The predominance of the radioactivity in that inventory of waste is in the category of short-lived intermediate level; the predominance of the radioactivity is not low level. Within that short-lived intermediate level, the predominance of the radioactivity is within three isotopes - strontium, caesium and tritium - which Dr Williams referred to, all within themselves serious radioactive hazards should they ever be lost control of.[246]

5.74 According to the Repository EIS, a key feature of the performance and safety of the facility is the "nature of the wastes that are accepted for disposal at the site. Waste acceptance criteria (WAC) are the set of requirements that must be met before radioactive waste can be accepted for disposal at a repository.

5.75 These criteria are "applicable to each individual waste package".

5.76 "Activity concentration limits for each type of radionuclide accepted into the facility would be from a full assessment of the risks posed by radioactivity reaching the biosphere".

5.77 The EIS outlined some of the general conditions of acceptance of waste that have been developed for the Repository. These included:

- "Only low and short-lived intermediate level waste will be accepted" and
- "Category S (long-lived intermediate waste) material will not be accepted" because they not suitable for near-surface disposal.[247]

5.78 The precise nature of the waste destined for the Repository is still uncertain because the final waste acceptance criteria are still being determined by ARPANSA as part of licensing application for the Repository. "They are not finalised...[and] could quite well change, the Committee was told.[248]

5.79 In finalising the criteria, Dr Loy has said that he will be guided by the NHMRC Code.

5.80 This Code provides some indication of the acceptable activity levels of the radioactive waste material suitable for shallow burial, in that they "decay to very low levels within the institutional control period".[249]

5.81 Dr Harries from ANSTO explained how this operates:

> **Dr HARRIES:** There are specifications that will be in the waste acceptance criteria for the repository that will limit the amount of alpha activity that can be in the waste. It is expressed in becquerels per kilogram and I do not have it in front of me to be able to give you a specific number, but it is in the Code of Practice.[250]

5.82 A singular concern raised was the inclusion of long lived wastes in the waste destined for the Repository. "There are other items which do not fall into that category and they

[246] Transcript of Evidence 19 September 2003 p63
[247] EIS pp32/3, pp72,74
[248] Transcript of Evidence 11 September 2003 pp27/8
[249] DEST Submission No. 367 p6
[250] Transcript of Evidence 11 September 2003 p45

are far more dangerous and long lived than is readily admitted", the committee was told.[251]

5.83 Cr McDonnell, representing Sutherland Shire Council, made the following comment to the Committee:

> **Mr McDONELL:** I draw the Committee's attention to page eight of our submission. The point at the top indicates that long-lived intermediate-level waste, including uranium and plutonium, are to be included in a repository inventory. That defies its definition as a short-lived repository because the radiotoxicity of those elements lasts beyond the 200-year institutional life of the repository.[252]

5.84 And Dr Green said in his evidence:

> **Dr GREEN:** I note that DEST stated in its submission that "long-lived intermediate-level waste is not suitable for near surface burial". I agree, but it begs the question: Why is it planning to truck long-lived intermediate-level waste through New South Wales to the dumpsite?
>
> ...the dump is not just for short-lived radionuclides; it is also for long-lived radionuclides such as radium-226, thorium-232, uranium-238 and americium-241. These are radionuclides with half-lives ranging from hundreds to billions of years, whereas the control period for the dump, once it is closed, is just 200 years.[253]

5.85 Sutherland Shire Council reinforced this point:

> **Dr SMITH:** ...We are worried about what will be transported now and put into the ground now, and the fact that uranium and plutonium are being included.... I think that things like uranium and plutonium are a particular problem because normally one would not have thought they were low-level or short-lived intermediate-level waste. The particular problem with them is the length of half life, thousands of years, so that if something is contaminated even at low levels it is contaminated for thousands of years... Thirty years is the normal cut-off for low level, so they are saying that some will be longer. The NHMRC code—that is the thing I showed you before—allows for the disposal of very low levels of radionuclides with longer half lives in a near surface repository...[254]

5.86 The NSW Environment Protection Authority advised in its submission that "long lived intermediate waste is not suitable for near surface burial and must be stored in an above ground purpose built facility.[255]

5.87 Two factors must be considered in assessing the suitability of waste for the Repository, according to Dr Lokan a consultant for DEST:

> **Dr LOKAN:** Yes, it has got to be safe to walk away from at the end of 200 years and forget it is there. That then puts two limits in place: a limit on the concentration, because it is the concentration of the radioactivity in that soil which determines its potential for causing damage in the environment in future; and the other limit, which is not specified here, is on the absolute strength of the source that goes into the ground. In the case of the Commonwealth-managed repository, that is something that will be defined when the situation first arises for that class of material, and it will be defined by the regulator.[256]

[251] Transcript of Evidence 11 September 2003 p52
[252] Transcript of Evidence 11 September 2003 p12
[253] Transcript of Evidence 7 October 2003 pp37,8
[254] Transcript of Evidence 11 September 2003 pp12,14
[255] EPS Submission No. 474 p3
[256] Transcript of Evidence 7 October 2003 p53

5.88 He explained to the Committee that it was appropriate to include higher level material if it were short lived:

> **Dr LOKAN:** …So that is the sort of higher-level sources which are carefully included because they are appropriate for near-surface disposal. But they are not low-level waste; they are intermediate-level waste, but short enough lived.[257]

5.89 On the ABC's Quantum program, Dr Lokan observed that "plutonium is particularly harmful to radiosensitive human organs, like the lungs. It has a half-life of twenty-four thousand years.

5.90 Peter Burns, of the Australian Radiation Laboratory, advised the same program that:

> "Plutonium is an alpha emitting nuclide that is very insoluble so that when you breathe it in, it lodges in the lung and stays there for a long period of time, close to living cells and emits a large amount of energy, radiation into those cells which can cause damage." Plutonium is also "very difficult to detect".[258]

5.91 This matter was raised with ANSTO at the public hearings:

> **THE HON. CHARLIE LYNN:** Will any of the waste destined for the repository include any long-lived waste such as plutonium or uranium?
>
> **Dr HARRIES:** Yes. Basically, low-level waste contains low-level long-lived material. Uranium has a half-life of three billion years; it is ubiquitous. It contains uranium, which is long lived. When we are characterising our waste, which we must do before it goes to the repository, we find that it contains uranium and potassium 40, which is a naturally occurring radioactive material. We have worked with uranium, so there is more than would be in normal bricks or housing. There are low levels of long-lived material. However, the repository waste acceptance criteria are designed to provide safety and put a limit on that.[259]

5.92 According to Dr Harries then the Repository is to receive low levels of long lived intermediate level waste.

5.93 This was discussed with DEST representatives at hearings and was the subject of an extensive discussion. It was pointed out to the witnesses that the EIS states:

> "The total activity limits for radionuclides will be established for the repository from the safety assessment. This will include very small quantities of long-lived intermediate level waste to be disposed of in the facility"[260]
>
> **Dr LOKAN:** I did not have any hand in the drafting of the EIS, and I just think that is a slightly sloppy use of words. I think it is a mistake. I think this makes it clear that the concentration of long-lived waste—alpha particle waste—is at such low concentrations that you would not call it intermediate. However, I have not spoken to the authors of the EIS.

5.94 There was no denial by the proponents that long-lived radioisotopes such as plutonium are currently included in the inventory for the Repository nor any reason explaining its presence.

5.95 The NHMRC Code certainly identifies plutonium as on of the alpha emitting radionuclides groups in Categories A,B and C, so this should come as no surprise.

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[257] Transcript of Evidence 7 October 2003 p52
[258] www.abc.net.au/quantum/info/radio2tx.htm pp3,7
[259] Transcript of Evidence 11 September 2003 p39
[260] EIS Supplement Chapter 5 p45

5.96 What the Committee does not understand is why the repository, designed specifically for low level waste and short-lived intermediate waste (defined in the EIS as having a half life of 30 years of less) will accept even small amounts of radioactive waste with half lives longer than that.

5.97 In seems that the Repository has two waste acceptance definitions. A primary one for low level waste and short-lived intermediate waste and a secondary one, which appears to contradict the first, for some long lived intermediate level waste but of low activity.

5.98 This might make sense to those in the industry but it makes little sense to the public and can only set off alarm bells for the already sceptical public.

RECOMMENDATION 15: ARPANSA should set waste acceptance criteria for any near surface burial repository to exclude all long-lived intermediate level waste

THE NATIONAL STORE (THE STORE)

5.99 Unlike the Repository which is a final disposal site, the Store is designed to be an interim holding place for **long-lived intermediate level waste** until a permanent solution for disposal of this waste can be implemented. It will be a specifically built above ground interim facility.[261]

> Dr LOY: The proposal for the store is just that; it is a store, I think that needs to be borne in mind as well, that for long-lived material, including spent fuel—the product from the processing of the spent fuel—a final disposal route has not been determined in Australia and the store is a store.[262]

5.100 This waste destined for the Store represents a higher level of hazard and requires shielding, as Dr Green stated:

> **Dr GREEN:** …I think someone mentioned this morning that Australia's national holdings of long-lived intermediate-level waste amount to something like 500 cubic metres. But, by radioactivity, I suspect that would exceed the 3,700 cubic metres of low-level waste by many orders of magnitude.[263]

5.101 The permanent solution currently proposed is deep geological burial.

5.102 This proposal is not as advanced as the Repository proposal. Discussion Papers for the site selection process were released in 1992, 1994, and 1998 as part of the site selection process.

Location

5.103 Currently, the Federal Government is evaluating eight possible sites for the Store but will not make public the sites under consideration.

5.104 This unwillingness to identify the short-listed sites can only add to public speculation and concern (as discussed chapter 4).

[261] Department of Industry, Science and Resources p3
[262] Transcript of Evidence 26 September 2003 p25
[263] Transcript of Evidence 7 October 2003 p43

5.105 The Federal Government has announced, hoverer, that the Store will not be located in South Australia.

New South Wales

5.106 Certainly the location of the Store is the matter of considerable speculation. A number of witnesses argued before the Committee that New South Wales will likely be the location for the Store.

5.107 The inclusion of a port as part of the site was an added attraction according to the ACF. Mr Noonan told the Committee that there is "the potential for the Commonwealth Government of not just siting a Store in NSW but combining it with a port.[264]

5.108 At the public hearings, Greenpeace representatives expanded on this theme, arguing that a particularly likely location is Jervis Bay:

> **Mr COURTNEY:** ...Jervis Bay being quite remote, having heavy lifting facilities and military presence, also in close proximity to ANSTO and the technical specialists that they would want to monitor the facility, it would appear to be a possible location for the store. I would be confident in saying that it is a location that would have been considered by the Federal Government.

5.109 In Mr Courtney's view, it also "stacks up" "as a store for long-lived intermediate level waste returning from France" by ship.[265]

5.110 Certainly the ACF agreed:

> **Mr NOONAN:** ...In the Federal Government retaining an option to impose a store in New South Wales they are retaining an option to use a New South Wales port to transport high level nuclear waste through your communities... We believe it is a serious possibility that the Federal Government will impose not just the use of Jervis Bay as a port site but the use of Jervis Bay as a store site and the reason that they would do so is first to maximise Commonwealth owned control of all the sites involved, and they already have full military control as a naval port of that facility, but also to minimise the transport corridors for those high level wastes across any part of New South Wales.[266]

5.111 According to DEST, it is expected that the Federal Government will announce the site shortly.

Storage Arrangement

5.112 The Store will be an above ground structure, purpose-built for the long-lived intermediate level waste, which will include reprocessed spent fuel. The waste will be enclosed in barriers to prevent any release of the material or any accidental contact with humans or wildlife. The Store will also have an environmental monitoring system to monitor any changes in environmental conditions such as groundwater, external gamma radiation, and radiation in air, soil and vegetation.[267]

5.113 As well as the facilities for the actual storage of the waste, the Store site will include an administration building and staff facilities, a road with access to the closest

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[264] Transcript of Evidence 19 September 2003 pp59,60
[265] Transcript of Evidence 19 September 2003 pp5,6
[266] Transcript of Evidence 19 September 2003 pp59,60
[267] Department of Industry, Science and Resources, *Safe Storage of Radioactive Waste: The National Store Project: Methods for choosing the right site*, Public Discussion Paper July 2001 pp13,16

transport route, a security monitoring system and fencing, and electrical power with freshwater supplies. These facilities will be built within the buffer zone.

Institutional Arrangements

5.114 The Store will operate as a holding facility for a period of fifty years until the national deep geological repository can be identified and constructed.

5.115 The development of a deep geological repository will be an interesting exercise in the light of overseas experiences in developing these permanent disposal facilities, as the Director General of the IAEA conceded:

> "In most countries, the siting of a [deep geological] repository has proven difficult. The public continues to have fears about safety, lack of confidence in the technology, and lack of knowledge about the technology. Other hurdles include locating sites with the appropriate geological make-up, establishing appropriate statutory and regulatory mechanisms, and sustaining the political support necessary for progress".[268]

Volume, Source and Type

5.116 According to DEST, Australia has "a small quantity" of about 500 cubic metres of waste, produced over the last 50 years, which is not suitable for near-surface disposal in the national repository in South Australia". This will, therefore, be accommodated in the Store. This is about one third of the volume of the low level and short-lived intermediate waste.

5.117 Long-lived intermediate-level radioactive wastes consist mostly of:

- spent nuclear fuel rods from the Lucas Heights reactor;
- material from the Australian Nuclear Science and Technology Organisation (ANSTO) radiopharmaceutical production;
- medical radioactive sources from cancer therapy devices;
- radioactive sources removed from industrial radiation gauges; and
- radioactive sources derived from medical, industrial and research equipment.[269]

5.118 In addition DEST advises that the waste consists of material such as higher activity disused radioactive sources, some radiation gauges used in research, radiotherapy sources, radium needles, and mineral sands concentrates arising from past activities".[270]

5.119 This inventory is summarised below.

Table 3

Source	Typical Waste	Volume (cubic metres)
ANSTO-radioisotope production, reactor operation and research	Target cans, ion exchange columns, used control arms, aluminium end pieces, some solidified liquid waste	205
Historical waste	Thorium and uranium residues from	165

[268] Speech to 3rd Scientific Forum, Vienna, September 2000
[269] EPA Submission No. 474 p3
[270] DEST Submission No. 367 p12

	mineral sands processing	
Other Commonwealth agencies	Disused sources from medical, Defence and research equipment	35

5.120 Sutherland Shire Council raised concerns in its submission about the physical nature and the implications of that for some of the intermediate waste:

> "ANSTO has a few thousand litres of intermediate-level liquid waste, mainly from the production of molybdenum-99, stored in shielded tanks, stainless steel or glass-lined steel. This is a very unsatisfactory situation. As far as is reasonably practicable, ILW should be stored in a passively safe form – the radioactivity should be immobile and the waste form and container should be chemically and physically stable, so that the need for safety systems, monitoring, maintenance and interference by people is minimised. This principle means that the liquid waste should be solidified as soon as possible."[271]

5.121 The Committee would agree with this understands that this process is underway at ANSTO.

Activity of Waste

5.122 The waste destined for the Store is classified as long-lived intermediate level waste. Under the Australian classification system (ie NHMRC 1992 Code), this is defined as Category S.

5.123 The EPA advised the Committee that long-lived intermediate level radioactive wastes "pose a more serious threat to both human and environmental health".

5.124 As observed in Chapter Two, world-wide intermediate level waste accounts for 7 percent by volume but 4 percent by activity. It is, therefore significantly more radioactive than LLW but still orders of magnitude below high level waste.

5.125 Sutherland Council stressed that the waste "is not trivial":

> **Dr SMITH:** ...Even lower-level waste for the proposed intermediate-level store waste is very long-lived in some of the radionuclides that will be transported, even for hundreds and thousands of years, and the material is vulnerable to misadventure, theft and, possibly, sabotage and security concerns.[272]

5.126 In essence the waste destined for the Store, Category S, is defined by exclusion:

> **Dr HARRIES:** ...Waste which is not acceptable for the repository will go into the long-lived intermediate-level category, which will be destined for the National Store. Whatever is not fit for the repository will be suitable for the store.[273]

5.127 This definition "by exclusion" continues the problem raised by the Committee earlier of being able to obtain a tangible quantitative guide to the hazard of the material.

5.128 From the point of view of enabling public understanding, it is simply not good enough to say that material to be transported to the store is that which is not suitable for the Repository.

[271] Sutherland Shire Council Submission No. 350Attach No 1 p4
[272] Transcript of Evidence 11 September 2003 pp52,3
[273] Transcript of Evidence 11 September 2003 pp27,8

5.129 As with Low level waste the Committee recommends strongly that, based on the range and activity of intermediate waste (for which ANSTO should have an inventory) a range of effective levels be determined to better inform the public on the hazard of the material. (see chapter six)

LUCAS HEIGHTS OPERATIONS

5.130 Lucas Heights has been at the centre of nuclear technology since its introduction to Australia in the 1950s.

5.131 In 1956, following the establishment of the Australian Atomic Energy Commission (AAEC), Lucas Heights was selected as the site for Australia's first nuclear reactor and work began on the HIFAR (High Flux Australian Reactor), a 10 MW research reactor. Lucas Heights was selected because of its remoteness.

5.132 The reactor achieved full power in early 1960, operating as a high-intensity neutron source for research purposes.

5.133 In 1961, the reactor capacity at Lucas Heights was supplemented with the commissioning of a smaller (100 kW) reactor called MOATA. It was a "versatile neutron source" used for a wide range of scientific studies. It ceased operations in 1995.

5.134 The Federal Government decided in 1997 to replace the HIFAR reactor with a new, larger (20 MW) research reactor known as the Replacement Research Reactor (RRR), which is expected to commence operations in 2005. Thus the Lucas Heights nuclear facility will continue to operate with Australia's only nuclear reactor for at least the life of this new reactor, estimated to be 50 years.[274]

5.135 In addition to the wastes accumulated by ANSTO at Lucas Heights which are destined for the Repository or the Store (and which have been discussed above) there are a number of other waste sources at the site which were raised with the Committee. These are:

- General standard of the management of the waste on site, including
  - Release of waste water, and
  - Little Forest Burial Ground.
- Decommissioning of Moata and HIFAR reactors

Onsite Waste Management

5.136 There was considerable criticism of ANSTO's management of waste at Lucas Heights.

5.137 According to Sutherland Shire Council, storage (and disposal) of waste at Lucas Heights is "far from best practice". The council stated that "the NSW EPA inspected the site in the mid 1990s and found considerable shortcomings in waste management processes and methods at that time".[275]

5.138 This view was restated at hearings. According to Cr Blight, "the existing waste management at Lucas Heights has a very poor record. It is below international best

[274] Transcript of Evidence 11 September 2003 p44
[275] Sutherland Shire Council Submission No. 350 pp5,6

practice, and must be improved. The Commonwealth Government is underfunding radioactive waste management at the Lucas Heights reactor".[276]

5.139 Dr Smith outlined the concerns in greater detail:

> **Dr SMITH:** ... nuclear waste [is] the back end of the nuclear industry in Australia. Waste issues and waste management have been neglected. They have been deferred until things had to be done about them. Historically, the record of the management of this waste is very poor. This has led to two particular concerns and problems for council. One is that the management of nuclear waste at Lucas Heights Science and Technology Centre is not adequate.[277]

5.140 The problem extended to the regulator according to Dr Smith:

> **Dr SMITH:** ...Unfortunately, although the regulator, ARPANSA, has improved the situation with somewhat more independent assessment of management in Australia, its record falls short of what the council feels is adequate. International forums with international experts convened by ARPANSA have made recommendations to it that have been ignored, particularly about making information on safety and risk available to the public."[278]

5.141 At public hearings ANSTO rejected these criticisms. According to Mr McIntosh:

> **Mr McINTOSH:** The operation of ANSTO's facilities necessarily produces a small amount of radioactive waste, which is managed in accordance with national and international standards.... This issue has been addressed by ARPANSA, among other bodies. In his decision licensing the construction of the replacement research reactor, Dr Loy said, "Given that I have issued a license for ANSTO waste operations, I do not agree that there is insufficient evidence that ANSTO's systems for managing radioactive waste are acceptable and in line with international best practice." Clearly the Commonwealth regulator has licensed our waste operations and has, in doing so, made an assessment and compared it against international best practice and come to the conclusion that it is in line with international best practice.[279]

5.142 This view was supported by Dr Harries:

> **Dr HARRIES:** The facility that the Committee saw is a storage facility for low-level waste. It contains drums of waste that are on racks. It is within a secure area, inside a monitored area. The area outside has bushfire control. The facility meets international standards for the storage of low- level waste. The material is solid, in drums.[280]

5.143 Dr Holland was somewhat sceptical of international standards and international treaties and organisations benchmarking work, saying that they can sometimes become "lowest common denominator instruments".[281]

5.144 Again, this is an area where the Committee is unable to form a view on these contradictory claims but makes recommendations to address this at the end of this chapter.

[276] Transcript of Evidence 11 September 2003 p3
[277] Transcript of Evidence 11 September 2003 p2
[278] Transcript of Evidence 11 September 2003 p52,3
[279] Transcript of Evidence 11 September 2003 pp23,4, 32
[280] Transcript of Evidence 11 September 2003 p28
[281] Transcript of Evidence 19 September 2003 p79

Aerial and Liquid Discharges

5.145 Sutherland Shire Council's submission to the Inquiry was very critical of ANSTO's management of discharges from the Lucas Heights site:

> "Liquid and aerial discharges into the environment from ANSTO are higher than necessary if the best available techniques (BAT) were applied…. It seems that the ALARA is not applied in practice by ANSTO that tends to discharge into the environment amounts up to the permissible level of radioactive release (determined by the regulators) rather than minimise discharges, preferable to zero or close to zero levels),..The BAT is not being applied presumably because of cost, including the costs of installing available technology and of conducting the required research and development to develop suitable technology."[282]

5.146 The issue of ANSTO's discharging of some 6,000 cubic metres of treated waste water into the Cronulla Sewage Treatment Plant and then to the ocean outfall at Potter Point on the Kurnell Peninsula was discussed in some detail at hearings. ANSTO rejected the claims made by the Sutherland Shire's submission:

> **Mr McINTOSH:** There are very low levels of radioactivity in the general sewerage disposal from ANSTO. Limits are set by the World Health Organisation as to the prescribed amounts of radioactivity that may be present in water. Radioactivity is present in all water, as it is in the ground and in the air, in you and in me. It is everywhere. There is a limit, called the drinking water standard, under which you are not allowed to have water with radioactivity above a limit. By the time our water gets to the sewage treatment plant it is many times below that World Health Organisation limit. The statement is true, but it is misleading because we would not be the only organisation discharging radioactive material to the sewer. For instance, hospitals in which nuclear medicine procedures are performed release greater amounts of radioactivity into the sewer. People void those products while in hospital.

5.147 With regard to monitoring, Dr Harries explained.

> **Dr HARRIES:** ANSTO's waste water and sewerage goes to the sewer and it includes some processed water. The effluent which goes into the sewer is under a trade waste agreement with Sydney Water. That trade waste agreement specifies what the level of radioactivity can be on its release, and what the level of other chemicals, such as chromium and other metals, might be. That trade waste agreement is specified by Sydney Water. We of course monitor the water that is released. Independent checks are done by Sydney Water and ARPANSA. ANSTO's environmental effluent and monitoring report is issued every year. The 2003 report is about to be issued and it is available in the Sutherland library. It is a publicly available document which identifies the results of ANSTO's environmental and effluent monitoring.[283]

5.148 The Sutherland Shire Environment Centre argued that the NSW EPA should become involved:

> **Mr PRICEMAN:** I think it would be a good idea if the New South Wales EPA got in the act here and started to do regular spot checks outside the perimeter. Obviously they do not have any right, because it is Commonwealth land, to go into the site but they could do regular checks in the soil and particularly in the streams around the area.[284]

[282] Sutherland Shire Council Submission No. 350 Attachment A p5
[283] Transcript of Evidence 11 September 2003 p30
[284] Transcript of Evidence 11 September 2003 p53

5.149 The matter was discussed with the EPA representative who confirmed that the waster was the subject of a trade water agreement between Sydney Water and ANSTO.

> **Mr SMITH:** ... So the key point of where control should take place, and does take place, is in that trade waste agreement between Sydney Water Corporation and the operator of the Lucas Heights facility. Our understanding is that there are limits on the amounts of radiation that can be in there. Our expectation is that the bulk of any radiation that would be in those discharges would be short-life materials that are typically stored just as they are in hospitals after use. Some of the half lives of these materials are a week or less so after they are stored for a few weeks the amount of radiation involved is very small.

5.150 Although the waste actually discharges in NSW its regulation is the responsibility of ARPANSA not the EPA. The EPA's only role is as the "regulator of Sydney Water Corporation, which is the agency that provides the sewage service," by applying the "limits to what is allowed to be discharged into the environment at the end of the sewage treatment plant". The EPA told the Committee:

> Even if we did discover something we would be impotent to address it. Therefore, the Commonwealth regulator looks at not only the boundaries but also the activities. It imposes a wide range of conditions for water monitoring at the Lucas Heights facility, just as it is responsible for regulating the trucks that transport material across the State.[285]

5.151 Dr Loy told the Committee that water-borne discharges were regulated by the trade waste agreement. However, ARPANSA had reviewed the document and "accepted" it. ANSTO is responsible for monitoring but ARPANSA takes independent samples from time to time to confirm ANSTO's results.[286]

5.152 The Committee has inspected ANSTO's "E Report, Environmental and Effluent Monitoring at ANSTO Sites, 2001". This report does suggest to the Committee that comprehensive monitoring and reporting is taking place.

5.153 The Sutherland community has sought from all parties involved a copy of the Trade Waste Agreement. The Committee itself asked Sydney Water for a copy but the Corporation had not provided a copy at the time of publication of this report nor even responded to the Committee. The Committee sees no reason why this should not be made public.

RECOMMENDATION 8: The Minister for Utilities should direct the Sydney Water Corporation to provide a copy of the ANSTO Trade Waste Agreement to Sutherland Shire Council.

5.154 The Committee notes the environmental reporting documentation produced by ANSTO. However, given the lack of trust and scepticism in the relationship between ANSTO and the Sutherland community, the Committee feels that DEC and Sydney Water could do more to provide independent monitoring of the discharge. The Committee understands that Sydney Water carries out risk assessment at its other facilities. This should be done at Cronulla.

[285] Transcript of Evidence 11 September 2003 pp73,77
[286] Transcript of Evidence 26 September 2003 p22

RECOMMENDATION 7: The NSW Department of Environment and Conservation should liaise with the Sydney Water Corporation to ensure a proper risk assessment be carried out at the Cronulla Sewerage Outfall. In addition to emission levels in the ocean, reporting should cover environmental, human health and biophysical impacts, similar to that carried out at other Sydney Water facilities.

Little Forest Burial Ground

5.155 As noted in chapter two, the Australian Atomic Energy Commission buried solid waste "with low levels of radioactivity and beryllium oxide "(which is non-radioactive at the Little Forest Burial Ground.

5.156 The No Time To Waste Inquiry reported in 1996:

> "The Sutherland Shire Environment Centre told the Committee that plutonium had migrated to the surface in the Little Forest Burial Ground. The Federal and State governments have decided to monitor the site and deal with any contaminants seeping from the site, although there are currently no long term plans to remediate the site."[287]

5.157 The waste management of this site was raised at hearings. ANSTO summarised the situation as it saw it:

> **Dr HARRIES:** Basically the material was put into the Little Forest Burial Ground 30 or so years ago. The material is well contained and we continue to monitor both the ground water and the air. We have regular surveillance done by Protective Services and individual ANSTO staff on that site.
>
> **CHAIR:** Am I correct in saying that no consideration has been given to moving that radioactive waste?
>
> **Dr HARRIES:** No consideration. It is adequately contained at the present time.[288]

5.158 Sutherland Shire Council essentially confirmed this situation

> **Dr SMITH:** … It is not best practice landfill or disposal but it is, in a sense, best not messed with at this point in time. It contains small amounts of plutonium which are of concern due to their longevity. In particular, it also contains a tonne of beryllium which is not radioactive but is highly toxic in that soil. So that older technology approach was a very poor approach. ANSTO does monitor the site. It monitors ground water, and it is convinced—and its consultants indicate to it—that there is not much passage of the material; it is better to leave it in situ at present. So that is essentially not an issue for the repository unless that is dug up and remediated.[289]

5.159 Mr Priceman, while somewhat ambivalent on a solution, felt that this was a case study in the dilemmas posed by producing radioactive waste.

> **Mr PRICEMAN:** …A study was done on the site and the safety of the site by Coffey Partners probably about 10 years ago and they came to the conclusion that nothing had migrated off site and it was probably quite safe, providing the trenches were not disturbed…We have been told that it is okay, probably quite safe, provided the trenches are not moved or disturbed. On the other hand they are talking about disturbing them

[287] *No Time To Waste*, Report Of The Senate Select Committee On The Dangers Of Radioactive Waste April 1996, Parliament Of The Commonwealth Of Australia p50
[288] Transcript of Evidence 11 Sept p31
[289] Transcript of Evidence 11 Sept p13

> and shifting off to another State. So it leaves me uneasy on both grounds. Once again it is a case of you produce radioactive waste, you put it there, you are not sure what it is going to do for the next 50 years or you say that 50 years is the limit and we, meaning somebody else, will look at it at that stage.[290]

5.160 The EPA advised that while technically off Commonwealth land, ARPANSA was, as the regulator of ANSTO's activities, the responsible authority and that the EPA was not involved.[291]

5.161 The Committee is of the view that no further action is required at this time.

Decommission HIFAR and Moata

5.162 In addition to the generation of waste from radiopharmaceutical production and the operation of the reactor, the reactors themselves become radioactive waste. At the end of their operational lives, all nuclear reactors are radioactive and they need to undergo some form of decommissioning (discussed previously in Chapter 2).

5.163 Decommissioning of the reactors produces both low level wastes and intermediate level waste, the amounts depending on the decommissioning path adopted, as Dr Harries explained:

> **Dr HARRIES:** The decommissioning plan has not been fully completed. There are amounts mentioned in the environmental impact statement. The EIS for the replacement reactor does have lists of low-level waste, which could be generated by decommissioning. It depends on what type of decommissioning is carried out.

5.164 The EIS into the Repository has estimated the volumes of decommissioned materials for each reactor.

5.165 MOATA

The Moata reactor was shut down in 1995 and its fuel and cooling water removed in 1996. A three stage decommissioning is planned to include complete dismantling and return to greenfield.[292] It is estimated that this will generate 55 cubic metres of low level waste.

5.166 HIFAR

The decommissioning of the HIFAR reactor was raised at hearings

> **Mr McINTOSH:** The Federal Government is to consider at some stage in the relatively near future a submission on the decommissioning of HIFAR. That submission has not been drafted yet and we are not drafting it, so we are not in a position to provide final information at this time. We can say that the EIS for the replacement research reactor considered a number of options for the decommissioning of HIFAR, mainly in terms of how quickly you do it, and those options ranged out to leaving it for 30 years before it was dismantled to allow most of the activity to decay. If that option is chosen, it will be a comparatively small amount of waste that is shifted to the repository. Obviously, if you dismantle it earlier, before allowing the radioactivity that is in situ to decay, you will have larger volumes of waste.[293]

[290] Transcript of Evidence 11 September 2003 p53
[291] Transcript of Evidence 11 September 2003 p73
[292] ARPANSA Joint Convention p5
[293] Transcript of Evidence 11 September 2003 p27

5.167 The estimates of waste volumes to be generated are:[294]

Low Level Waste	500-2,500m³
Intermediate Level Waste	5m³

5.168 The upper end of this estimated volume is of the same order of magnitude as the existing low level backlog and this decommissioning, when it happens, would represent another large transport campaign.

5.169 However, Dr Perkins from DEST identified a further option during public hearings:

> **Dr PERKINS:** So there is one option. It would be immediately defuelled after it ceases operations and then it would be left for 30 years and then there would be physical removal of some parts. There is also another option. It would be left for about 120 years after it ceased operations and then there would be dismantling of it. The Government has not yet selected an option for the decommissioning but, whichever option is selected, some waste would go to the low-level repository.[295]

5.170 The holding of the inoperative reactors on site for a significant length of time effectively continues the site's role in waste storage.

5.171 It is hard not to reach the conclusion that Lucas Heights will remain a store if the HIFAR reactor is left for 30 years to "allow most of the activity to decay", let alone 120 years. After all, this is the basic principle behind radioactive waste depositories.

FUTURE WASTE GENERATION – OPERATION OF REPLACEMENT RESEARCH REACTOR

5.172 So far the Committee has looked at issues relating to existing waste. As noted at the start of this chapter, the Federal Government announced in 1997 its decision to replace HIFAR with the RRR, to commence operations in 2005.

5.173 The operation of the reactor will obviously have implications for waste in NSW, as the new reactor will continue to generate radioactive waste.

5.174 The links between the new reactor and waste generation have been the subject of discussion for some time.

5.175 As early as 1993 the "McKinnon Report made a connection recommending that no new reactor should be built until the situation with radioactive waste is resolved".[296]

5.176 The CEO or ARPANSA has made a similar connection in considering the licensing for the new reactor. His pre-condition for to an Operating License stated that "A license to operate would not be issued by ARPANSA without there being clear and definite means available for the ultimate disposal of radioactive waste and spent nuclear fuel".[297]

[294] Department of Education, Science and Training, *EIS for the national repository* pp70,1
[295] Transcript of Evidence 7 October 2003 p73
[296] Transcript of Evidence 11 September 2003 p2
[297] Australian Conservation Foundation Submission No. 337 p7

5.177 As one witness put it simply, "if you are going to have a reactor, you are going to have waste".[298]

5.178 ANSTO recognises the link between the new reactor and the waste proposals:

> **Mr McINTOSH**: "The store for intermediate-level waste is linked to the reactor approval process. The repository is not, for whatever historical reasons, linked. If the repository never goes ahead that has no formal impact in terms of the licensing process on the replacement reactor".[299]

5.179 Yet, curiously, ANSTO did not see fit to follow this logic through in its submission to this inquiry, concentrating entirely on low level waste and making no reference to the proposals for intermediate level waste, the Store nor the RRR.

5.180 The decision to build the new reactor and continue with radiopharmaceutical production at Lucas Heights continues the relationship between the Sutherland Shire and nuclear technology.

5.181 This is an ongoing concern and a dilemma for those in the Sutherland area, according to the Sutherland Shire Environment Centre:

> **Mr PRICEMAN:** ... Whatever the outcome, the good folks of Sutherland Shire are faced with a lose-lose situation. Another half century of waste production followed by the decommissioning of three reactors—a gloomy outlook! Along with the prospect of daily emissions of radioactive gases, we are now told that the site is a prime terrorist target.[300]

5.182 Mr Priceman noted that even with the Repository and Store, all waste would continue to accrue at Lucas Heights because "whilst ever a reactor operates at Lucas Heights the site will be a waste dump... If the Commonwealth gets its way and moves some of the existing waste to someone else's backyard, waste will continue to pile up and refill the empty spaces."[301]

5.183 ANSTO acknowledged this point. When asked if, following the initial backlog transfer of waste to the Repository, there would be anything stored on site at Lucas Heights, Mr McIntosh advised that "we will still have a continuing store of a generation of waste on our site from the production of radiopharmaceuticals and from the operation of the reactor.[302]

5.184 Sutherland Shire told the Committee that it was "given an undertaking when the decision was made to build a new reactor that the waste stored at Lucas Heights would be removed and [the shire] would not be the national repository.[303]

5.185 This according to Dr Green goes to the heart of the proposals:

> **Dr GREEN:** ...these plans are being driven not by a public health or environmental agenda but by a political agenda, namely, shifting waste from Lucas Heights in order to reduce public opposition to a new reactor, and that reactor is arguably unnecessary.[304]

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[298] Holland Transcript of Evidence 19/11 p82
[299] Transcript of Evidence 22 October 2003 p74
[300] Transcript of Evidence 11 September 2003 p49
[301] Transcript of Evidence 11 September 2003 p49
[302] Transcript of Evidence 11 September 2003 p28
[303] Transcript of Evidence 11 September 2003 p17
[304] Transcript of Evidence 7 October 2003 p34

5.186 So even though the 40-year backlog of low and intermediate level waste will be removed with the operation of the Repository and Store, the commissioning of the new (RRR) reactor, expected in 2005, will begin to generate waste at Lucas Heights. In many ways it will be business as usual as RRR takes over from HIFAR.

5.187 Specifically, waste to be generated by the new reactor falls into three categories:

- **Lower Level waste** – suitable for the Repository or Store;
- **Spent Fuel** – to be reprocessed and sent to the Store; and
- **Reactor** – ultimately to be decommissioned.

Low Level Waste

5.188 It is estimated that something in the order of 40 cubic metres of LLW and SLILW will be generated every year. About 30 cubic metres of this will be produced by ANSTO

5.189 Assuming a design life of 50 years for the RRR,[305] ANSTO will generate another 1,500m³, which is similar to the current holding of ANSTO for this type of waste. Over the life of the reactor the total of waste generated by "disperse sources" will be about 500 cubic metres.

Intermediate Level Waste

5.190 As with low level waste, the operation of the Store will mean the removal of the existing waste "legacy" of intermediate level waste at Lucas Heights, but this does not mean this type of waste will disappear from that facility. It will continue to accumulate on site until it is transferred to the Store.

5.191 It is expected that the level of intermediate waste that the replacement research reactor creates will be similar to that which HIFAR currently produces, although there may be some reduction through recycling.[306]

5.192 Below is an estimate of the annual production of intermediate level waste following the commencement of operation of the RRR (This does not include the intermediate level waste returned from reprocessing of the spent fuel):

Table 1 Estimated rate of production per annum of waste for the Store (LLILW)[307]

Source	Typical Waste	Volume (cubic metres)
After 2005 ANSTO – radioisotope production, RRR operation and research	Target cans, ion exchange columns, used control arms, aluminium end pieces (about 1.5 cubic metres per year), solidified liquid waste from radiopharmaceutical production (about 0.12 cubic metres per year)	1.6
2000 onwards	Sealed sources from medical and research equipment	1.0

[305] Transcript of Evidence 11 September 2003 p44

[306] Department of Industry, Science and Resources, *Safe Storage of Radioactive Waste: The National Store Project: Methods for choosing the right site*, Public Discussion Paper July 2001 p5

[307] Safe Storage of Radioactive Waste Discussion Paper July 2001

Other Commonwealth agencies		

Spent Fuel

5.193 The other source of waste from the RRR (as well as HIFAR) is spent fuel or high level waste.

5.194 According to ARPANSA, "Australia's existing contract with COGEMA for the reprocessing of spent fuel from HIFAR includes provision for the reprocessing of spent fuel from the replacement reactor".

5.195 The new reactor will obviously continue to generate spent fuel, estimated to be some 20 to 30 spent fuel elements each year. Over its expected life of some 50 years it will therefore produce between 1,000 and 1,500 spent fuel elements.

5.196 Waste from the reprocessed spent fuel will be "returned in purpose-designed transport and storage containers as vitrified (glass) residues and compacted waste. The containers will be appropriate for storage in the national store and will not require additional shielding or remote handling equipment for their management".[308]

5.197 The nature of spent fuel management requires it be initially kept on site. Councillor McDonnell, quoting the RRR EIS, said that this would be for ten years:

> **Mr McDONNELL:** I draw the Committee's attention to the environmental impact statement that was done in relation to the construction of the new reactor, which revealed that whether we like it or not the spent fuel rods coming out of the new reactor will remain at Lucas Heights for 10 years before any consideration is given to what will be done with them.[309]

5.198 The CEO of ARPANSA has advised the IAEA that the first shipment "would be approximately eight years after the commencement of reactor operation" and that "it is anticipated that there will be one overseas shipment of spent fuel every five or six years".[310]

5.199 The new reactor will have the capacity to store "up to 10 years' arisings of spent fuel discharged from the reactor, while retaining sufficient spare space to unload the complete operating reactor core at any time, should this be required".[311]

Table 2 Intermediate level waste from decommissioning and spent fuel management

Source	Typical Waste	Volume (cubic metres)	Year of Waste Production
RRR spent fuel	Vitrified (glass) residues and compacted waste	20	After 2025

5.200 The issue of reprocessing is discussed in detail below.

5.201 The NSW Fire Brigade is satisfied that the risk to the current spent fuel arrangements (from ANSTO to Port Botany) is low to moderate. It told the Committee:

[308] Dept of Industry, Science and Resources, Safe Storage of Radioactive Waste, The National Store Project, Discussion paper July 2001, p9
[309] Transcript of Evidence 11 September 2003 p17
[310] ARPANSA Joint Convention p7
[311] ARPANSA Joint Convention p6

> To date radiation sources in the form of nuclear waste have been predominantly transported directly from ANSTO at Lucas Heights to Port Botany for transportation by sea from Australia. The low frequency of such movements, the short distance, and the nature of required packaging, means that the risk from such movements is low to moderate. There is a low likelihood of an accident or substance escape/spillage.[312]

5.202 Regardless of this assessment, as this high level waste represents the greatest hazard to the community, the Committee is of the opinion that the production and transportation of this material should be kept to an absolute minimum.

Decommissioning

5.203 Like the other two reactors, the RRR will eventually need to be decommissioned at the end of its life, expected to be 50 years. It can be assumed that similar considerations apply to the RRR as to HIFAR and so the volumes and types of waste generated will be similar to that for the HIFAR reactor.

New Storage Facility

5.204 Many submissions asserted that the new reactor effectively created a new storage facility at Lucas Heights, thus breaking an "undertaking" with Sutherland community and contrary to current state government policy.

5.205 The ACF told the Committee:

> **Mr NOONAN:** …A new reactor is a new nuclear waste storage facility in Sydney… So, for the first decade of operation of the new reactor in Sydney, that site will use Sydney as a high level nuclear waste dump and it will be used continuously thereafter as a high level nuclear waste dump because the Commonwealth transport arrangement… does not remove at any one time all of the high level waste.[313]

5.206 The Medical Association for the Prevention of War (MAPW) supported this view:

> **Dr WILLIAMS:** …We feel that the Lucas Heights research reactor is in fact …a de facto store for not just low and intermediate level waste but high level waste in the form of spent fuel. There are many rods sitting there. They are hot. They will remain radioactive for a long time and they can sit in their storage pool for up to 10 years before being sent elsewhere for reprocessing.[314]

5.207 The representative from the NSW EPA told the Committee:

> **Mr SMITH:** I do not think there is a definition of the storage facility, but it sounds like they intend to store high-level materials on the site.[315]

5.208 While ANSTO's RRR will mean that waste continues to be created at Lucas Heights, the Committee is not of the view that the new reactor constitutes the creation of a new storage facility; it is simply the continuation if existing practice.

5.209 There is no doubt that Lucas Heights will continue to be a storage for all levels of waste from low to high. The RRR will simply continue a process that has been ongoing for years.

[312] NSW Fire Brigades Submission No. 285
[313] Transcript of Evidence 19 September 2003 p58
[314] Transcript of Evidence 19 September 2003 pp 50,1
[315] Transcript of Evidence 11 September 2003 pp77,9

5.210 This is not meant to downplay the significance or impact of these operations but it is the fact of the situation in the Committee's view.

MANAGEMENT OF REPROCESSED SPENT FUEL

5.211 One of the most contentious issues put to the Committee was the management of spent fuel (or high level waste). The general management of this material was discussed in Chapter Two. Transportation aspects will be discussed in the following chapter.

5.212 There is no disagreement on the hazard presented by spent fuel when it has been removed from a reactor — it is the most highly radioactive of substances.

5.213 Mr Courtney from Greenpeace called it the "the most dangerous of the risks posed",[316] while Dr Loy, ARPANSA, observed that "it is a highly hazardous material … it has to handled with a very strict and careful method".[317]

5.214 There are two paths for the management of spent fuel.

5.215 The first is reprocessing to recycle fissile material. The residue of this process is regarded as LLILW.

5.216 Secondly, if the spent fuel is not reprocessed, it is simply treated as a (high level) waste.

5.217 The whole process, from removal from the reactor to the return for the Store takes many years.

5.218 As at 31 December 2002, in storage at Lucas Heights there were:

- 904 HIFAR spent fuel elements (with a total mass of uranium of 192 kg), and
- 177 Moata spent fuel plates (with a total mass of 4kg).[318]

5.219 According to ARPANSA, the Moata spent fuel is of US origin and by agreement it will be returned to the United States and no waste will be returned to Australia.[319]

5.220 This inventory was reduced by a recent shipment of spent fuel in late 2003.

5.221 It is estimated that reprocessed spent fuel from HIFAR will commence returning in 2015 and from RRR in 2025.

5.222 The inventory of HIFAR spent fuel elements that have been sent abroad for re-processing and for which there is a contractual requirement for the return of waste to Australia, is as follows:[320]

Reprocessing Location	Number of elements	Total mass of Uranium (kg)
UKAEA Dounreay	114	16
COGEMA, Le Hague, France	668	104

[316] Transcript of Evidence 19 September 2003 p11
[317] Transcript of Evidence 26 September 2003 p23
[318] ARPANSA Joint Convention p41
[319] ARPANSA, Joint Convention p6
[320] Source ARPANSA Joint p41

5.223 Reprocessed fuel will be returned in two forms either "… in large glass boxes of vitrified waste and in cases of steel and metal. There is also some waste that is due to come back which is encased in concrete… from the United Kingdom".[321]

5.224 The discussion paper on the site selection for the Store proposal, estimated the reprocessed spent fuel waste as follows:[322]

Source	Typical Waste	Volume (cubic metres)	Year of Return
HIFAR spent fuel	Packaged conditioned waste in concrete	20	By 2020
	Vitrified (glass) residues and compacted waste	6	2015

5.225 It is current government policy to reprocess all spent fuel. As Australia does not possess a reprocessing facility, this is carried out overseas and the residue long-lived intermediate waste is returned to Australia. It is destined for the Store:

> **Mr McINTOSH:** … There was a de facto extended interim storage strategy until the Federal Labor Government made a decision in the mid-1990s to send spent fuel overseas for reprocessing. Approximately half of the spent fuel that was on site at that time has now been removed overseas for reprocessing. The rest will be removed in the next few years. But at the moment there is no contingency plan to that effect.[323]

5.226 There have been concerns raised about the ability of Australia to manage its spent fuel in the future.

5.227 According to the EPA,

> "One of the major issues raised in the Environmental Impact Statement in 1998 for the application by ANSTO to the Commonwealth for the site licence for the new reactor is the lack of facilities for storage of radioactive waste material. This problem has been accumulating over the nearly fifty years of operation of the Lucas Heights facility and is especially marked in relation to spent fuel elements."[324]

5.228 The September 1999 Report by the Senate Economics References Committee on a New Reactor at Lucas Heights and the May 2001 Report of the Senate Select Committee for an Inquiry into the Contract for a New Reactor at Lucas Heights recommended that the proposed new reactor not be built until the issue of off-site storage of radioactive waste is resolved. The NSW Government has consistently supported this position".

5.229 This requirement for the resolution of the issue of management of intermediate level radioactive waste was also proposed by the McKinnon Report as early as 1993.[325]

5.230 Dr Smith for Sutherland summarised the issue as follows:

> **Dr SMITH:** …The Commonwealth Government is getting into a very difficult situation with potential solutions to the highly radioactive spent fuel waste, which is to be sent off to France to be reconditioned or potentially to go to Argentina for conditioning and then

[321] Transcript of Evidence 19 September 2003 p6
[322] Safe Storage of Radioactive Waste Discussion Paper July 2001
[323] Transcript of Evidence 11 September 2003 pp 32,3
[324] EPS Submission No. 474 p4
[325] EPA Submission No. 474 p4

> come back to Australia. He [Barnaby] strongly questions whether France will continue to recondition. We question strongly whether Argentina will condition this material and in fact constitutionally can do so. He points directly to the possibility that Australia may have to condition its own highly radioactive spent fuel waste. This would take the risk levels an order of magnitude or more higher. New South Wales would have to worry about that, because the spent fuel is now at Lucas Heights and any potential conditioning could be done there. In fact, management of ANSTO have said in the past that they have advocated conditioning of spent fuel at Lucas Heights, in which case the risk levels increase markedly.[326]

5.231 Minister McGauran was reported as saying in 1997 that reprocessing was not dangerous. "This is medium level waste and we can either have it reprocessed in the United Kingdom or do it in Australia".[327]

5.232 ANSTO told the Committee that Lucas Height will not be used to accommodate reprocessed spent fuel:

> **Mr McINTOSH:** The Government has told us that the reprocessing waste will be accommodated in the national store and that there is no intention that it be returned to ANSTO. I know that the Government has written to Sutherland Shire Council to that effect. Therefore, there is no need for us to prepare any contingency plans for that waste because it is not coming back to us... It would breach undertakings given by successive Governments to the local council and to other groups. It would be contrary to Government policy ...
>
> ... At the time we applied for the construction license, Dr Loy indicated that he was satisfied that the options do exist and that the reprocessing strategy we had in place was adequate at that stage. There has been nothing since to change that.[328]

5.233 Rather than being a problem, ANSTO argued that any fall-off reprocessing in Europe actually increased the opportunity for reprocessing ANSTO spent fuel: "In fact, we would suggest looking at what is happening in Europe, that the pressure on reprocessing is in fact reducing rather than increasing."[329]

5.234 ARPANSA's nuclear safety committee recommended that a contingency plan for domestic management of spent fuel be developed. However this was deemed unnecessary by the CEO of ARPANSA, who "in his decision to licence the construction of the replacement research reactor, said that, given the number of options for overseas reprocessing available, there was no need for ANSTO to do that at this time". Accordingly, ANSTO is doing what it was directed by the Government to do – "arrange for reprocessing of the fuel overseas".[330]

5.235 The executive officer from SSROC summed the concerns from many groups when she said "...We were quite concerned that the new reactor proposal was allowed to proceed without the resolution of the waste issue".[331]

5.236 Dr Loy advised the IAEA joint convention that reprocessed spent fuel will be "repatriated to Australia at some contractually-determined time, at which point an appropriate storage facility is **expected** to be available". [emphasis added].

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[326] Transcript of Evidence 11 September 2003 p16
[327] Search, Vol 28, No2 March 1997 p39
[328] Transcript of Evidence 11 September 2003 pp36,37, p34
[329] Transcript of Evidence 11 September 2003 p34
[330] Transcript of Evidence 11 September 2003 p36
[331] Transcript of Evidence 11 September 2003 p64

5.237 As there are only ten years of spent fuel holdings at Lucas Heights for the new reactor a major concern is that, in the event reprocessing options overseas become unavailable, this capacity would quickly be reached. In this situation the EIS into the new reactor speculated that spent fuel would be sent to the Store on a temporary basis until other reprocessing options are established overseas.

5.238 Sutherland Shire Council has recommended to the Committee that:

> "That the NSW Parliament require that ARPANSA not license a RRR until the details of the reprocessing and conditioning of spent RRR fuel and of the transport and storage, including permanent storage, of the waste that would be created have been firmly decided"[332]

5.239 The uncertainty in this matter is a concern the the Committee. The comments by Dr Loy to the IAEA are not totally comforting. The Committee is escpecially concerned with any unnecessary trasnportation of spent fuel to and from the Store. This should be avoided and indeed opposed.

5.240 The Committee believes that its recommendations at the end of this chapter will go along way to addressing this problem.

WASTE MINIMISATION

5.241 Many submissions argued that, given the problems we are having in finding solutions to radioactive waste, the most sensible, logical thing to do is to pursue waste minimisation.

5.242 In fact this approach was not only encouraged but urged. For some it was the only way to go because "arguably, there is no acceptable solution, which is why we have to come back to the issue of waste minimisation time and time again".[333]

5.243 One submission put it as follows:

> "All affected communities would agree, I am sure, that plans to transport and store nuclear waste are very short-sighted if there is no plan to minimise waste at its source".[334]

5.244 Mr Priceman said, "the question of what to do with nuclear waste cannot be separated from the operation of a reactor. If a new reactor were not built then the waste problem would immediately be halved".[335]

5.245 Thus the most effective waste minimisation method proferred to stop producing the waste, "to turn off the tap", is not to proceed with the new reactor – currently under construction but awaiting an operating licence.

5.246 The executive officer from SSROC argued there was an equity issue to be considered in continuing to produce radioactive waste because "it is inequitable to create a problem for future generations. We need to address intergenerational equity".[336]

[332] Sutherland Shire Council Submission No. 350 p36
[333] Transcript of Evidence 7 October 2003 p48
[334] Submission No. 6
[335] Transcript of Evidence 11 September 2003 p49
[336] Transcript of Evidence 11 September 2003 p64

5.247 It should be restated here that the IAEA regards waste minimisation as one of the two fundamental principles of waste management.(see page 26)

5.248 Dr Williams, Vice President of the Medical Association for the Prevention of War (MPAW), observed that the timing for this was very favourable, stating that "in Australia, we are in a fortunate position. If we want to we can reduce our radioactive waste problem in a rapid way by terminating, mothballing the current nuclear reactor in Sydney and not building a new one".[337]

5.249 This of course raises the issue of how to provide the important services supplied by the reactor. Certainly no one disputes the benefits they provide to society.

5.250 Proponents of this waste minimisation approach claim that these valuable and important benefits can now be provided by other means. Alternatives technologies exist, and are still being developed, that can produce radioisotopes without the need for reactors. In the interim, those radioisotopes that can still only be produced by reactors can be imported.

Alternatives to a New Reactor

5.251 Dr Williams, vice-president of Medical Association for the Prevention of War, posed the following questions to the Committee in hearings: What would happen if we closed down the reactor? Would that be the end of the vibrant nuclear medicine industry in Australia?

5.252 (He explained that MAPW was not "an anti-nuclear organisation as such. Many of our over 800 members are radiologists and nuclear physicians. We have some very prestigious medical scientists in our ranks. As I said, I am a GP. I not infrequently refer people for nuclear medical reasons for bone scans, lung scans and so forth."[338]

5.253 He went on to answer these questions as follows:

> **Dr WILLIAMS:** ... No, not at all. It's a furphy. The medical fraternity, if you like, has been used as a trojan horse for the nuclear industry. We do not need to build a nuclear reactor to have a high quality nuclear medical industry. At the moment we already import substantial quantities of isotopes for our medical capability ... Talk to people in New Zealand. They do not have a reactor. They have a very high quality nuclear medicine capability. Talk to people in the United States, the United Kingdom and Japan. Talk to people in Canada. We need one or maybe two reactors in the world to produce enough radioactive isotopes to keep the best quality medical services available to human beings throughout the world, let alone in Australia.[339]

5.254 Indeed, there have been times when Australia has imported all of its isotopes without any noticeable effect:

> **Dr GREEN:** ... the reactor was closed for three months from February to May 2000. After that, a journalist asked the senior nuclear medicine physician in Australia, Dr Barry Ellison, President of the Association of Physicians in Nuclear Medicine, how doctors coped during the three-month closure of the reactor, and he was not aware that the reactor was closed down.[340]

[337] Transcript of Evidence 19 September 2003 pp50,1
[338] Transcript of Evidence 19 September 2003 p50
[339] Transcript of Evidence 19 September 2003 p51
[340] Transcript of Evidence 7 October 2003 p41

5.255 According to the ACF:

> **Mr NOONAN:** … We believe that it is essentially untrue for the Federal Government to be telling your Committee that they require a reactor in Sydney to provide medical services. There is no need to have any nuclear reactor in Australia to provide the same level of nuclear medical services.[341]

5.256 Mr Courtney called the medical isotopes argument "a myth".[342]

5.257 A number of witnesses advised the Committee that, while isotopes could be imported in the short term, in the longer term it would be possible and preferable to produce them in Australia using non-nuclear technology:

> **Dr WILLIAMS:** … Already a lot of the isotopes are produced in cyclotrons and other types of particle accelerators which are driven by electricity, not by nuclear fission, and the future of producing relevant isotopes like technetium is in particle acceleration. That will require millions of dollars, not hundreds of millions of dollars, and it will require some years of research and further development. I think one of the papers that was presented by Sutherland shire, by Professor Robert Budnitz, a very respected nuclear engineer talking about these alternatives, describes quite clearly the process by which we could achieve that and I certainly believe that short-term importation, long-term non-reactor generation, no problem.[343]

5.258 (Sutherland Shire Council provided a copy of Dr Budnitz's work in its submission)

5.259 After noting that "a very large majority of the short-lived isotopes are produced in cyclotrons in Australia", Dr Green told the Committee:

> **Dr GREEN**: With hardly any exceptions, the longer-lived isotopes are reactor produced and can be imported as an interim measure with no problems whatever, or very rare problems. In the longer term we would look to produce as many of those reactor-produced isotopes in accelerators and including cyclotrons.[344]

5.260 Some witnesses claimed that these alternatives presented a significant economic opportunity:

> **Mr COURTNEY:**… These are exactly the sort of technologies that Australia could become a world leader in. ANSTO could be a world leader in non-nuclear methods of developing radioisotopes or producing radioisotopes; ANSTO could become a world leader in waste management solutions. These two areas are real and practical areas of research. Australia is never going to be a world leader in nuclear technology, and when you look at the problems that nuclear technology has given us, low level waste, high level waste, compared to the problems in the United States and parts of Europe where they are drowning under mountains of nuclear waste, we should be learning by the international example and saying nuclear technology, building nuclear reactors is a mistake. There is no way of dealing with the waste that is produced by them and ANSTO could be becoming a world leader in these alternatives.[345]

5.261 Councillor McDonnell agreed:

> **Mr McDONELL:** …The point I want to make is that the alternative, as seen in attachment 2 [to the submission], is more cost effective than building replacement reactors, and

[341] Transcript of Evidence 19 September 2003 p66
[342] Transcript of Evidence 19 September 2003 p13
[343] Transcript of Evidence 19 September 2003 pp53,4
[344] Transcript of Evidence 7 October 2003 p45
[345] Transcript of Evidence 19 September 2003 p13

> would provide as many jobs ... I would have thought that the possible use of alternative technology that resulted in a significant reduction in the production of nuclear waste that produced the necessary radiopharmaceuticals for nuclear medicine at a far cheaper cost would have been given more attention than it has been given to date. I believe this has been largely ignored. There are significant economic benefits to Australia as a whole. It has been spelled out very clearly in the report that the council put together.[346]

5.262 Mr McIntosh responded in detail to these arguments:

> **Mr McINTOSH:** The Government decided that a replacement reactor was necessary and it was necessary for a number of reasons, not merely production of medical isotopes, important though that is. Suggestions have been made regarding technetium, the most important isotope from a medical treatment point of view, which is used in 70 per cent to 80 per cent of nuclear medical procedures. It is used to diagnose cancer, heart disease, stress fractures in bone, et cetera. Around the world that is only produced in reactors.
>
> There was a theoretical paper that was produced in the early 1990s that argued it was possible to produce technetium in an accelerator. It has not actually happened. It was a theoretical study. Canada made a decision about the same time we made a decision on the replacement reactor. MDS Nordion in Canada is the largest producer of radioisotopes in the world and they were producing them in a reactor roughly the same vintage as HIFAR—a different design but the same vintage. They decided, like with HIFAR, that it was reaching the end of its life and they needed to look at technologies for producing technetium in the future. Their decision was to replace it with two new reactors, not accelerators, but reactors. They have built two maple class reactors to produce radioisotopes for all of North America and some of the world beyond. Clearly, the view not just in Australia but elsewhere is that reactors are necessary to produce technetium, which is the workhorse at present for radioactive diagnosis in nuclear medicine.
>
> There are a number of other isotopes that can only be produced in reactors and they are often used in treatment as well as diagnosis. You referred to imports. At the recent International Conference on the Safety of Transport of Radioactive Material held in Vienna in July that I attended, from many different angles there were complaints about the increasing difficulties being encountered in the air shipment of radioisotopes. I understand that those difficulties are leading Japan, for instance, which at the moment relies mostly on imports, to be looking seriously at building their own reactor to produce medical isotopes.
>
> Of course, there are uses beyond nuclear medicine—science and probing the structure of materials. You may have seen the *Catalyst* recently on the Ned Kelly armour, which was just an illustration of the way in which reactors are used to test materials, new materials, new lightweight ceramics and so on. The new reactor will have an instrument where you can put a component like an engine inside this instrument and probe it with neutrons to check that it is welded correctly and that there are no hidden flaws in the metal, rather than having to do external industrial radiography. There is a multiplicity of uses for the reactor, and nuclear medicine is one of them. That is why the Government made the decision to replace it.[347]

5.263 Without wanting to trivialise these issues, the Committee would question the need to generate high level radioactive waste in order to analyse Ned Kelly's armour.

5.264 Professor Allen (a former Chief Research Scientist at ANSTO, Director of the Centre for Experimental Radiation Oncology, St George Hospital and Adjunct Professor,

[346] Transcript of Evidence 11 September 2003 p22
[347] Transcript of Evidence 11 September 2003 pp47,8

Medical Physics, University NSW) did not agree that alternative technologies could provide all the necessary isotopes for the foreseeable future. But he agreed Australia did not need the new reactor for medical reasons:

> **Professor ALLEN:** Medically I do not believe the new reactor is essential. But there may be other reasons why the Government wants a reactor. Having said that, it is fallacious to say that all those isotopes can be produced on accelerators. The reality is they cannot. The molybdenum technetium generator for the foreseeable future has to be produced in a reactor. That can be and has been imported from all round the world. I believe there is at the present time and in the short-term future excess capacity to produce that generator. So, I do not believe that is a particular problem. Accelerators can produce other types of isotopes which have a role, a role of increasing importance, like positron emission tomography... What the real reason for the new reactor is really is a matter for the Federal Government. I believe I know what the reason is and in that sense I probably concur with it, but I think it was inappropriate to claim that it was required to save lives with nuclear medicine.[348]

5.265 Because of the economic and social benefits, Mr Priceman ascribed an active role for the NSW Government in developing alternatives.

> **Mr PRICEMAN:** ...Alternative methods of producing technetium^{99m}, the main medical isotope used around the world, are available. The New South Wales Government should investigate this and preferably build and install one in Sydney in opposition to ANSTO. The benefits of accelerator technology versus reactors are apparent. That they produce only small amounts of waste is only one benefit, and it would be a source of income for the State.[349]

5.266 Most if not all "developed" countries would utilise radioactive materials for medicine, industry and research. Yet not all them necessarily possess nuclear reactors to produce radiopharmaceuticals.

5.267 As at January 2004, there are 272 operational research reactors worldwide, distributed among some 58 countries.[350] Of these, only about 60 produce isotopes, with the rest, as the Committee understands it, engaged in activities such as providing a neutron source for research.[351]

5.268 While not conclusive, there appears to be a downward trend in the number of operational research reactors around the world, and a significant increase in the number of reactors undertaking decommissioning. This figure seems set to increase rapidly as aging and obsolete reactors are shut down. (A 1999 study found that 66 per cent of the world's research reactors were more than 30 years old and 80 per cent were more than 20 years old.)[352]

5.269 According to information gathered from the IAEA Research Reactor Database[353]:

- Ireland, Iceland, Luxembourg, and New Zealand are developed countries without research reactors or power reactors;

[348] Transcript of Evidence 22 October 2003 pp20,1
[349] Transcript of Evidence 11 September 2003 p51
[350] IAEA Research Reactor Database. www.iaea.or.at/worldatom/rrdb
[351] Dodd, B. *Current Status of the World's Research Reactors*. International Atomic Energy Agency, Vienna, Austria. October 1999
[352] Dodd, B. *Current Status of the World's Research Reactors*. International Atomic Energy Agency, Vienna, Austria. October 1999
[353] IAEA Research Reactor Database; and Dodd, B. *Current Status of the World's Research*

- Bulgaria, Georgia, Latvia, the Philippines and Spain, do not have operational research reactors and therefore do not produce radioisotopes;
- Austria, Denmark, Finland, France[354], Greece, Israel, the Republic of Korea, Malaysia, Mexico, Slovenia, Sweden, Turkey, the Ukraine and the Former Yugoslavia have research reactors but do not use them to produce radioisotopes;
- Portugal has one research reactor only, which is used to produce short-lived radioisotopes.

5.270 Dr Green provided some further information on overseas approached in evidence:

> **Dr GREEN:** ... We also have the case of the United States where plans for a very high-powered nuclear research reactor have been abandoned in favour of, again, a spallation source. In other countries around the world there are similar examples where reactors are being replaced with accelerator spallation secretion technology. So it is certainly not pie in the sky.

5.271 He also argued that a move to alternatives does not mean the demise of ANSTO, for it could become "the cutting edge modern scientific facility investigating non-nuclear methods for the production of radioisotopes and developing real management solutions".[355]

5.272 In 1993 the McKinnon Report into the proposed new research reactor considered the range of non-reactor options available to meet Australia's needs "in neutron science and applications". It was not able to reach any firm conclusion, reporting that the "jury is out on too many issues". Because of the rapid advances in this area the Report recommended keeping HIFAR operating and "making a decision on a new neutron source in about five years' time when the relative arguments relating to spallatial sources, cyclotrons and reactors might be clearer".[356]

5.273 It is the Committee's view that the time is right for a formal review of this situation.

RATIONALE FOR THE PROPOSALS

5.274 The Federal Government has put forward a number of reasons for the current proposals for the Repository and Store.

5.275 According to DEST, the Repository "represents the safest and most cost effective option for Australia to manage its low level and short-lived intermediate level waste, particularly as the ongoing generation of this material is expected to be relatively small and therefore technically and economically does not justify the establishment of separate facilities on a state-by-state basis.[357]

5.276 Both ANSTO and ARPANSA told the Committee that the proposals "centralised" radioactive waste management"[358].

5.277 Both ARPANSA and ANSTO told the Committee that the waste facility proposals "centralised" waste management in Australia.

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[354] Although France currently has 15 operational research reactors, none produce medical radioisotopes.
[355] Transcript of Evidence 19 September 2003 p6
[356] McKinnon Report, pp xiv, 48
[357] Submission No. 367 p2
[358] ARPANSA Joint Convention, p33; ANSTO Transcript of Evidence, 22 October, p48

5.278 But according to ANSTO and ARPANSA waste is being properly managed at Lucas Heights:

> **Mr McNTOSH:** …Obviously, that waste has been safely managed at Lucas Heights for many decades and ANSTO has the capacity to safely manage it for years to come. But, as discussed previously, ANSTO is not the only holder of radioactive waste in New South Wales. Any decision on the State management of radioactive waste in New South Wales eeds to recognise that indefinite storage of radioactive waste by small holders is not consistent with international best practice.[359]

5.279 And Dr Loy, as the ACF reported:

> **Mr NOONAN:** … I refer the Committee to a quote on page 12 of the ACF submission where the CEO of ARPANSA, John Loy, in his reasons for decision in granting a construction licence for the new reactor… He then goes on to say that essentially he is satisfied that the existing reactor waste and the new reactor waste in those classes can be properly managed at the Lucas Heights reactor. Essentially he has already looked at the management planning issues and he is satisfied that those wastes do not need to leave the Sydney reactor site, even if the new reactor should go ahead… essentially through this statement the Federal regulator is saying that there is no need to move those wastes out of Lucas Heights.[360]

5.280 So the proposals seem aimed at perceived inadequacies in the non-ANSTO, "dispersed" sites.

5.281 In his submission to this inquiry, Minister McGauran observed:

> "It is strongly in the interests of public security and safety to secure radioactive materials by disposal or storage in facilities specially designed for this purpose. In the absence of purpose-built facilities, Australia's radioactive waste will continue to be stored under ad hoc arrangements at hundreds of sites, including in NSW, which do not represent international best practice in radioactive waste management".[361]

5.282 As noted previously, ANSTO confirmed for the Committee that the Repository did not need to be in the "back of beyond" pointing out that a Repository existed in Champagne in France – hardly the back of beyond.

5.283 These non-ANSTO sites include metropolitan and regional hospitals, universities and other research organisations, private companies and some government departments,[362] in numerous locations in New South Wales, including Sydney CBD, Lidcombe, Liverpool, Menai (ie Lucas Heights), North Ryde, Griffith, Wollongong and Armidale.

5.284 It would seem then that the aim of these proposals is to address inadequacies in the non-ANSTO, dispersed sites, sites that currently hold a small fraction of the waste holdings destined for the Repository (27 cubic metres in NSW), waste holdings that are low in radioactivity and that will generate about a quarter or the waste in the future.

5.285 There is not doubt justifiable concern about the standard of these facilities. DEST advised… "that there is risk involved in storing even small quantities of waste "in facilities that were not designed for [its] long-term management". It poses greater

[359] Transcript of Evidence 22 October 2003 p47
[360] Transcript of Evidence 19 September 2003 p58
[361] DEST Sub NO 367 Minister's Correspondence
[362] Submission No. 367 p8

potential health risks for people and the environment than waste stored in purpose-built facilities."[363]

5.286 Minister McGauran advised the Committee that "NSW has not previously provided DEST officials with an inventory of waste held in universities, hospitals and industry stores within the state" and that might "benefit from an audit of the radioactive waste held in the state to determine the exact amount and type of waste, its location and current storage conditions".[364]

5.287 According to the NSW EPA this risk might not be large:

> **Mr SMITH:** ... You will appreciate that there is a trend in the use of radioactive materials for medicine, which is the favouring of much shorter lived isotopes because they are much more easy to manage because their radioactive force is spent very quickly. That means that they need to be delivered very frequently using air or road around the State... Our expectation is that the bulk of any radiation that would be in those discharges would be short-life materials that are typically stored just as they are in hospitals after use. Some of the half lives of these materials are a week or less so after they are stored for a few weeks the amount of radiation involved is very small.[365]

5.288 But Mr Smith agreed that the Minister's suggestion had merit.

> **Mr SMITH:** I think that it is useful, I guess, in our assessment of the risks of the use of these materials. It would be a lower risk if the materials are consolidated into a smaller number of larger facilities.[366]

5.289 The NSW Fire Brigade also saw merit in having a waste audit.[367]

5.290 The EPA advised the Committee that as a consequence of changes to the Radiation Control Act Regulation such an audit would take place:

> **Mr SMITH:** We have started implementing a solution, which is to require registration of facilities that have such materials and are moving to prepare an inventory to identify which sources they are, and to ensure that the facilities in which they are held are safe.[368]

5.291 While acknowledging the need to better manage this waste, Greenpeace regards the focus on this low level waste issue as a diversion:

> **Mr COURTNEY:** ...In relation to the low level waste that is stored in hospitals and so on, there has never been a proper investigation into whether those facilities are adequate. The Federal Government has used that as a way of spreading the threat to hide the fact that it is actually ANSTO that is driving the need for a waste dump in South Australia or for a store for waste. The waste that is stored in universities and hospitals is a non-issue compared to the waste that is produced by ANSTO...[369]

5.292 Dr Williams argued that the proposal did not really reduce the number of dispersed sites:

[363] Submission No. 367 p2
[364] DEST Submission No. 367 Minister's Correspondence
[365] Transcript of Evidence 11 September 2003 pp70,73
[366] Transcript of Evidence 11 September 2003 p71
[367] Transcript of Evidence 19 September 2003 p36
[368] Transcript of Evidence 11 September 2003 p80
[369] Transcript of Evidence 19 September 2003 p7

> **Dr WILLIAMS:** …The question about dispersed storage: As it stands now, there are many facilities all around Australia that are storing radioactive waste. If there is a problem with them, we should fix it now. That is the point. We are not going to get rid of those storages because the store, if we build one, in South Australia, or the repository I should say, or a store, is not going to obviate the need to continue to store it on site at the Royal Melbourne Hospital or at the Peter McCallum Clinic. You will still need to do that as well. The point is that you are just creating another problem.

5.293 Dr Williams raises an important point: Do the proposals actually deliver a rationalisation or "centralisation" of the existing waste facilities?

5.294 Some of the sites holding waste are "historical" facilities, meaning they have produced waste in the past but are no longer operational. They do, however, still hold the waste they have produced. When this waste is removed the sites will have effectively closed.[370] This would reduce the overall number of non-ANSTO sites.

5.295 However, the sites that are currently producing waste will, under these proposals continue to do so. That waste will then be stored "…until it is transported to the national repository", which will take place every two to five years.[371] Thus they will continue to operate as dispersed waste facilities.

5.296 It is important to restate that, although the proposals seek to remove waste from Lucas Heights, there is in the view of the CEO of ARPANSA, adequate storage at Lucas Heights for existing and future waste, certainly for Low Level Waste – the largest volume of waste to be accommodated.

CONCLUSIONS

5.297 In terms of the stated aims of the proposals the Committee finds the decision to create two new waste facilities perplexing.

5.298 The proposals are justified on the grounds of improving the safety and security of waste facilities by centralising and (possibly) upgrading the dispersed sites.

5.299 In order to achieve this, the government is proposing to establish two new waste facilities, one of which is in a very isolated location, while continuing to the operation of all other existing waste facilities.

5.300 It is very difficult to see how the achieves the objectives identified by the Minister, his Department, ARPANSA and ANSTO.

5.301 Firstly there is no real rationalisation of the operating waste sites around the country. In fact the number of operating waste facilities will increase by two (the Repository and the Store)

5.302 Except for removal of historical waste from non-operating facilities, all the current producers of waste, including ANSTO will continue to produce and hold waste on site for a period of two to five years, while awaiting the next transport to the Repository. The only difference is that the facilities will not be accumulating waste over extended periods

[370] Transcript of Evidence 7 October 2003 p36
[371] Correspondence, DEST, 9 January 2004

5.303 The Repository is so isolated waste transfers cannot be economically justified until holding have accumulated every two to five years. Yet this isolation is not premised on the need for safety.

5.304 The decision not to create separate state facilities was based on the small volumes of waste generated. But this can hardly justify locating the "centralised" waste facility distant as far as possible from the source of production of that waste.

5.305 It is self-evident that transporting the material such distances must be expensive and certainly increases the risk of an accident or some intervention. The transportation of the waste to the Repository and eventually the Store will can only increase the costs and the risk. The proposals therefore creates an increased risk.

5.306 This is a major concern if spent fuel is to be transported to the Store should reprocessing options fail.

5.307 Clearly these proposals for the new waste facilities fail the test of their own objectives. They do not appear to be cost-effective, a genuine rationalisation nor improve safety. They certainly do not reduce the number of operating waste facilities.

5.308 It is also hard to see how moving waste from Lucas Heights, a storage facility which already, according to ANSTO, "meets international best practice", and transporting it thousands of kilometres can represent a "cost-effective solution".

5.309 The Committee certainly supports attempts to improve the management of waste at the non-ANSTO sites and supports the audit of these sites and, given that these sites will continue to store waste, an urgent upgrade of those facilities if needed.

5.310 The best short-term solution to the storage of waste, one that will achieve the objectives the government is claiming for these proposals, is to maintain waste facility at Lucas Heights.

5.311 The benefits of this approach include:

- A genuine centralised waste storage, located where most waste is produced
- The opportunity to collect waste from dispersed sites on a regular basis, obviating the need to store waste for longer periods
- Significant reduction in transport arrangements reducing costs and risk (highly desirable in an era of terrorist threat)
- Avoids the costs of separate new waste facilities
- Security and technological expertise on hand at the storage facility

5.312 This could well mean an upgrade of the facilities at Lucas Heights and the residents of the Sutherland Shire would need to be assured that best systems achievable have been put in place.

5.313 In order to ensure that the waste facilities at Lucas Heights operate to the highest standards to ensure the health and safety of the community, the Committee recommends an inquiry to determine operating conditions to achieve these highest of standards.

5.314 However, it is vital that Lucas Heights does not become a de facto or permanent facility for the storage of nuclear waste.

5.315 The rationality of this solution is obvious and many submissions made this suggestion.

5.316 Mr Courtney told the Committee:

> **Mr COURTNEY:** …One of the biggest hazards that arises through radioactive waste is the transportation of it. If you are keeping waste on site at Lucas Heights in hard structures, where it is close to specialists who can monitor it and maintain that it is not leaking for instance, you are reducing an enormous amount of risk, and you are forcing ANSTO, who are responsible for producing it, to take responsibility for its maintenance and care.[372]

5.317 And the ACF:

> **Mr NOONAN**: While there is a reactor operating at Lucas Heights we consider that the reactor's waste should be maintained on site. We believe that minimising transport issues maximises the safety of the management of that waste. We believe that the Commonwealth has invested in both expertise and facilities at Lucas Heights. That is where the Commonwealth's ability to manage nuclear waste lies, and while they impose reactor operations there, we believe that waste should be retained on site.[373]

5.318 More importantly a number of witnesses from the Sutherland Shire acknowledge, often implicitly or tacitly, that this was the best option but with a single qualification – that the new reactor not proceed.

5.319 Dr Smith:

> **Dr SMITH:** …We would not rule out some storage in whatever the appropriate location is, whether it be Lucas Heights or somewhere else. It would need to be addressed and looked at, but it is a matter of scale.[374]

5.320 Councillor McDonnell in wishing the waste away acknowledged the ethical dilemma in moving it onto others:

> **Mr McDONELL:** It is not up to us to say that it should be taken from our backyard and put in someone else's backyard. It is difficult for us because we do not want the waste stored here.[375]

5.321 Mr Priceman from the Sutherland Shire Environment Centre highlighted an ethic problem for the NSW Government:

> **Mr PRICEMAN:** … If the New South Wales Government is unwilling to allow ANSTO to dump its low level wastes at the Lucas Heights tip, why should it agree to its dumping in another State?
>
> …Transporting nuclear waste up to 1,700 kilometres across Australia does not make sense. Transporting waste off the Lucas Heights site would provide no winners. Those individuals and organisations that believe they will have won would be deluding themselves. A case of out of sight, out of mind!

5.322 As well as the dilemma for the Sutherland Shire:

[372] Transcript of Evidence 19 September 2003 p7
[373] Transcript of Evidence 19 September 2003 p60
[374] Transcript of Evidence 22 October 2003 p61
[375] Transcript of Evidence 11 September 2003 p17

> **Mr PRICEMAN:** Ethically, it should be stored on site at ANSTO. They say they do not have enough space. There is plenty of space up there… I would not be happy with that. As I said, from a local point of view this is a lose-lose situation.[376]

5.323 Councillor Blight observed that the waste should not be anywhere in the Shire nor in Sydney but that it was a matter for the state government to take the bigger picture and it was not Council's job "to say where the site should be".

5.324 He then made a key point. In the end he said, "the ultimate question is whether we should be making it".

5.325 The Committee is unable to answer that question. But it is a question that needs an answer.

5.326 The intractable problem of the management of radioactive waste (both technically and socially) indicates strongly that if the important services (both medical and industrial) can be provided by means other than nuclear reactors then these alternative means should be embraced. It accords with the IAEA principle of waste minimisation.

5.327 The case put by the those advocating alternatives to the reactor was convincing. But as usual in this whole area things are polarised and ANSTO was able to argue strongly that a nuclear reactor is needed.

5.328 The Committee's own research was able to identify countries comparable to Australia that exist without their own reactors. It is unlikely they have lower standards of medicine.

5.329 The Committee agrees with Dr Williams that we find ourselves with a opportunity to look closely at alternative technologies before the new reactor commences operations.

5.330 The Committee has come to the conclusion that an inquiry should be established to resolve this issue and that in the mean time the operations of the new reactor should be postponed.

5.331 During this time HIFAR could continue to provide radioisotopes. After all, Mr McIntosh advised the Committee that "ANSTO are actually experts in life extension… The Government could have elected to extend the life of HIFAR and could have replaced a number of major components.[377]

5.332 This approach has a number of benefits.

5.333 Firstly it should settle this outstanding but extremely important question of the viability of alternative technologies.

5.334 Secondly, it gives more time to resolve the reprocessing and permanent storage issues for intermediate level waste.

5.335 Thirdly, it provides some opportunity for the Sutherland community. This community has had the burden of nuclear technology imposed upon it for historical reasons. It is these historical circumstances that make the Committee's recommendation the most logical. This is, regrettably, contrary to the Committee's stated need (in chapter four) of having community consent as a vital component in waste site selection. But the Committee's proposal is that the storage at Lucas Heights is only an interim measure.

[376] Transcript of Evidence 11 September 2003 pp51,2
[377] Transcript of Evidence 11 September 2003 p48

5.336 By deferring the licensing of the reactor in order to seriously and carefully look at alternatives to a new reactor, with the stated intention of adopting them if feasible, this might go some way to having this community actively embrace the Committee's approach.

5.337 The fourth and final benefit relates to transport. The transport proposal to move radioactive waste to the Repository and Store are the consequences of the decision to establish these new facilities distant from the production of the waste. They are not stand-alone proposals. Without waste facilities distant from the point of production they become unnecessary.

5.338 The Committee discusses the transport issues in the following chapter. While the Committee is of the opinion that the transportation, particularly of lower levels of waste, can be managed relatively safely, it still increases the risk of accident or intervention and costs. It should be avoided if possible and the Committee's proposal does this.

5.339 The Committee feels that if the Federal Government does not implement the recommendations to abandon the current proposals, the New South Wales Government should, as a statement of principle, amend the Uranium Mining and Nuclear Facilities (Prohibition) Act to prohibit any nuclear waste facilities in New South Wales with the exception of the interim storage at Lucas Heights and obtain legal advice on the state and commonwealth constitutional powers regarding nuclear technology.

5.340 The Committee recommends:

RECOMMENDATION 1: The current Federal Government proposals for the Repository and the Store cannot be justified and should be abandoned.

RECOMMENDATION 2: The current transport proposals to the Repository (and the Store) should, therefore, also be abandoned.

RECOMMENDATION 3: In the interim, Lucas Heights should continue to act as a waste facility, subject to a public inquiry into the facilities on site to identify operating conditions which will ensure world's best practice.

RECOMMENDATION 4: Consequently, during the interim period of storage at Lucas Heights:

a. a new site selection process based on contemporary overseas models should be undertaken as a priority, incorporating community acceptance criteria.

b. a public inquiry should be instigated by the Federal Government to consider the viability and practicality of alternative technologies and sources of radioisotope provision in Australia. Issues for consideration would include:

   i. whether or not medical and industrial isotopes can be produced

from alternative sources and whether this can be achieved before the current facility has expired;

ii. the economic and industry impact of importing medical isotopes; and

iii. whether or not it is necessary for research funding to be allocated to the development of alternative sources for radiopharmaceutical production.

c. The operating licence for the Replacement Research Reactor (RRR) should be deferred. An inquiry should be undertaken by the Federal Government into the need for and possible uses of the RRR. Issues for consideration would include:

i. a review of the licensing processes and conditions applied to the reactor;

ii. security issues relating to the reactor site;

iii. the impact on jobs and Australian nuclear research of not proceeding with the replacement reactor;

iv. whether and effective solution to the problem of the final management of nuclear waste has been identified;

v. emergency management and response implications of the new facility; and

vi. whether there has been adequate consultation with the community, local government and the NSW Government.

RECOMMENDATION 6: The NSW Department of Environment and Conservation should complete the inventory of non-ANSTO storage sites as a matter of urgency. Identifying, in particular, those sites where upgrading of facilities is required.

RECOMMENDATION 22: In the event the Federal Government fails to adopt the Committee's recommendations 1 to 4:

The NSW Government should amend the *Uranium Mining and Nuclear Waste Facilities (Prohibition) Act* to prohibit:

- the construction and operation of nuclear waste facilities in New South Wales (with the exception of an interim waste facility at Lucas Heights), and
- the transportation of reactor sourced radioactive waste (with the exception of stocks of existing spent fuel)

Chapter Six - Radioactive Waste Transport Proposals

INTRODUCTION

6.1 As noted in the previous chapter, the proposals to transport radioactive waste across New South Wales are a consequence of the decision to establish waste facilities distant from their point of production.

6.2 Without the storage proposals there are no transport proposals.

6.3 Maintaining a single national waste facility at Lucas Heights (in line with the Committee's recommendation) effectively removes the need for transport and would thus placate much of the public concern and opposition to the proposals.

6.4 However, the decision on the waste facility proposals is one for the Federal Government and it may well choose to proceed with the proposals to establish the Repository in South Australia and a Store in some other state.

6.5 The Committee needs therefore to still consider the implications for New South Wales of transporting the waste to these facilities.

6.6 In so doing, this chapter will focus on the proposals to transport low level and short-lived intermediate waste to the Repository. This is simply because there is more information available on this and most of the submissions dealt with this proposal.

6.7 This does not mean the Committee does not recognise the other transport issues. The principles under discussion, are similar. Where appropriate, comment on the transport of intermediate and high level wastes has been made.

6.8 In essence there are three transport proposals in prospect:

- The Repository;
- The Store; and
- Spent Fuel – currently moved from time to time from ANSTO to a NSW port (to date Port Botany).

PROPOSAL TO TRANSPORT TO THE REPOSITORY

6.9 Aspects of the transport proposal to the Repository has been referred to elsewhere in this report.

6.10 Basically, it involves an initial transfer to the Repository in South Australia of 171 trucks carrying standard 6 metre shipping containers loaded with 205 litres drums of packaged and conditioned low level and short lived intermediate level waste. 132 trucks will travel from New South Wales.

6.11 Following this shipment, it is expected that waste will be generated at a rate requiring movement to the repository of four to five truck loads every two to five years.

6.12 The EIS into the Repository essentially considered three modes for transporting the waste - road, rail or air. Road transport was identified as the preferred mode.

6.13 The relative merits of all modes as identified by the EIS are reproduced below:

TABLE Comparison of risks of different modes of transport

Mode of Transport	Comparison of practicality	Comparison of risks
Road	This is the most practical option. Road transport has the most secure chain of custody, as drivers accompany each consignment.	The probability of accidents reduces on major interstate roads, and is higher on minor single-lane roads. The probability of accidents increases with speed. The risks are lower on rural roads and higher as the vehicle drives through urban areas. Overall, the environmental pollution (non-radiation) risks of road transport are higher than for rail transport.
Rail	Road transport to the nearest railway station with freight loading facilities is required, meaning additional handling. Also, additional handling would be required with the unloading of the waste for transfer to a truck for shipment to the repository. Chain of custody is poor compared with road transport.	The risks of rail transport are less than road transport because the probability of a crash is lower, and access to the rail reserve is better controlled. However, although accident rates are lower, in the event of a rail accident, the potential for damage to the waste containment is higher owing to the larger momentum forces. The security of chain of custody is poor compared with road transport.
Air	This is generally likely to be impractical for the large volumes of waste to be transported, and is considered feasible only for remote locations a long way from the repository, e.g. Tasmania.	Type C containers have been specially designed for air transport of higher activity sources. Air transport is suitable provided the special restrictions in the International Atomic Energy Agency (IAEA) Regulations (International Atomic Energy Agency 2000) are followed.
Inland Waterways Vessel	No inland waterway vessels would be utilised in the transport of material to the repository.	
Ocean-going Ship	This is only relevant to the small amount of waste from Tasmania, which could be transported in two trucks on either a commercial freight ship or car ferry.	The recovery of materials in event of an accident is more problematical, but consignments would be conditioned and of comparatively low activity. However, because the distance from Tasmania to the mainland is short, the number of journeys few and the contents small, the transport risks are insignificant.

6.14 The EIS opted for road because it "provides a safe, flexible, secure and cost-effective mode of transport" for the radioactive waste circumstances in Australia.[378]

6.15 The EIS identified two road route options between Sydney and the repository. They are:

6.16 *Option* 1: via Broken Hill:

- Sydney to Molong via Katoomba, Bathurst and Orange: on Great Western Highway (SH32)
- Molong to Nyngan via Wellington and Dubbo: on Mitchell Highway (SH32)
- Nyngan to Broken Hill via Cobar and Wilcannia: on Barrier Highway (SH32)
- Broken Hill to Peterborough (SA)

6.17 *Option 2*: via Wagga Wagga:

This option seeks to use the Hume and Sturt national highways, and then state highways to Port Augusta. The Hume Highway is high standard, bypassing towns en route to Wagga. Sections along this option are:

- Sydney to Wagga turnoff via Goulburn, Yass and Gundagai: on Hume Highway (NH31)
- Wagga turnoff to Renmark via Narrandera, Hay, Balranald and Mildura (Vic): on Sturt Highway (NH2O)

6.18 A potential sub-option (Option 3) of this route comprises the route Sydney to Buronga in New South Wales (across the River Murray from Mildura as above), then:

- Buronga to Broken Hill via Wentworth: on Silver City Highway (SH79)
- Broken Hill to Peterborough (SA)

6.19 The transport arrangements though are still not finalised as Dr Harries explained:

> **Dr HARRIES:** The arrangements are not totally clear. The EIS for the repository talks either about shipments under the control of the repository operator or it may be the generator. In either case, the transport plan has to be prepared and it has to meet the requirements for the shipment of radioactive material. If it comes to our responsibility we will follow that Code of Practice, as required.[379]

6.20 The EIS gave no details of the proposed routes out of Sydney, that is, from Lucas Heights to link to the respective highways in the above options. This is information that should be available to the public.

RECOMMENDATION 14: That the Federal Government identify any proposed road transport routes through Sydney.

6.21 In its submission the ACF argued that both "options" could be used:

[378] EIS summary p12]
[379] Transcript of Evidence 11 September 2003 p29

> "while the Commonwealth has stated a preference for use of the Blue Mountains route the Minister for Science has reserved a 'right' to use both or either route and to make a decision through a non-public process. In any case they do not intend to give notice of waste transports to any local government or local MP or State Agency".[380]

6.22 Many submissions were highly critical of the decision to transport by road, arguing that it was the mode most likely to have an accident. (see below)

CODES

6.23 Transport of radioactive waste (like the storage) is regulated by a complex arrangement of legislation and various codes and standards, based on internationally agreed standards, as ANSTO explained to the Committee:

> **Mr McINTOSH:** …All shipments of radioactive materials in Australia, including shipments of radioactive waste, are required to be transported in accordance with the Australian Code of Practice for the Transportation of Radioactive Materials 2001. This code is based on guidelines developed by the International Atomic Energy Agency and is administered by competent authorities in Australia, such as ARPANSA and the New South Wales Environment Protection Authority. The Code ensures that the level of packaging is appropriate for the level of radioactivity in the material being transported, whether or not that material is waste.[381]

6.24 The NSW Environment Protection Authority adopts the same Codes because "it has been very important to have harmonisation of those two systems", as its representative explained:

> **Mr SMITH:** The system of rules under which radioactive materials are transported within Australia is the same. It is the same code that applies because our regulation references the national code, which is also the one that ARPANSA applies as it regulates ANSTO. The code has been adopted almost unchanged from the international code that was put out by the International Atomic Energy Agency.[382]

6.25 The essential aim of the Code is to ensure that the material is transported in a safe manner without risking the health of the public or workers or damaging the environment.

6.26 In its submission the EPA advised that "the ability to reduce the risk to very low levels underlines the need for strong regulatory framework and effective enforcement and compliance measures".[383]

6.27 Mr Smith expanded on how the Code operates in practice:

> **Mr SMITH:** …The code has four main parts by which it seeks to achieve safety. The first and most important is the focus on the specification of containers within which radioactive material is transported. There is a hierarchy of radioactive intensity, which is used to determine how strong the container is. The higher risk sources have a very strong container. The principle is that the consignor—that is, the person who is sending the material—is responsible to package it in a container such that no special measures are required so that it can be treated as if it were a normal hazardous material.

[380] Australian Conservation Foundation Submission No. 337 p4
[381] Transcript of Evidence 11 September 2003 p24
[382] Transcript of Evidence 11 September 2003 pp69,70
[383] EPA Submission No. 474 p7

> The other three parts of the code are a requirement for labelling of the material so that people who handle it know what they have got, the placarding on the vehicle so that emergency response personnel will know how to deal with the situation if they come across an incident, and the detailed documentation that goes along with the consignment so that where it goes can be tracked. A key principle of the code is that the consignor is responsible for making sure that all the steps that need to be taken are taken. I think the relevance of that principle is that, as it is proposed, the Commonwealth will be the one generating the material and originating the transport, then it should bear the costs of those activities to the full extent required to ensure safe transport of it.[384]

6.28 The issue of compliance was raised by Mr Nolan (see Chapter 3) who also stressed the need to develop mechanisms to ensure that proper compliance occurs.

6.29 It is important to ensure the Codes are applied to fully protect the residents of NSW and ways need to be developed to provide the appropriate agency in NSW to monitor and confirm that waste transported as part of these proposals have complied.

Shielding/Packaging

6.30 The key element in the regulatory framework to guarantee public safety during transportation is the provision of appropriate protection through shielding and packaging of the radioactive waste.

6.31 Dr Loy explained this in hearings:

> **Dr LOY:** ...Fundamentally, the code focuses on the packaging of the radioactive material and that it is designed to achieve an appropriate level of safety, taking into account the inherent hazard of the particular material. These passive packaging provisions are supported by various active measures, such as labelling, loading and stowage provisions, and quality and compliance assurance arrangements.[385]

6.32 The shielding and packaging is designed for the inherent hazard characteristics of the waste to be transported:

> **Mr SMITH:** As I said, it is important to highlight the difference between high-level materials that pose a significantly greater risk and medium and low-level materials. The steps that should be taken to protect against an accident are different for the different types of materials.[386]

6.33 Mr Hanna discussed these issues in his submission, pointing out that "the principal assurance of safety in the transport of nuclear material is the design of the packaging, which must allow for foreseeable accidents".

> Because the degree of potential hazard varies considerably, "different packaging standards have been developed".
>
> "Ordinary industrial containers are used for low-activity material".
>
> "Type A packages are designed to withstand minor accidents and are used for medium-activity materials".
>
> Type B packages are "are robust and very secure" and are used for high level waste and spent fuel. "They also maintain shielding from gamma and neutron radiation, even under

[384] Transcript of Evidence 11 September 2003 pp69,70
[385] Transcript of Evidence 26 September 2003 p15
[386] Transcript of Evidence 11 September 2003 p75

extreme conditions". There are over 150 kinds of Type B packages with some of the larger one costing US$1.6million each.

A Type C package also exists for the transportation by aircraft of "smaller amounts of high-activity materials".[387]

6.34 Mr Smith (NSW EPA) confirmed for the Committee the robustness of the packages:

> **Mr SMITH:** ...The containers in which the materials are transported have been shown to be very effective. Where they are a high-intensity source, they are very strong. They are designed and tested to be capable of dropping from a nine-metre height onto a concrete block and being driven over and squashed and burnt and all the rest of it and they are safe. So judging by the evidence, which would be the best way, we are confident that that transport can be done, provided that all the requirements are followed.[388]

6.35 The low level and short lived intermediate level waste destined for the repository are of such a level that standard industrial packaging will be used (steel drums and steel containers). The material is "conditioned" by placing it in concrete (for some of the short-lived sources) or compacting. The conditioned waste is then placed in 205 litre steel drums.

6.36 Dr Green expressed concern about how waste destined for the Repository would be conditioned, stating that "the DEST submission gives the strong impression that only a small fraction of that waste will be encased in concrete".[389] The DEST submission, quoting the Transport Code, stated that not all the material will be packed in concrete.

6.37 The Committee sought further information from the Department of Education Science and Training. It advised that, the requirements for conditioning waste with concrete are linked to the NHMRC waste classification scheme.

> "Conditioning with concrete will be required for Category B waste in order to immobilise the waste and provide an additional barrier to the migration of radionuclides from the waste. The concrete will also prevent the release of the material in the event that the waste container is damaged in an accident. Unless the source is contained securely in its original housing or shielding, the source would also be sealed in a welded metal (stainless steel or brass) capsule or tube before being embedded in concrete in the steel drum. The encapsulation of the source in this manner would provide an additional isolation barrier and further containment of radioactivity".
>
> "Concrete may also be used to condition waste classified as Category A or Category C under the NHMRC Code. The purpose of concreting in these cases is either to fill void spaces in the containers to prevent the containers from deforming under load after disposal or to homogeneously distribute the waste material through the container."
>
> "Only solid waste will be accepted at the national repository. Waste that is in fluid form must be solidified before transport to the repository".
>
> Operational criteria for the proposed national store have not been developed at this stage. However, it is expected that only solid waste would be accepted for storage at the facility."[390]

[387] Mr Hanna Submission No. 213 p14
[388] Transcript of Evidence 11 September 2003 p70
[389] Transcript of Evidence 7 October 2003 p35
[390] DEST Correspondence 9 January 2004

6.38 A major factor in the view of the Committee limiting a proper understanding of these issues is a measure of the radiological hazard to be transported.

WASTE HAZARD

6.39 The public sees radioactive waste as presenting a hazard to health of a very particular nature.

> **Mr SMITH:** ...The hazard posed by radioactive materials is not self-evident. Radioactivity cannot normally be detected by human beings. While everyone can understand the risks of other hazardous materials, such as petrol, or chemicals, which can cause explosions or burns, radioactive materials of the type proposed for transport here are not like that.[391]

6.40 All radioactive waste does not present the same hazard, however. The hazard increases significantly (even enormously) as the level of waste increases – from low, through intermediate to high.

6.41 Yet it is clear from many submissions to the inquiry that, in the public mind, there is an imprecision or a lack of understanding of this range of hazard inherent in the wastes to be transported (from low to high). This is not the fault of the community.

6.42 A good example of this occurred in the following exchange at hearings:

> **Mr IAN SLACK-SMITH:** If it can be proven by scientific measurement that the amount of radiation emitted from this waste is less than or the same as the natural level of radiation, for example, in this room, in the Blue Mountains, in sand and groundwater, in Finland or any other place in the world, would that change the association's attitude to the transportation?
>
> **Ms MILLER:** Who will employ the scientists—the Federal Government?
>
> **Mr VERHEY:** Are you saying that the nuclear waste being transported has a lower level of radiation than the surrounding earth and rocks?
>
> **Mr IAN SLACK-SMITH:** We have been informed that that is the case.
>
> **Dr MURRAY:** Are you saying that you could stand in the truck and receive a lower dose of radiation than we are getting in this room?[392]

6.43 Essentially the public wants to know:

- the hazard of any material before packaging - what will they be confronted with in the worst case of a breach of packaging, and
- the hazard on the outside of the containers to be transported - what hazard do we face as the transport passes through out communities.

6.44 Unfortunately, current approaches to identifying or categorising radioactive waste do not provide this type of information.

6.45 Dr Harries provided a perfect example of this problem:

> **Dr HARRIES:** It is clearly one of those words that you can put in different ways. The material which is being shipped has a very low specific activity. It is doubly contained. It is in steel drums inside a shipping container. The dose on the outside of the material is low. The dispersion of this material is very difficult. The radiological health effects of any of these accidents will be much less, will be insignificant compared to the physical

[391] Transcript of Evidence 9 September 2003 p67
[392] Transcript of Evidence 22 October 2003 p9

> damage that drivers get when they have been crashed into by trucks. So it is very low compared to other injuries that people receive.[393]

6.46 To be effective, such qualitative definitions requires a public trust in the industry – a trust that does not exist.

6.47 The general (international) categories of radioactive waste (described in chapter two) are qualitative, using terms such as low, intermediate (short and long lived) and high level. These categories become more problematic (therefore less enlightening) and more controversial (as the discussion in the last chapter attests) when waste categories are mixed – short lived intermediate with low level.

6.48 These qualitative descriptions are supplemented by physical descriptions (such as gloves, gauges etc). While useful information, they can be interpreted as a form of "smoke screen".

6.49 The only quantitative approach in the Australian context is the NHMRC Code with defines categories A, B, C and S for radioactive waste. The first three are defined in terms of activity, being in becquerels per kilogram while category S has no such definition (being a definition by exclusion as noted in the previous chapter). Unfortunately, both these approaches do not really inform the non-expert.

6.50 What is needed is a yardstick by which the public can evaluate the hazard. Dr Harries, in the quote above, provided an indication to that yardstick when he said "the dose on the outside of the material is low", meaning the equivalent dose.

6.51 In discussing the health affects of radiation, the nuclear industry discusses and analyses the matter quantitatively, in terms of equivalent dose, measured in sieverts per hour (see chapter 2). However, it does not do this for waste management and in particular waste categories.

6.52 In its submission to the inquiry ANSTO states that "standing 2 metres away from a truck containing LLW or SLILW" would result in a dose of less than 0.1mSv per hour.[394]

6.53 ANSTO is obviously able to determine the dose outside the container and presumably has determined the dose inside the container.

6.54 It appears to collect the necessary information to do just that. Its waste management policy contains "quite a detailed inventory" of the "waste and low level material eligible" to go to the Repository.[395] Its own material confirms that "the radioactivity in the waste drums… is measured in a scanning system… The drums are bar coded and the radionuclide content of each drum is entered into a database". This creates a "complete record of ANSTO's radioactive wastes to be compiled".[396]

6.55 Dr Smith (Sutherland Council) referred to this material at hearings:

> **Dr SMITH:** …I referred … to table 3.1 of ANSTO's radioactive waste management policy in which there is, commendably, a categorisation of the levels of waste. The possible

[393] Transcript of Evidence 11 September 2003 p35
[394] Submission No. 352 p9
[395] Transcript of Evidence 11 September 2003 p12
[396] ANSTO, Managing Radioactive Wastes and Spent Fuel, undated p4

> range of contact dose rates for low-level solids was up to 2,000 micro sieverts per hour. [ie 2mSv per hour].[397]

6.56 Dr Smith, using this yardstick argued quantitatively that even low level waste has significant health implications:

> **Dr SMITH:** ... The inventory undertaken by ANSTO shows the type of material to be transported to South Australia. The background level is one or two units per year, whereas the level in the highest radioactive amounts of the low-level waste is about one to two units per hour. The levels are significant, even in that low-level waste, especially if you look for it. The bulk of it is likely to be contaminated...[398]

6.57 This, of course, is the dose level inside packaging which is designed to keep this radioactivity from the public. But the public is entitled to know these levels.

6.58 It should be noted here that the recommended annual dose for the public from non-background radiation is 1mSv. This then provides the yardstick by which the public can make some evaluation of the hazard involved.

6.59 Clearly ANSTO is able to provide a dose rate for every one of its (6,000) drums, and hence all containers, destined for the Repository. Similar information would be available for intermediate level waste destined for the store.

6.60 In the interests of useable quantitative information and an informed public this type of information should be mandatory and be part of the proposal.

6.61 The development of a range of equivalent dose rates should be developed as part of the general categorisation of the waste under the NHMRC system. However, it should not be limited to low level waste. Categorisation by exclusion (Category S) is not acceptable.

6.62 As well as the actual dose levels of waste and packaged containers it would be of immense use, and probably save the industry considerable grief, to define waste categories in similar terms, even if only approximate.

6.63 The Committee recommends the following:

RECOMMENDATION 10: ARPANSA should supplement the current Australian (NHMRC Code) waste classifications, Categories A, B, and C, with an equivalent range of effective dose rates (sieverts/hr) for each classification.

RECOMMENDATION 11: ARPANSA should develop a quantitative definition for Category S waste (NHMRC Code), to include effective dose rates thus doing away with the current "definition by exclusion".

RECOMMENDATION 16: ARPANSA should require ANSTO to provide effective dose rate (sievert/hour) information for all waste containers. The dose rate will be provided for waste before conditioning as well as being measured on the outside of the container.

[397] Transcript of Evidence 22 October 2003 p53
[398] Transcript of Evidence 11 September 2003 pp10,11

RISK OF ACCIDENT

6.64 Most concerns in submissions were about the risk and consequences of an accident during transportation and many opposed the transport proposal outright on the grounds that it represented an unacceptably high risk.

6.65 Sutherland Shire Council argued that "the transport of nuclear waste obviously increases the risk of radioactive contamination; for this reason … nuclear transport should be kept to an absolute minimum". Dr Smith went on to state that "…We do not feel that the small amount of waste that has been conducted around the country so far is giving us comfort. The material is vulnerable to accident. It is also vulnerable to misadventure and theft, if someone has the information that it is being transported".[399]

6.66 The Medical Association for the Prevention of War held a similar view:

> **Dr WILLIAMS:** … You are creating the vast problem of transport as well, which is my final point, …If you start carting it around the community you increase the risk through terrorism, sabotage and obviously through accidents.[400]

6.67 Greenpeace sees transportation as an "enormous" risk . Mr Courtney told the Committee that "…one of the biggest hazards that arises through radioactive waste is the transportation of it. If you are keeping waste on site at Lucas Heights… you are reducing an enormous amount of risk, and you are forcing ANSTO, who are responsible for producing it, to take responsibility for its maintenance and care.[401]

6.68 The New South Wales EPA acknowledged the "the seriousness of the risks" involved in the proposals,[402] as did the NSW State Emergency Management Committee advising that "the transportation of nuclear waste brings with it additional risks…"[403]

6.69 Transportation issues were at the heart of the Local Government and the Shires Associations' concerns:

> **Dr MURRAY:** …Local government and the communities of New South Wales are not comfortable, reassured nor relaxed in any way by the assurances we continue to receive from the Commonwealth or the nuclear industry, specifically the Australian Nuclear Science and Technology Organisation [ANSTO], about proposals to transport nuclear waste, whether it be low-grade, medium grade or high-level nuclear waste, across our councils.[404]

6.70 This increased risk demanded a detailed response to the community asserted a representative from Blue Mountains City Council:

> **Mr GAROFALOW:** Nuclear materials, their processing and particularly their transport create an increased level of risk. That risk should be clearly quantified, adequately managed and transparently communicated to the community. The response measures that are in place to deal with any risk events and situations need to be specified.[405]

[399] Transcript of Evidence 11 September 2003 p11
[400] Transcript of Evidence 19 September 2003 p52
[401] Transcript of Evidence 19 September 2003 p7
[402] EPA Submission No. 474 p7
[403] SEMC Submission No. 285 p1
[404] Transcript of Evidence 22 October 2003 p1
[405] Transcript of Evidence 26 September 2003 p1

6.71 The proponent rejected these assertions. DEST stated categorically that the transport of radioactive waste to the national repository will be safe.[406]

6.72 ANSTO pointed out the intermediate level waste had been transported before in NSW with no adverse effects:

> **Mr McINTOSH:** In connection with the intermediate-level waste, in the early 1990s ANSTO was engaged by the Department of Defence to assist in cleaning up the ADI site at St Marys, which had become a de facto repository for Commonwealth waste. They included things like radium needles, radium dials and so on, some of which is intermediate-level waste. ANSTO basically identified the material, categorised the material, packed the material and shifted it to South Australia. So, intermediate-level waste has already been shipped through New South Wales to South Australia under the supervision of ANSTO. Again, that happened without incident and without any concerns.[407]

6.73 ACF does not accept this argument, stating that:

> **Mr NOONAN:** …just because authorities could act in a way to prevent an adverse outcome in four transports does not mean that they could do so in the fifth or the sixth or the tenth, just as a number of shuttle launches were made before one blew up on launch and one blew up on landing.[408]

6.74 There are five particular issues which the Committee feels need to be raised with regard to risk of accident during transportation.

6.75 These are:

- Mode of transport
- Consequence of an accident – breach of packaging
- Comparison with other hazardous materials
- Security
- Emergency Services

Mode

6.76 The decision to transport by road received much criticism on the grounds that it is the most likely to have an accident.

6.77 According to the EIS "since there have been no major transport accidents involving the release of radioactive material, accurate predictions … are problematic. Therefore, general (non nuclear) transport accidents have been used as an indicator". It goes on to say that "less than one accident involving trucks carrying the accumulated waste from the respective states and territories to the repository might be expected. The potential number of accidents involving trucks carrying future waste is negligible".[409]

6.78 Submissions questioned this conclusion:

6.79 Mr Green told the Committee that "according to the Federal Government's EIS for the dump, there is a 23 per cent risk of one truck accident shifting the existing national

[406] Transcript of Evidence 7 October 2003 pp54,5
[407] Transcript of Evidence 11 September 2003 p41
[408] Transcript of Evidence 19 September 2003 p70
[409] EIS pp137,9

stockpile to Woomera. For the transportation of existing waste from New South Wales and the Australian Capital Territory to Woomera, there is a 20.8 per cent chance of one truck accident shifting the existing stockpile according to the Federal Government's EIS.[410]

6.80 Sutherland Council argued:

> **Dr SMITH:** …With respect to accidents, a couple of analyses in the short time available to us indicated that the level of accidents is at least as equal to that of other levels of accidents on the roads, which are relatively high particularly in town areas and congested areas.[411]

6.81 Witnesses from the Blue Mountains and Central Western NSW pointed to regular accidents in these areas as proof that an accident is likely:

6.82 Mr Sykes from Orange City Councils told the Committee there is "a very high accident rate in the central west. So at that level there are some resource issues, and those road networks are in fact deteriorating as well".[412]

6.83 The Blue Mountains, in particular, were seen as a potential trouble spot. One resident said he **"**just cannot believe that they would go over the mountains and not the Hume Highway".[413]

6.84 Other residents highlighted truck accidents in the area:

> **Mrs ARMITAGE:** … As for petrol being dragged across the mountains and all other things, there have been accidents and the road has been closed. Most of us would have spent one night in Katoomba, Blackheath or Lithgow, and not been able to get home because of something happening.[414]

6.85 Dangerous conditions contributed significantly to these accidents:

> **Mr GRAVISON:** Snow and black ice would not happen that frequently, but it does happen. It is probably annually. I had an experience with black ice and I will not drive if there is snow or ice around. I did a 380 degree turn in Katoomba once and several other cars just stopped in the middle of the road. It actually stops you. You cannot move.[415]

6.86 Submissions advised the Committee that the other modes, particularly rail, made more sense. A few suggested air transport, though:

> **Mr LALICH:** … I agree with the Mayor of Blacktown that it should not go over the Mountains, it should take the shortest and quickest possible route to Woomera… My own personal opinion on this - it is not a council issue and nor have we discussed it in council - is that I do not see why we could not do a feasibility study of shipping the stuff by aircraft, by Hercules or by helicopter which can carry four or five trucks in its own body in one hit and travel over low populated areas, and transporting it from the site to Woomera in one hit.[416]

6.87 The Member for Calare, Mr Peter Andren MP, argued likewise in his submission.

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[410] Transcript of Evidence 7 October 2003 p35
[411] Transcript of Evidence 11 September 2003 p11
[412] Transcript of Evidence 22 October 2003 p11
[413] Transcript of Evidence 19 September 2003 p40
[414] Transcript of Evidence 26 September 2003 pp45,6
[415] Transcript of Evidence 26 September 2003 p46
[416] Transcript of Evidence 19 September 2003 p41

6.88 The CEO of ARPANSA argued that the mode of transport is irrelevant, as long as the Codes are properly applied:

> **Dr LOY:** The code ultimately relies upon the packaging as the ultimate protection. I think the code says that irrespective of how you transport it, whether it is by road, rail or air, "here is how you have got to package it", and when you have packaged it that way, it can be safely transported, whether you throw it on the back of a truck or whether you use a train. In that sense the code is about the packaging, not about the mode of transport.[417]

6.89 At hearings, the EPA was asked on ways to assess risk.

> **Mr SMITH:** ...First, we look at the international experience that involves more than 10 million transports each year.
>
> **Mr IAN COHEN:** Road transport?
>
> **Mr SMITH:** Yes. We have been unable to find any records of accidents which resulted in harm. There have been accidents because with that many transports accidents naturally occur. We have been unable to find any record of significant harm caused as a result of failure of the systems. The industry has gone to elaborate lengths mathematically and scientifically to devise steps to minimise the risks, and they are incorporated in the codes.[418]

6.90 A view agreed by Mr McIntosh

> **Mr McINTOSH:** The transportation of radioactive materials has a remarkable safety record....Over several decades, tens of millions of packages of radioactive material, including packages of radioactive waste, have been transported around the world each year. In all those transports, there has never been an in-transit accident with serious human health, economic or environmental consequences attributable to the radioactive nature of the goods.[419]

6.91 The EIS advised that the transport of radioactive waste a very safe enterprise:

> Over the past 40 years there have been no accidents in which there has been a significant radiological release harmful to the environment or public health.[420]

6.92 The New South Wales EPA supported this view:

> **Mr SMITH:** ...The track record of the industry or the experience of that high volume of transport is that we are unaware of any incidents when there has been an impact on human health or harm done.[421]

6.93 The Ohio State University web site provided the following information on radioactive waste accidents involving low level waste in the US:

> "During the 20-year period from 1971 to 1991 there were 53 reported accidents involving transportation of commercial low-level radioactive waste in the United States. Four of those accidents resulted in a release of low-level waste. To date no radiological related injuries or deaths have been reported as a result of commercial low-level waste transportation accidents".[422]

[417] Transcript of Evidence 26 September 2003 p25
[418] Transcript of Evidence 11 September 2003 p75
[419] Transcript of Evidence 11 September 2003 pp24,5
[420] Department of Education, Science and Training, *EIS for the national repository – summary*, p16
[421] Transcript of Evidence 11 September 2003 p70
[422] www.ag.ohio-state.edu/~rer/rerhtml/rer_41.html

6.94 There appears to be only a few radiological incidents to have occurred in Australia in the last few years. For example:

- in 2001 radioactive material was found in some scrap metal;
- in 2002 a radioactive gauge was stolen;
- Last September a schoolboy was exposed to radiation from a canister containing caesium – 137.

6.95 While any incident is a matter for concern these do not represent major health issues and none relate to road accidents.

Accident Data

6.96 The Committee sought precise data on the accidents or incidents involving the transportation of radioactive material including waste within NSW:

6.97 The NSW Fire Brigades:

> **Mr HAMILTON:** I am not aware of any incidents [with radioisotopes] at this stage and, as I said, transportation is occurring on a daily basis. They are not communicated to the fire brigade. Whether or not EPA is getting that information, I could not advise.[423]

6.98 WorkCover advised the Committee that it did not collate information specifically on radiological incidents.

6.99 This was put to the Department of Education Science and Technology:

6.100 Dr Perkins thought ARPANSA might collect data. Dr Lokan on the other hand said that the only organisation he knew of "which collects information about radiation incidents or accidents which lead to exposure of humans and usually fairly serious exposures… is done by an organisation at Oak Ridge, Tennessee" He said he could not think of any in Australia.[424]

6.101 NSW Fire Brigades responded in writing on this matter advising that it a search of its incident recording database revealed that the Brigade had responded to "eight suspected radiological incidents since 2000".

6.102 These incidents could be fairly described as minor. [see Appendix 8]

6.103 Subsequently, the EPA advised that under the Radiation Protection Control Act there are legislative requirements to report radiological incidents or accidents to the EPA which maintains a database of these incidents.

6.104 In addition, the Radiation Health Committee (which works with ARPANSA) is establishing a national database.

Consequences of an Accident/Breach of Packaging

6.105 An accident does not necessarily mean that there will be a release or spill of radioactive material, though there was much concern at this possibility.

6.106 The Committee heard views on the impacts of a breach of the packaging in the event of an accident that ranged from the catastrophic to the harmless.

[423] Transcript of Evidence 19 September 2003 p35
[424] Transcript of Evidence 7 October 2003 pp73,4

6.107 Adverse impacts it was claimed would be both radiological, impacting on health and the environment to social, affecting tourist and agricultural economies and the mental wellbeing of communities.

6.108 At the "harmless" end of the spectrum Dr Harries advised, "one advantage to radioactivity is that you can go with the radiation detector, find where this material is and pick it up".[425]

6.109 At the "catastrophic" end Sutherland Council argued in its submission that the "potential threat of radiation exposure means that even low level solid or liquid waste dispersed in the environment can significantly affect public access to local areas and private properties contaminated with the material".[426] (As noted above, DEST advises that all waste transported to the repository will be solid).

6.110 Dr Williams flagged some potential health issue if radionuclides were released:

> **Dr WILLIAMS:** … It is not just low level waste either that would be going to a repository, it includes things like strontium, caesium and tritium, potentially uranium and plutonium. Strontium, for example, is treated by the human body much the same way it treats calcium, so you incorporate it into your bone. It causes cancer of the bone. It is not something that we should be transporting around the community if we do not have to.[427]

6.111 Social impacts on areas in the vicinity of an accident can occur with or without a breach of the packaging. These impacts are driven more by the psychological fears and uncertainties that radioactive material can engender in the public.

6.112 These were certainly to the fore in the Blue Mountains but were also raised in submissions from other areas such as the agricultural areas of western NSW where there was a fear that "clean and green" images could be irrefutably tarnished.

6.113 Mr Garofalow summed up some of these concerns from the Blue Mountains City Council perspective:

> **Mr GAROFALOW:** …Blue Mountains City Council is concerned about the potential impact of nuclear waste on our community, the economy and the environment… an absolute assurance that there will be no social, economic or environmental impacts arising from the transport of nuclear waste across their local area… Just the illusion that there is a problem associated with nuclear waste in this area could hurt the economy of the local area.[428]

6.114 Mr Garofalow described the possible consequences of an accident:

> **Mr GAROFALOW:** …it would be difficult to convince everyone that it was cleaned up appropriately. So whether it was or was not, I think that the perception that there was an issue would remain, and I think that would have an impact, particularly in this area that relies heavily, as I said, on the image as world heritage, as natural. … So all those factors would put a taint on the image of the Blue Mountains as a clean, green place to be, as a world heritage city. I think that would impact both on regional tourism and on international tourism. People would be concerned about coming to an area where there

[425] Transcript of Evidence 11 September 2003 pp 25,6
[426] Sutherland Shire Council Submission No. 350 p6
[427] Transcript of Evidence 19 September 2003 p52
[428] Transcript of Evidence 26 September 2003 p1

> was a potential to become contaminated from radiation. I think it would also impact on the social structure of the Blue Mountains in terms of the reasons people live here.[429]

6.115 The potential impact on the image of the Blue Mountains World Heritage Area, given "in recognition of the environmental significance of the area" was a prime concern. The residents did not want "any of those ecosystems put at risk". "The economy is fragile" and is heavily reliant "on the tourist industry for employment".[430]

6.116 The Committee took evidence in Dubbo where representatives from Narromine explained how important tourism had become to the area. Any adverse impact on that industry would be a local disaster.

6.117 Friends of the Earth offered this view of the impact of an accident:

> **Dr GREEN**: It just depends. If there is an accident and there has been no breach of the containment of the radioactive materials, then it is not such a big problem. If there is a breach of the containment, then potentially you do have a problem: you have exposure of people and the natural environment to radioactive materials and all those issues surrounding perception, which I think are quite important as social costs.[431]

6.118 While the very low number of significant accidents worldwide in transporting radioactive waste indicates that the packaging is extremely effective, it was argued to the Committee that it is still possible to breach it.

6.119 Dr Smith from Sutherland argued that the circumstances on the highways made increased the risk of an accident that could create a fire and that risks with the casks

> **Dr SMITH:** … there are a lot of big tankers that are potentially flammable, if one of them runs into a shipment of this material, this material will be very heavily tested potentially by fire. As you will see in the submission we have made to you through Barnaby, there are a number of concerns about the robustness of the package material, even using the international codes and packaging due to fire—800 degrees for 30 minutes is the standard for level B containment that has to pass 800 degrees fire for 30 minutes. A number of the experts indicate that at less than 30 minutes the integrity of the packaging starts to get challenged so the fact that there are plenty of LPG tankers wafting around regional New South Wales is not any comfort to us. It actually makes the concern worse. Why in particular with this type of waste? Because this waste is very long lived. LPG and so on are not. This is a totally different category. Unfortunately the Commonwealth keeps trivialising this type of material because there is less of it than there is of LPG or because it is not flammable.[432]

6.120 While ANSTO acknowledged that it was possible to breach packaging this would be only likely to occur with low activity waste:

> **Dr HARRIES:** …Even in this extreme, hypothetical accident, the amount of dispersed material is very low. Clearly, there can be some accidents where you can have some dispersion but they are low compared to the normal background level. Normally after any accident, emergency response procedures are put in place. With a clean-up process one goes through and picks up any material that is spilt.[433]

[429] Transcript of Evidence 26 September 2003 p3
[430] Transcript of Evidence 26 September 2003 pp38,48
[431] Transcript of Evidence 7 October 2003 p40
[432] Transcript of Evidence 11 September 2003 pp15,16
[433] Transcript of Evidence 11 September 2003 p25

6.121 Mr McIntosh, however, explained to the Committee that Dr Smith's scenario was ill-founded as concrete and steel did not burn[434]

> **Mr McINTOSH:** Most radioactive material is not flammable so it will not burn. It will be encased in cement or within steel, it will just sit there during the fire and once the fire is out, you can come and recover it".

6.122 He went on to say that even if there were a release the activity of the material would be equivalent to natural background radiation.[435]

6.123 The issue of integrity of the packaging in the case of fire was discussed with the Mr Snow, President of the Fire Brigades Employees' Union. He told the Committee that:

> **Mr SNOW:** Concrete burns, it spalls, it expands and it explodes. That is what happens to it if it is subject to fire for long enough. You can put it in concrete and you can have steel mesh holding the whole thing together, but when you apply heat, the granules grow and things start spalling, just throwing out bits of itself everywhere until, in the end, that concrete or the integrity of the structure that encases it is broken. Steel burns as well. It does not surprise many firefighters but steel burns. Anything burns, distorts, warps, breaks and spalls. Maybe that is why we have a fascination with it, but in our society nothing is safe from fire. There is nothing in this world that is safe from fire.[436]

6.124 Under these circumstances, any radioactive material would be vaporised thus being changed into a physical form that presents the greatest health risk to living things.

6.125 As both the ACF and Greenpeace discussed in evidence:

> **Mr NOONAN:** Again, we believe that ANSTO is misleading your Committee to claim that they can recover nuclear material that may be dispersed in an accident scenario, particularly when there is potential for fire, when there is potential for material to be vaporised and to be dispersed through the heat plume that is involved in a fire. There will be no recovery of that material. There is potential recovery of material that may be physically dispersed, as the Fire Brigade has made the distinction between a release and a spill. There may be the potential to recover material in a spill accident scenario but there is not, in our belief, the potential to recover radioactive material from a release.[437]
>
> **Mr COURTNEY:** Well, any radioactive material is of consequence. It is disingenuous to say that this is not a problem because it is rubber gloves and glass containers and so on. Any radioactive spill is going to have consequences. Any burning radioactive material is going to have health consequences.[438]

6.126 The impact of a radioactive waste accident that breaches the containment has the potential to be very significant (both radiologically and socially) on communities in New South Wales. However, the likelihood that an accident would occur with all the necessary ingredients present to create the circumstances that breach the containment is very low.

6.127 Basically, the Committee is of the view that the transport of the low level waste is relatively safe.

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[434] Transcript of Evidence 11 September 2003 p25
[435] Transcript of Evidence 11 September 2003 p25
[436] Transcript of Evidence 26 September 2003 p35
[437] Transcript of Evidence 19 September 2003 p70
[438] Transcript of Evidence 19 September 2003 p11

6.128 However, in risk management terms, while little can be done about the impact of such an unlikely event, certainly all reasonable steps should be taken to reduce any possible risk of an accident. The most effective risk reduction approach in these circumstances is to not transport the waste.

6.129 The Committee discusses this further in its conclusion.

Comparison with Other Hazardous Materials

6.130 It was put to the Committee a number of times during the inquiry that the transportation of other hazardous goods presented a greater risk to the community than the transport of radioactive waste, particularly low level waste.

6.131 These arguments are summed up by the following comments from Mr McIntosh when he told the Committee that:

> **Mr McINTOSH:** ...The road transport of hazardous materials such as petrol, other flammable liquids, flammable gases and toxic chemicals is a common event throughout New South Wales and Australia. When vehicles carrying such non-radioactive goods are involved in accidents, a wide area can be affected. Occasionally lives are lost as a direct result of the hazardous nature of the load. Experience demonstrates that the risks associated with the transport of radioactive waste are much lower than the risks associated with the transport of many other hazardous materials classified as dangerous goods.[439]

6.132 This argument was put to the New South Wales Fire Brigade, its representative, Mr Hamilton, responded as follows:

> **Mr HAMILTON:** Having been at numerous hazardous material incidents involving both petrol tankers and leaking chemicals, there is an immediate issue of the consequences of that. A petrol tanker involved in an accident, overturned, et cetera, can catch on fire very quickly. You have liquid fuel spills, so it can run down drains. You have vapour hazard issues. There is an immediate and pronounced issue with that. We have had chemical fires and they are the same: They are fairly significant and serious. With regards to a radiological incident, probably the initial outcomes are not as drastic in the sense that there is the immediate fire or immediate spill and containment and evacuation. However, obviously the consequences of it are just as significant in a different way, so we would treat any hazardous material as a significant and dangerous issue.[440]

6.133 The Committee agrees with these arguments from the NSW Fire Brigades. However, there is another crucial factor which differentiates the hazardous materials and the radioactive wastes. That is one of demonstrable benefit. The community identifies and accepts a level risk inherent in the range of these hazardous goods which need to be transported to contribute the quality of life it enjoys. Medical and other isotopes would fall into this category.

6.134 The community does not see any benefit with transporting radioactive waste.

Emergency Services

[439] Transcript of Evidence 11 September 2003 pp24,5
[440] Transcript of Evidence 19 September 2003 p22

6.135 Preparedness to deal with any accident or incident involved in the storage and transportation of radioactive waste is obviously of primary concern to residents of NSW. This was particularly true for the transport proposals.

6.136 According to Department Education Science and Training:

> There are well established procedures to manage an emergency involving radioactive materials in NSW and elsewhere in Australia which would enable an appropriate response in the unlikely event of an accident. Specialists in managing radioactive materials would attend an accident if required.
>
> In the unlikely event of an accident, the following response could be expected if an incident occurred in NSW:
>
> - An initial response would be by the NSW Fire Brigade; the nature of the incident would be assessed, and the site restricted;
> - A HAZMAT response unit would be called to the site; there are three main HAZMAT centres, and 15 intermediate stations where a substantial level of HAZMAT equipment is maintained. In addition, every fire station in NSW has a basic level of HAZMAT equipment;
> - The NSW Police Service would assume control of the emergency site in support of the Fire Brigade; and
> - Representatives of the Radiation Control Section of the NSW Environment Protection Agency would also attend the scene and provide specialist advice as required.
>
> The Commonwealth can provide assistance on request from states and territories via Emergency Management Australia. ARPANSA and ANSTO can also assist".[441]

6.137 Practically speaking, full responsibility for any emergency arising from these Commonwealth proposals obviously rests with New South Wales government agencies.

6.138 Major-General Howard, Chair of the State Emergency Management described the NSW agencies' roles as follows:

> **Mr HOWARD**: ...An incident or any emergency involving nuclear materials would be dealt with under the New South Wales hazardous materials subplan, for which the New South Wales Fire Brigades is the legal combat agency, and they are supported by the Environmental Protection Authority. I think I should comment at this stage that in respect of security for transport of this type or other types of material, the primary responsibility here rests with the New South Wales Police... In the emergency game we work underneath the police system.[442]

6.139 To these agencies could be added Ambulance Service the Roads and Traffic Authority and local councils.

6.140 The importance of consultation between police and fire brigade is acknowledged by the NSW Fire Brigades:

> **Mr HAMILTON**: ...we are the response organisation and the security is obviously the police area, but if we were consulted in that we would be able to offer advice... in the global environment as it stands today, the security of those materials being transported in the event that they got into the wrong hands, any issues that might result from that. Again,

[441] DEST Submission No. 367 pp10,1
[442] Transcript of Evidence 19 September 2003 p18,25

> that becomes a police issue under security, but that would be a concern of the New South Wales Fire Brigades.[443]

6.141 Any emergency would be managed by the HAZMATPLAN, which is "specifically designed to cater for emergencies, which involve hazardous substances. Nuclear waste is considered a hazardous substance under this plan. This plan was last reviewed in 1999 as part of the preparation for the Olympic Games. At which time there was an enhancement of the State's Chemical, Biological and Radiological capabilities.

6.142 The plan details the special arrangements for all hazardous materials emergencies in New South Wales except those, which occur on State waters. The latter is the responsibility of the respective Port Authority as detailed in the Marine Oil and Chemical Spill Contingency Plan."[444]

6.143 Under the NSW Fire Brigade's structure there are three levels of HAMZAT response:

- Standard – there is protective clothing on every fire appliance in New South Wales with staff trained to wear breathing apparatus and protective clothing;
- Intermediate level - HAZMAT vehicles carry some extra resources of protective clothing and also carry a lap-top computer with databases on chemicals and that type of thing. It also has a standard gas detector, not a radiological detector. There are 15 of these in NSW;
- Highest level - HAZMAT technicians, which are based at Sydney, Newcastle and Wollongong. Currently they can be flown by Westpac or Care Flight. In the near future Fire Brigades will have a shared helicopter with NSW Police for deployment of personnel.

6.144 In summary, every one of the 340 fire stations in NSW has a standard HAZMAT capability. There are 15 intermediate HAZMAT vehicles in country areas and there are specialist HAZMAT technicians available to respond in Newcastle, Sydney and Wollongong.[445]

6.145 The Department of Education Science and Training scenario outlined above relies significantly on the HAZMAT resources of the New South Wales Fire Brigades. As one submission noted, however,

> The NSW Fire Brigade has, for undoubtedly good reasons, deployed its HAZMAT units to cover road transport incidents between NSW and Queensland and NSW and Victoria. Essentially north/south movements. The Draft EIS however, states that most movements of radioactive material will be from Sydney to the Repository, an east/west movement.[446]

6.146 In dealing with a possible radiological incident Mr Hamilton explained how the fire brigade would respond:

> **Mr HAMILTON**: Our procedures would be to establish a hot, warm and cold zone. The hot zone would be the area that is the contaminated zone and that would be done through detection. We would actually be able to identify the contaminated area through the detection. We would establish a warm zone outside of that area where we would put in place our decontamination processes and also our staging area for crews to be put in

[443] Transcript of Evidence 19 September 2003 p26,7
[444] SEMC Submission No. 285
[445] Transcript of Evidence 19 September 2003 pp29,30
[446] Sutherland Shire Council Submission No. 350 Attachment 3 p10

> protective clothing to enter if required. We would also have outside that a cold zone, which is the exclusion zone. We would set up our command post, which would include agencies such as the New South Wales ambulance, New South Wales police and EPA. We would also be calling for specialist advice, and if it was a known shipment that we were talking about, we would have someone from ANSTO or the likes there as well to offer advice.
>
> If crews were to be put into the incident, they would have a dosimeter and also a radiological detector, they would wear protective clothing, and if there was a spillage, we would then looking at what the spillage was and the mechanism to contain that substance, but it goes back to every incident is different. It depends whether or not we actually have a release, whether it is a release or a spillage. We would then deal with that accordingly.[447]

6.147 Dr Lokan, a consultant to DEST, told the Committee there is no need for emergency personnel to wear special suits "for low level waste that certainly would not be necessary".[448]

6.148 ANSTO rejected assertions that the existing emergency procedures were inadequate to meet the needs of these proposals, arguing that, as radioactive waste was in essence no different to other radioactive substances, current arrangements would cope:

> **Mr McINTOSH**: … I have heard allegations that there are no plans out there. There are plans out there because these shipments occur every day of the week, every week of the year, and they could be equally applied to this small number. As I said, there are more than 50,000 shipments a year in New South Wales alone, every one of which from ANSTO passes through Sutherland shire incidentally. There are plans out there and they will cover any waste shipments from ANSTO as well… There is a nuclear medicine clinic in Dubbo that receives weekly deliveries from ANSTO. They are already transported every day. Mining towns, like Broken Hill, will use large numbers of radioactive sources in the mining process. They are transported through western New South Wales every day and there is no notification of those shipments because they are standard shipments.
>
> Existing emergency arrangements in place for addressing accidents involving the carriage of that material and those emergency arrangements would be equally applied to the carriage of low-level waste.[449]

6.149 In the view of DEST and ANSTO then, the existing emergency procedures are adequate to deal with any incidents arising from the transport proposals.

6.150 This was a view not shared by state agencies.

6.151 The EPA advised that while "there are established procedures in place… those procedures will require adaptation, given the scale of the proposed transport of waste".[450]

6.152 The New South Fire Brigades stated that:

> **Mr HAMILTON**: … If the proposal to take it to Woomera in South Australia was to occur, then the New South Wales Fire Brigades would have to increase its capability to cover that country area. The country area is covered by New South Wales Fire Brigade stations across that whole area and they have a standard level of response for hazardous

[447] Transcript of Evidence 19 September 2003 pp22,3, 33
[448] Transcript of Evidence 7 October 2003 p64
[449] Transcript of Evidence 11 September 2003 p 35,42
[450] Transcript of Evidence 11 September 2003 p72

> materials response. They have protective clothing and set skills to do that. When it comes to radiological though, we do not have any radiological detectors in that area, so that would be a shortcoming we would have.[451]

6.153 Local Councils held a similar view:

6.154 Mr Garofalow, an officer with Blue Mountains City Council asserted that the Federal Government would need to provide assistance:

> **Mr GAROFALOW**: …It appears that if there were to be a spill it would be left to the State Government and local councils to undertake the clean-up operations. The Commonwealth Government needs to put in place increased emergency response capability to fully address transport accident responses should there be a radioactive spill at any point on the proposed route.[452]

6.155 Mr Sykes from Orange City Council said that they "do not believe there are appropriate mechanisms for effectively protecting the community against some sort of accident".[453]

6.156 The Fire Brigade concluded in its submission that:

> The proposed transportation arrangements to move radiation sources through NSW to Woomera present new challenges, given the identified capability gaps. The proposed movements, although infrequent, introduce possible health and safety risks to first responders and the public due to a lack of specialised detection equipment in rural areas… an enhanced capability will be required by the NSWFB, especially in rural areas.

6.157 According to Councillor Rankin from Sutherland Shire, there has been discussion at Local Government forums about the limited HAZMAT capabilities in rural NSW:

> **Clr RANKIN**: What has come up at meetings of the Local Government Association in relation to HAZMAT is the isolated communities. A councillor from Dubbo who was a former HAZMAT member of the Fire Brigade… stated that in a lot of remote areas of Western NSW there are isolated communities and the facilities along the proposed transport corridor do not exist.[454]

6.158 Dr Loy (from ARPANSA) advised the Committee that no matter what the arrangements currently in place, he needed "to examine the [emergency services] arrangements in the context of the specific proposal" before him. Accordingly, as part of the DEST's application for a license for the repository, he would be "assessing the viability and necessity and strength of emergency arrangements for transport".[455]

6.159 Sutherland Council's submission to the Inquiry includes a report prepared by consultants which assessed the implications of the proposals for the emergency services in NSW. It included a detailed list of issues that should form part of a detailed management plan of the proposals. (See Appendix 9)

6.160 Major-General Howard (SEMC) was provided with a copy prior to giving evidence. In referring to the material, he observed:

> **Mr HOWARD**: …it seems to me that that draft submission makes a very good checklist of the sorts of things that we would need to do to arrive at a jointly acceptable protocol for

[451] Transcript of Evidence 19 September 2003 p19
[452] Transcript of Evidence 26 September 2003 p1
[453] Transcript of Evidence 22 October 2003 p10
[454] Transcript of Evidence 11 September 2003 pp22,3
[455] Transcript of Evidence 26 September 2003 p20

> the proposed movement of that material. Obviously a lot of the answers are not there because we do not know the Commonwealth's policy at this stage, but I think the authors of it are to be congratulated because they have helped us with a task which is yet to come, that is, to develop a protocol which is acceptable to our own Government, and I think it will be of great help to us.[456]

Escort or Upgrade

6.161 It was argued that a cost effective way to provide emergency services, rather than upgrading along the proposed routes, was to provide escort vehicles, thus significantly reducing costs by avoiding duplication.

6.162 Dr Murray, President of the Local Government Association told that committee that "If nuclear waste is to be transported, the emergency response capability must be provided by the transporter of the waste and it must travel with that waste."[457]

6.163 The representative of the Fire Brigade advised at hearings that at the moment in preference to upgrading capabilities at stations along the routes, they would "put some technical crews from a HAZMAT unite to escort it that distance".[458]

6.164 However, in its submission the Fire Brigade observed that there would be a community and union expectations:

> to provide capabilities in detection equipment and training to firefighters in rural areas. As a priority, those resources would need to be available at locations along prescribed transport routes. [However], funding for this enhanced capability is not available from existing sources.[459]

6.165 Other local councils favoured the escort approach, including Fairfield and Blacktown:

> **Mr LALICH**: Yes. Our position is at Fairfield City Council that we feel that any shipment, whether it go by rail or by road, that there must be an emergency response, a specialised emergency response team travelling with the convoy.[460]
>
> **Mr PENDLETON**: ...to have a response team capable of looking after a nuclear spill for every local government area would be an absolute waste of resources from local government's perspective, because each area that it went through would have to have a response team. It would be a duplication... I would support what the Mayor of Holroyd said, that this team should travel with the material so that it is there at the time, should there be an incident or accident.[461]

6.166 This is a technical issue that will need to be addressed as part of any risk assessment of the proposals. (See Conclusions)

Lucas Heights

6.167 The report has looked at the management of waste on-site in the previous chapter.

6.168 However, there were issues raised during the inquiry relating to emergency services at Lucas Heights. In accordance with its terms of reference, the Committee has

[456] Transcript of Evidence 19 September 2003 p35
[457] Transcript of Evidence 22 October 2003 p2
[458] Transcript of Evidence 19 September 2003 p30
[459] NSW Fire Brigades Submission No. 285
[460] Transcript of Evidence 19 September 2003 p45
[461] Transcript of Evidence 19 September 2003 p45

restricted itself generally to matters relating to emergency services and radioactive waste at Lucas Heights.

6.169 The Police Association explained how "the Sutherland local area command is responsible for the contingency planning in conjunction with other emergency services and ANSTO, and all plans are reviewed on a regular basis".[462]

6.170 The NSW Fire Brigades Employee's Union provided the following background:

> The initial aim in controlling any HAZMAT incident is to contain the release of the substance. The ANSTO site at Lucas Heights is classified by the NSWFB as a Major Hazard Facility. A Major Hazard Facility sensibly attracts attention from ESOs [Emergency Service Organisations] for all the right reasons. Along with that classification comes extensive preparation by ESO's for a potential incident involving planning and training for a multi-agency response.
>
> The ANSTO site has a 1.6km buffer zone around the perimeter affording professional firefighters some opportunity in containing a HAZMAT incident involving a release of radioactive materials. Of further advantage to professional firefighters is the ability to work with the operators of the site and industry response teams in developing Pre Incident Plans (PIP) specific to the hazards of the site.[463]

6.171 Councillor Rankin from Sutherland Shire told the Committee:

> **Ms RANKIN**: My understanding is that HAZMAT in Sydney is very well equipped. Recently, with the $17 million upgrade from the Premier, HAZMAT increased the level of equipment it would have in an accident. It also says that its response time to an incident at Lucas Heights, from memory, is seven minutes. We can check that. However, there are some concerns about whether that could be met if there is, for instance, an emergency and there is only one road in via either Engadine or Menai. There are concerns among community representatives on the Emergency Management Committee about whether that could be met. But that is certainly the standard the Fire Brigade is working to, depending on what the hazard is.[464]

6.172 The Fire Brigade went into further detail on emergency service involvement at Lucas Heights:

> **Mr HAMILTON**: …With the majority of the nuclear waste being stored at ANSTO, we have based our model on that local area… With regard to Lucas Heights itself, we have been involved through the local emergency management committee and the district emergency management committee, and that is including the Sutherland Shire, in the reviews that have been undertaken, development of local plans and exercises. Our hazardous materials response unit, which is based at Greenacre, also at Wollongong and Newcastle, part of their training is a day's training at ANSTO and there are regular refreshers on that, and that is out at ANSTO itself. They have a familiarisation and they work with the local plan. The local stations, being Menai and Sutherland, because of their locality also do incident plans and exercises with Lucas Heights and they also have a detector.[465]

6.173 The Fire Brigade Union came to the following conclusion with regard to emergency service approaches to radioactive waste management in NSW:

[462] Transcript of Evidence 19 September 2003 p72
[463] NSWFBEU Submission No. 438 pp2,3
[464] Transcript of Evidence 11 September 2003 p21
[465] Transcript of Evidence 19 September 2003 p19

6.174 ANSTO currently retains approximately 1320 cubic metres of low level and short-lived intermediate level radioactive waste at the facility at Lucas Heights. From the perspective of Emergency Service Organisations (ESO), this lamentable fact does provide some advantages in the event of a hazardous materials (HAZMAT) incident involving radioactive materials.[466]

6.175 Lucas Heights quite rightly is a focus of emergency service attention. This and the argument put forward by the NSWFBEU give further support the Committee's recommendation in chapter five that the waste, for the time being, should continue to be stored at Lucas Heights.

Security

6.176 "The threat of terrorism in the changing global environment is of major concern.... The consequences could be significant if security is breached." This terrorism threat still exists.[467]

6.177 Dr Murray (President of the Local Government Association) said that "... there needs to be a provision, again by the transporter, of complete transport security, including an ability to deal with theft or sabotage, and for terrorism incidents. This is not alarmism or paranoia; it is just a precautionary approach."[468]

6.178 According to the NSW FB Union, ongoing storage at Lucas Heights presents distinct advantages over transportation in terms of security, given the increased risk during transport:

> In recent years terrorism has emerged as a real threat to citizens and particularly to professional firefighters. FBEU members are now seen as the first line of civil defence in the event of a terrorist attack. Professional firefighters recognise the superior ability to secure the Lucas Heights site and understand the particular advantage this ability presents in containing an obvious risk during uncertain times. Of considerable concern to professional firefighters is the possibility that groups associated with terrorist activities may target trucks transporting nuclear waste in order to advance their aims and objectives. There is, in our opinion, simply no way of providing similar levels of security once waste has left the site on the back of a truck.[469]

6.179 Security is the key to reducing the risk of intervention. The threat, and hence the security response, differs according to the nature of the material.

6.180 The EPA observed at hearings that "...it is important to highlight the difference between high-level materials that pose a significantly greater risk and medium and low-level materials. The steps that should be taken to protect against an accident are different for the different types of materials".[470]

6.181 This is just as valid for intervention and security issues as it is for accidents.

[466] NSWFBEU Submission No. 438 pp2,3
[467] NSW Fire Brigades Submission No. 285
[468] Transcript of Evidence 22 October 2003 p3
[469] NSWFBEU Submission No. 438 pp2,3
[470] Transcript of Evidence 11 September 2003 p75

Spent Fuel

6.182 From the security perspective, spent fuel (or high level waste) presents a significantly greater risk than other waste material, as ANSTO explained:

> **Mr McINTOSH**: You raised the spent fuel. Spent fuel and fresh fuel is different. Earlier we talked about the International Atomic Energy Agency [IAEA] INFCIRC 225, which refers to the protection of nuclear material—stuff that you can make nuclear weapons out of—and those standards are the ones that they basically keep tightly held information about. If you manage to have a reprocessing facility you could extract, particularly from HIFAR fuel, highly enriched uranium. Therefore there is a weapons interest and, therefore, the security consideration is high… Historically it has not been an issue of radiation. The issue with spent fuel is that it contains nuclear material… It is an international guideline that that material has to be very highly protected. The secrecy requirements are attached to that rather than to its level of radioactivity. If something did not contain nuclear material that was highly radioactive, the international guidelines would not be relevant.[471]

6.183 For this reason spent fuel has been a cause for concern and always attracted a high level of security.

6.184 Dr Loy, CEO of ARPANSA, acknowledges the need for special treatment:

> **Dr LOY**: The transport of spent fuel from the Lucas Heights site must be approved under the licence that ANSTO possesses for the Lucas Heights site and for its fuel operations on that site. In addition, ARPANSA approves the transport casks in which the spent fuel is carried. In terms of my approval of the transport itself, I can advise that there are discussions going on between ANSTO, ARPANSA and New South Wales authorities about the arrangements to apply.[472]

6.185 The ACF argues that this material is so dangerous its production and transportation needed very careful consideration:

> **Mr NOONAN**: What the Commonwealth Government refers to as long-lived intermediate level waste and what we refer to as high level waste, the spent fuel and the reprocessed nuclear waste, all of those categories of waste are significant security and potential terrorist related materials and any production and movement of those wastes should be significantly canvassed against in the public interest.[473]

6.186 Greenpeace identified concerns with the suitability of spent fuel casks to deal with terrorist attack:

> **Mr COURTNEY**: …the major threat… is posed by spent nuclear fuel transports…. It is the one that poses the most serious risks in relation to the transport and emergency planning surrounding it. Just as the Federal Government has only recently conducted a consequence analysis of an accident or attack at Lucas Heights, it has never conducted a consequence analysis of an attack on a spent fuel cask. Now we know from the United States that it is considered a credible threat, a credible risk, that those casks could be targeted by terrorists. The casks that ANSTO use to transport spent nuclear fuel have never been tested to withstand an explosion or an attack… There have been several tests conducted on spent fuel casks by Sandia Laboratories, and again public information relating to these tests is not readily available, but it was shown that a cask could not withstand the impact of a man-portable missile or a shoulder-fired missile.[474]

[471] Transcript of Evidence 22 October 2003 p66; 11 September 2003 pp41,2
[472] Transcript of Evidence 26 September 2003 p16
[473] Transcript of Evidence 19 September 2003 p70
[474] Transcript of Evidence 19 September 2003 pp4,9,10

6.187 The NSWFBEU has similar concerns about the viability of casks in the terrorist climate:

> Given the heightened possibility of a terrorist related incident the FBEU believes that any assurance given by the Commonwealth in relation to the ability of the packaging to withstand normal accident impacts is unacceptably narrow in failing to consider the issue of terrorism and sabotage".[475]

6.188 ANSTO in response advised the Committee that:

> **Mr McINTOSH**: The casks have been tested in the United States. There have been some studies done—and we will give you the results of those studies—into the possibility of terrorist attacks on spent fuel casks. Briefly, it has been found that an explosion per se would have no impact. It is possible that if you use an anti-tank missile you could penetrate the cask, but that very small amounts of material would be dispersed into the environment. A study was done on what would happen if the fuel is six months old, which means it is very radioactive, and the release occurs in Manhattan in the middle of the day. I will provide you with that study. It came up with about 48 additional long-term cancer deaths.[476]

6.189 The Police Association representatives advised the Committee that from the information and training they have received the casks seemed to be extremely safe:

> **Mr MORGAN**: … Before each operation our members are provided with a safety briefing as well as operational briefing. This briefing includes a safety film explaining loading and testing of the canister carrying the rods. The testing also shows dropping of the canister from a height, a train crash at 160 kilometres per hour and a pinch-bar test.[477]

6.190 According to NSWFBEU, fire fighters were not advised of the transportation of spent fuel, a fact that put the community at risk:

> It is of significant concern to professional firefighters that the Commonwealth Government indicates there are no plans to inform emergency services of shipments of nuclear waste. At present, firefighters are not notified of shipments of spent fuel rods to Port Botany. As a direct result, Emergency Service workers, the public and the environment are exposed to significant risk. Firefighters responding to a transport accident involving nuclear waste must be aware of the presence of radioactive material in order to deal with the incident in the most effective and safe manner".[478]

6.191 Both the Department of Education Science and Training and ANSTO dispute this:

> **Dr PERKINS**: … In the case of things like spent fuel, it [ANSTO] follows well-established procedures. First, I believe it consults with the New South Wales Government… My understanding is that ANSTO contacts the police and the police then talk to emergency services and co-ordinate it in that manner.[479]

6.192 Mr McIntosh told the Committee that it did coordinate with relevant state emergency services about the spent fuel shipments, working "in close liaison with New South Wales police, HAZMAT, the ambulance service and so on" Furthermore "local councils and MPs [both state and federal] have been advised a day or so before the

[475] NSWFBEU Submission No. 438 p8
[476] Transcript of Evidence 22 October 2003 p58
[477] Transcript of Evidence 19 September 2003 p71
[478] NSWFEU Submission No. 438 p5
[479] Transcript of Evidence 7 October 2003 p62

shipment has gone as a matter of courtesy. Earlier notification than that, we have been advised, would prejudice the security of the shipments".[480]

6.193 Ultimately the issue of security rests with the NSW Police Service and the Committee has recommended that the Police Service be involved in any risk assessments of the proposals. (See Conclusions)

6.194 It must be stressed here that any proposal to transport unreprocessed high level waste (in the form of spent fuel) to the Store – a possibility raised in the RRR EIS – must represent a major increase in risk and would be a concern to the Committee.

Low Level and Intermediate Level Waste

6.195 Unlike spent fuel, lower level wastes do no contain the fissile material suitable for the production of nuclear weapons. Its (potential) security risk comes from the possibility of its use by terrorists as a "dirty bomb".

Dirty Bomb

6.196 The Sutherland Shire Council submission described how a dirty bomb would operate:

> There is considerable current concern about the risk that a terrorist group will fabricate and explode a radiological dispersal device, commonly called a dirty bomb, the simplest and most primitive terrorist nuclear device. A terrorist group could steal or otherwise acquire radioactive waste, perhaps from a transport or a store, and make a dirty bomb.
>
> The radioactive waste would be surrounded by a conventional high explosive (for example, semtex or TNT) and incendiary material (thermite). The explosive would spread the radioactivity, the incendiary material will cause a fierce fire, carrying radioactivity up into the atmosphere, to be spread by the wind. The explosion of a dirty bomb could result in the contamination of an area with radioactivity. The area would have to be evacuated and decontaminated; this could be a lengthy and expensive operation.[481]

6.197 Sutherland Shire told the Committee that it would be unwise to downplay the threat:

> **Dr SMITH**: …With respect to terrorists, we have indicated very clearly that we do not want to go down the track of what is particularly vulnerable and how to make it more vulnerable. Information is clearly available in the popular media and on the Internet about misuse of the types of levels of radioactivity even from laboratories and so forth. How to build dirty bombs and those sorts of things are publicly available. Based on those observations and on the expert report that is attached to our submission, we certainly feel it is wrong for the department and the industry to trivialise these matters not only with respect to the low-level repository but in particular for the intermediate-level store, which is yet to be placed.[482]

6.198 Greenpeace argued that the implications of a dirty bomb have not been fully assessed:

> **Mr COURTNEY**: I think that the consequences of an attack on even a low level waste transport has not been investigated and to say that there would be no consequences is ludicrous. Burning radioactive materials emit radiation that is carried by smoke. How far is that smoke going to travel? What are the consequences on the community living

[480] Transcript of Evidence 11 September 2003 p33
[481] Sutherland Shire Council Submission No. 350 pp9,10
[482] Transcript of Evidence 11 September 2003 p11

> nearby? What are the long-term consequences? What is the economic impact of an attack like that?[483]

6.199 The EPA said in its submission to the Inquiry that:

> An additional hazard posed by intermediate-level long-lived radioactive wastes is their potential for abuse in a radiological dispersal device (RDD, or 'dirty bomb'). Although the human health and environmental effects of such a device would not be immediately serious, the potential social and economic disruption caused would be significant".[484]

6.200 Dr Loy was asked if the material destined for the Repository could be used as a dirty bomb:

> **Dr LOY**: Security for transport of LLW is "relatively minor". The storage at the various locations is, according to Loy, a greater "security concern" ...I do not believe so insofar as you would be dealing with waste that had been prepared, conditioned, for placement in the repository or use in the store. As I said, if you are looking to get sources for a dirty bomb you are more likely to look at sources that are in use or that have been forgotten about or stored in somebody's bottom cupboard. Once they are, if you like, put in a drum with concrete poured over them, they are much less available for malevolent use of that kind.[485]

6.201 ANSTO also suggested some waste sources that might be a target for a dirty bomb:

> **Mr McINTOSH**: I have been involved in the international discussions on the possibly of dirty bombs. The focus of the discussions is the use of the type of sources I talked about earlier; that is, the high-activity industrial sources used for pipeline integrity and so on. They are highly active and there is no doubt that if you knew what to do with them they could be used in a dirty bomb. Low-level waste is of such activity that it would be useless; you might as well blow up a stack of newspapers. It defies logic to suggest that it would be of any use in a radiological dispersal device in terms of inflicting any meaningful or measurable dose on people...[486]

6.202 Mr Courtney told the Committee that reprocessed spent fuel would not be a terrorist target stating that "it is unlikely in the form that the waste comes back to Australia that a terrorist organisation, for instance, would attempt to steal that and convert it into a dirty bomb for instance".[487]

6.203 The NSW Fire Brigade outlined its concerns about the risk lower level waste presents, not so much from accident but from terrorist intervention:

> The proposed new practice to transport nuclear waste by road through NSW to Woomera in South Australia, in the context of the current geo-political environment, necessitates a wider risk assessment. Longer travel distances with known routes could provide an opportunity for terrorists to secure radioactive sources for "dirty bombs". The possibility of terrorist intervention may raise the risk assessment. The prescribed packaging for radioactive sources means that there is minimal risk of radioactive contamination occurring, even in the event of a high-speed road accident.[488]

6.204 In evidence Dr Perkins told the Committee that the material is not seen as a terrorist target

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[483] Transcript of Evidence 19 September 2003 pp 9,10
[484] EPA Submission No. 474 p3
[485] Transcript of Evidence 26 September 2003 p 21/7
[486] Transcript of Evidence 11 September 2003 pp 39/40
[487] Transcript of Evidence 19 September 2003 p6
[488] NSW Fire Brigade Submission No. 285

> **Dr PERKINS**: The first point is that low-level and short-lived intermediate-level waste transported to the repository in accordance with the 2001 code would not require a police escort with respect to radiological safety requirements. In terms of the security of the waste, we have advice from ASIO, and ASIO does not assess that a terrorist attack against the transport, storage or disposal of radioactive waste is likely.

6.205 Furthermore, due to the nature of the conditioning of the waste, "…is unattractive [to terrorists] and… is not a terrorist target.[489]

6.206 However, later in evidence she clarified this point, explaining that an assessment of the transport proposals would be carried out as part of ARPANSA's evaluation of the transport plan:

> **Dr PERKINS:** …In relation to the need for police escorts, you would have to assess the situation prior to doing the transport as unforeseen things can happen. You have to have a flexible approach. We cannot make a statement at this stage about something that might happen sometime next year. We would take the best advice, including advice from NSW Police and the Australian Security Intelligence Organisation. Prior to transporting the material we would undertake a threat assessment to work out the issues and we would take appropriate action.[490]

6.207 The EPA has recommended an assessment of the proposals, which would include security aspects, by the IAEA's Transport Safety Appraisal Service. (See Conclusions)

6.208 In the meantime, the Committee is concerned that some intermediate level waste, suitable for use in a dirty bomb, could be a targeted by terrorists. This material needs to be identified and secured as a high priority.

> **RECOMMENDATION 12:** ARPANSA should liaise with ANSTO and the NSW Department of Environment and Conservation to identify and properly secure any intermediate level waste considered suitable for use in "dirty bombs".

who should be notified

6.209 Closely related to the issue of the potential terrorist threat to this material, is the question of the merits of advising emergency services and the community of transport shipments.

6.210 ANSTO was of the opinion that the community could safely be advised:

> **Mr McINTOSH**: For low-level waste those considerations do not apply because we are not talking about weapons-relevant material. Notification restrictions that apply to the transport of spent fuel or fresh fuel will not apply to the transport of low-level waste and, I suspect, would not apply to the transport of intermediate-level waste… we would have to be guided by security agencies on that. We have not yet gone through that process. But in terms of radiological protection, I would see no reason why that should not happen.[491]

6.211 Later Mr McIntosh put two qualifications on this. He repeated to the Committee that "from a radiological protection point of view, there would be no reason not to advise the local community of the transport of intermediate and low-level waste", with the rider that:

[489] Transcript of Evidence 7 October 2003 pp58/9
[490] Transcript of Evidence 7 October 2003 p62
[491] Transcript of Evidence 11 September 2003 pp 4,1/2

> **Mr McINTOSH**: ...in the light of recently arisen concerns about the so-called dirty bomb, there is very much still an evolving stage in International Atomic Energy Agency development guidelines on security during transport of radioactive material—non-nuclear material. That may have something to say on that subject... The second rider is that the police may decide that to prevent public injury from people trying to throw themselves in front of trucks and so on precise details of timing will not be available. That is certainly not an ANSTO decision.[492]

6.212 There was general agreement that, with regard to the second point, this was a decision for government.

6.213 It was also generally agreed that the emergency services (including councils) should be advised of any transport shipments. The NSW Fire Brigades:

> **Mr HAMILTON**: I agree. The confidentiality of those transfers - we talked about preparedness before and we spoke about the response times and those type of issues. If there is going to be a transfer of waste, if the New South Wales Fire Brigades is advised of that, then we can actually put the preparatory measures in place so that response times can be minimised, we can have crews there, etc, if we needed to, to escort it.[493]

6.214 And later:

> **Mr HAMILTON**: That was in the fire brigade's submission indicating that if there was going to be a transfer through western New South Wales the community should be advised and should be consulted. An example of that is the Sutherland shire where there is a community group that does get involved, as Mr Howard indicated, being included in consultation and raising issues and getting an understanding, so that is what we were raising in that comment, that it should occur across the whole gamut rather than just locally. Who should do it? I would suggest probably the local emergency management committee.[494]

6.215 At the council level:

> **Mr GAROFALOW**: ... If the decision is made to transport waste, should everyone be informed that the transport is occurring? Probably not, for the reasons you have mentioned. However, we must ensure that in the quest for security we do not overlook the need to ensure that proper emergency procedures are in place.[495]

6.216 While the Mayor of Dubbo argued that "emergency services and councils should be notified", councillor McKinnon from Broken Hill was of the opinion that she "did not see a need for councils to be informed, as long as emergency services are alerted". Mr Oldsen on the staff of Broken Hill told the Committee that as a "bare minimum" emergency services should be advised but "it is for politicians to tell us whether councils should be informed on top of that".[496]

6.217 Although the Commonwealth preferred to wait for the final appraisal of the transport arrangements before coming to a position on this:

> **Dr PERKINS**: ...Obviously, we would fully explore that avenue prior to the transport. My understanding is that ARPANSA would want to see our transport plan as part of the

[492] Transcript of Evidence 22 October 2003 p66/7
[493] Transcript of Evidence 19 September 2003 p27
[494] Transcript of Evidence 19 September 2003 p36
[495] Transcript of Evidence 26 September 2003 p5
[496] Transcript of Evidence 7 October 2003 p16

> licensing arrangements. So all those things would be considered and people would be notified appropriately.[497]

6.218 Sutherland Shire Council suggested to the Committee that it:

> recommend that transportation of radioactivity should be kept to an absolute minimum and that emergency services be informed about the transport of radioactivity through their area – including the route, timing and the type and amount of radioactivity being transported [498]

6.219 Dr Barnaby, as part of Sutherland submission, stressed that "a sensible balance has to be struck here" as,

> it is important that emergency services (including police, fire, and ambulance) are informed about the transport of nuclear waste through their area. Authorities responsible for nuclear transports, however, do not want to give anyone details for security reasons".[499]

6.220 The Committee concedes that a final decision on this matter needs to be developed as part of a detailed risk assessment. However, it is of the view that as an absolute minimum all necessary emergency services organisations should be informed.

RESOURCING

6.221 The Committee heard that there were, potentially, significant costs to be borne by the state as a consequence of the these transport proposals. Most related to the preparedness of the emergency services to deal with any accident or incident. It was argued that the commonwealth, as the proponent, should be responsible for providing the necessary resources.

6.222 Dr Keay argued that, because low level radioactive waste was so benign, money was being wasted on its protection. He told the Committee "I quoted Professor Jaworowski in this regard. In other words, the amount of money that is spent on overprotecting nuclear waste in the transport of it cannot be justified".[500]

6.223 In discussing resourcing, the Department of Education Science and Training pointed out that:

> Commonwealth contractors would undertake the transport of radioactive waste to the national repository. Waste producers would be required to pay for disposal of waste in the facility and its transport to site. Charges would be determined prior to each disposal campaign".[501]

6.224 As was noted above, the Federal Government and ANSTO did not see any major emergency services implications in the proposals, arguing that the existing arrangments were adequate to cover the proposals. Presumably then they see no resourcing implications as well.

6.225 At the state level, the story was different, as the following sample indicates:

- Sutherland Council:

[497] Transcript of Evidence 7/10 pp61,2
[498] SSC Sub No 350 p22
[499] Sutherland Shire Council Submission No. 350 Attachment 1 p7
[500] Transcript of Evidence 22 October 2003 p28
[501] DEST Submission No. 367 p12

> …the Commonwealth's proposals can be expected to impose considerable costs on the State of NSW. The Draft EIS does not attempt to quantify these costs, or to suggest how NSW would be compensated by the Commonwealth."[502]

- NSW Fire Brigades Employees' Union

> Significant sums of public money will be required to provide basic protective measures against the threat to firefighters and to the citizens of NSW proposed by the Commonwealth Government. The people of NSW should not suffer reduced services in order to fund the capital and recurrent drain on the NSWFB's budget caused by the necessity to protect the community against a completely unnecessary threat.[503]

- The NSW EPA:

> …I think the relevance of that principle is that, as it is proposed, the Commonwealth will be the one generating the material and originating the transport, then it should bear the costs of those activities to the full extent required to ensure safe transport of it.[504]

- The mayor of Fairfield:

> …At the end of the day …New South Wales should not be paying for this, neither the State Government nor the councils. This should be a Federal Government issue. They should be paying for and handling the whole issue. We should not be expecting our communities to pay for a waste that is produced by a Federal Government body.[505]

- Southern Sydney Regional Organisation of Councils:

> …SSROC stated in its submission that we think it is highly inappropriate for the taxpayers of New South Wales to bear these responsibilities and associated costs, particularly as the State Government has had no say in the decision-making process that has led to the need to transport nuclear waste in the first place"[506]

6.226 New South Wales carried the cost, through the Fire Brigades, of escorting the transportation of radioactive waste to Woomera, in 1997.

> **Mr HAMILTON**: I would have to come back on notice with that, but I can inform you that the New South Wales Fire Brigades paid for that, paid for our own resources, but the cost of it I cannot tell you off the top of my head.[507]

6.227 In addition to arguing that the Federal Government should carry the costs associated with the proposals, a number of witnesses outlined some specific resourcing concerns:

6.228 Councillor Anthony from Liverpool City Council:

> **Ms ANTHONY**: …We can work as a council in an emergency situation with fire and with other major disasters that we know about and we are trained for, but we do not have an active response team for a nuclear spill or accident or explosion of radioactive material. We have not been asked if we can commence training people; we do not know how to train people. That, in terms of allocation of resources, is a significant issue for Liverpool council because that will cost us money, but we do not know how, where, what or how much.[508]

6.229 Friends of the Earth detailed some of the resourcing implication in its submission:

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[502] Sutherland Shire Council Submission No. 350 p25
[503] NSWFEU Submission No. 438 p8
[504] Transcript of Evidence 11 September 2003 pp 69,70
[505] Transcript of Evidence 19 September 2003 p48
[506] Transcript of Evidence 19 September 2003 p60
[507] Transcript of Evidence 19 September 2003 p33
[508] Transcript of Evidence 19 September 2003 p42

There remain serious concerns regarding the preparedness of emergency services, including:

- training of local emergency services on the transport route in how to respond to an accident that may involve a radiological release;
- time delay in getting HAZMAT response team to isolated rural areas; and
- incorporation of response to an accident that involves radiological release into local emergency disaster plans.[509]

6.230 As did the NSW Fire Brigade:

> The existing NSWFB Hazmat capability is premised mainly on response to chemical spills/escapes. Response to low level incidents involving radioactive isotopes and movement of small radiation sources from ANSTO to Port Botany can be catered for with existing resources.
>
> The proposed transportation arrangements to move radiation sources through NSW to Woomera present new challenges, given the identified capability gaps. The proposed movements, although infrequent, introduce possible health and safety risks to first responders and the public due to a lack of specialised detection equipment in rural areas.
>
> … As a priority, those resources would need to be available at locations along prescribed transport routes. Funding for this enhanced capability is not available from existing sources.
>
> With adequate funding the NSWFB would be able to sufficiently resource and train NSWFB personnel across the State to address its legislative responsibility to manage incidents that could involve radioactive sources".

6.231 In evidence, Chief Superintendent Hamilton cautioned that "…on further funding issues, presently, if we were to fund that through New South Wales Fire Brigades, we would have to reprioritise plans or projects at the present time, which may or may not be possible"[510]

6.232 The Fire Brigade submission concluded:

> The risks associated with the proposal to transport nuclear waste across NSW can be managed. Existing Codes of Practice and emergency management arrangements are sound. However, an enhanced capability will be required by the NSWFB, especially in rural areas. Close community consultation and awareness is also required to assist in addressing the perceptions and fears of communities throughout NSW.[511]

6.233 Sutherland Shire Council in its submission concluded:

> The current proposals for the transportation of radioactive wastes along NSW roadways are likely to involve additional cost-shifting between the Commonwealth and the State, and impose a high level of costs on the NSW Government and the public. Currently the operation of Lucas Heights facility within NSW imposes costs would be imposing costs on State agencies, such as Sydney Water and the Environmental Protection Authority, arising from ANSTO's disposal of liquid and gaseous wastes. These proposals, if implemented, will add to those costs.

[509] Friends of the Earth Submission No. 234 p17
[510] Transcript of Evidence 19 September 2003 p30
[511] NSWFB Submission No. 285

6.234 It has not been possible to fully quantify those costs, from information publicly available.[512]

6.235 The Committee too has been unable to quantify costs from information available to it but regards the quantification of any costs as a vital part of any agreement between the Commonwealth and NSW on the proposals. The state should not be carrying the costs associated with proposals it does not support.

Indemnity

6.236 On other resourcing-related issue that was raised on a number of occasions during the inquiry are the costs and the indemnity associated with a radioactive waste accident.

6.237 According to Friends of the Earth,

> Insurance against transportation accidents involving radioactive waste is not available. The only potential form of redress would be legal action against the Federal Government. The Supplement to the EIS (pp.55-56) confirms that in the event of an accident, '... redress would be sought under the relevant domestic laws dealing with pollution and liability for harm to the environment'."[513]

6.238 Sutherland Shire Councils observed in its submission:

> Notwithstanding the claim that the Commonwealth indemnifies the public against nuclear industry accident, it is clearly the case that the Commonwealth only bases that claim on potential success of affected citizens through the Courts, or possible out-of-court settlement of claims against the Commonwealth. This practice falls well short of the common international practice of indemnifying the public against radioactivity accidents with respect to government activities".[514]

6.239 The Local Government Association put the position directly in evidence:

> **Dr MURRAY**: ...We want a clear provision, again by the Commonwealth, of complete and indisputable indemnity for damage or contamination of private and public property along the transport route. The Commonwealth must take complete responsibility for this activity and anything that may go wrong, and we believe this should be enshrined in legislation.[515]

6.240 A view supported by Blue Mountains City Council:

> **Mr GAROFALOW**: ... Supposedly there is community good in terms of the activity going on, but if somebody's house is going to become radioactive or somebody will be put at risk, I definitely think it is the role of the Federal Government to ensure that that is indemnified.[516]

6.241 Mr Priceman (Sutherland Shire Environment Centre) argued that the commonwealth took a somewhat hypocritical position:

> **Mr PRICEMAN**: ... social and economic effects following an accident or an act of terrorism have not been acknowledged by any government or bureaucracy. The community is

[512] Sutherland Shire Council Submission No. 350 Attachment 5 p16
[513] Friends of the Earth Submission No. 234 p9
[514] Sutherland Shire Council Submission No. 350 p21
[515] Transcript of Evidence 22 October 2003 p3
[516] Transcript of Evidence 26 September 2003 p6

> denied insurance against any radiation release. Whilst the Commonwealth accepts all ANSTO's exaggerated claims of safety it refuses automatic and comprehensive cover.[517]

CONCLUSIONS

6.242 The transport of radioactive waste is performed in a highly regulated environment. Packaging and shielding of radioactive material for transportation has evolved to give a considerable degree of protection to the public. This does not mean, however, that there is no risk involved in transporting nuclear waste. Nor does it mean that the Committee supports these transport proposals.

6.243 The NSW Fire Brigades, the State Emergency Management Committee and the Department of Environment and Conservation were of the opinion that the risk of the proposals could be managed:

- EPA - it "is potentially safe provided it is done in accordance with the code. Everyone would rather have nil risk than any risk. It is all about how that risk is managed".[518] The regulatory framework has an important role in this because a very strong framework will "reduce the risk to very low levels".[519]
- NSW Fire Brigade - "the risks associated with the proposal to transport LLW across NSW can be managed"
- State Emergency Management Committee - "the system can be adapted to deal with" any additional risks brought about by the transportation proposals.[520]

6.244 But they also acknowledge that the proposals represent a potential risk that needs to be assessed.

6.245 Regardless of the effectiveness of the regulatory regime it cannot guarantee nil risk. Any transportation of radioactive waste means an increased risk of an accident or terrorist intervention.

6.246 In chapter five the Committee concluded that the proposal for two new storage facilities was unnecessary. As they did not achieve the objectives ascribed to them, it made more sense to continue to store the waste at Lucas Heights.

6.247 This approach removes the need to transport the waste. With no need to move the waste, the transport proposals and their inherent risks cannot be justified or supported.

6.248 This, therefore, is a case where there should be "nil risk" for there is no point trying to manage a risk that is unnecessary.

6.249 The NSW Fire Brigades Union perhaps summed up the situation:

> It is then very difficult for our members to understand why the Commonwealth Government effectively plans to shoot holes in this contained and controlled repository [Lucas Heights] in transporting its unnecessary detritus through the largest city of Australia and across the breadth of New South Wales. In doing so, the Commonwealth

[517] Transcript of Evidence 11 September 2003 p51
[518] Transcript of Evidence 11 September 2003 pp76,7
[519] EPA Submission No. 474 p7
[520] SEMC Submission No. 285

> Government will be transporting a clearly dangerous substance through an uncontrolled, and uncontrollable, environment".[521]

6.250 There is no "demonstrable benefit" to the proposal to transport the waste to the repository and store and it, therefore is an unsupportable risk.

6.251 The New South Wales government should make clear its opposition to the possible siting of a new, unnecessary store in NSW and the unnecessary transporting of waste through the state by amending the Uranium Mining and Nuclear Facilities (Prohibition) Act, in an approach similar to that adopted by South Australia and Western Australia.

6.252 Should the proposals proceed, however, it will be necessary for the NSW Government to become involved to ensure the proposals are managed in the best interest of the its residents.

6.253 Both the Department of Environment and Conservation and the NSW Fire Brigades have recommended, as part of the management of the proposals, further assessment of the Federal Government's plans.

6.254 The Committee supports this and has recommended that a group of nominated agencies carry out the assessment. This should include, modes of transport, security of the material and resourcing implications. The assessment should utilise the "checklist" of emergency services issues provided in Sutherland Shire Council's submission.

6.255 The Committee believes strongly that the highest levels of safety and security should prevail when dealing with high level waste (spent fuel). It is also opposed in principle to any proposals to transport high level waste to any new Store.

6.256 On balance the Committee feels that low level waste is not likely to be the target of any terrorist action nor does it see any problem in alerting communities of the transport arrangements. However, this should form part of the risk assessment process.

6.257 However, efforts should be made to identify those waste sources (see Mr McIntosh's evidence above) that might be targeted for a dirty bomb and commensurate security should be provided for this material.

6.258 The DEC has recommended that the Commonwealth request the IAEA's Transport Safety Appraisal Service to carry out an assessment of the safety and security of the proposals. The Committee certainly supports such a "second opinion".

6.259 These various assessment should be able to throw light on some of the issues raised with the Committee but which have not able to be resolved. These would include:

- The extent to which current emergency service arrangements are adequate for the transport of the radioactive waste to South Australia (as claimed by ANSTO);
- The extent to which the existing emergency service arrangements require enhancement;

[521] NSWFBEU Submission No. 438 pp2,3

- The best means to augment safety and security, if needed – for example, by provision of escorts vehicles or upgrading HAZMAT services along the proposed routes;
- Quantifying the costs of all resource implications for the state, including costs for local government bodies;
- Ways to prevent accidents;
- Possible sources for dirty bombs; or
- Methods to monitor or ensure the relevant codes are being implemented in the transport operations.

6.260 All these issues should form part of a negotiation with the Federal Government to obtain a formal agreement before any transportation takes place.

6.261 The Committee agrees with the arguments that the Commonwealth should indemnify the community against accidents from radioactive waste.

RECOMMENDATION 17: Risk assessments should be carried out by New South Wales Agencies (including Police, NSW Fire Brigades, NSW Health, and the Department of Environment and Conservation), in consultation with the Commonwealth for any transport proposals. This assessment should include consideration of the risk of potential terrorist activities.

RECOMMENDATION 18: NSW Agencies including Police, NSW Fire Brigades, NSW Health, and the Department of Environment and Conservation should, in consultation with the Commonwealth, detail and cost the emergency services requirement to best manage the transport proposals.

RECOMMENDATION 19: A formal agreement should be negotiated between the NSW Government and the Federal Government on any proposals to store and transport radioactive waste in New South Wales, based on the above risk assessments. This agreement would include:

- The Commonwealth to arrange an assessment of the transport proposals by the IAEA's Transport Safety Appraisal Service.
  - This assessment should consider all possible modes of transport including sea, depending on the site location being assessed
- Clearly defined roles and responsibilities (clarify jurisdictional uncertainties)
- Tracking of waste material
- Emergency services requirements (resourcing, training, responses)
- Risk minimisation
- Prevention of accidents
- No liquid wastes to be transported
- Community acceptance criteria
- Independent monitoring by NSW to certify that the relevant codes

are adhered to

RECOMMENDATION 20: Any agreement be based on the principle that the Federal Government bear the full costs incurred by the community (including local councils) of any transport and storage proposal.

RECOMMENDATION 5: The Federal Government should accept liability for radioactive waste and indemnify state and local government, and the public against the impacts of any radioactive waste incidents.

RECOMMENDATION 13: The New South Wales Government should formally forward a copy of this report to ARPANSA.

APPENDICIES

APPENDIX ONE– LIST OF SUBMISSIONS

No. 1 – BEENEY Mr A J
No. 2 - CROOK Mr F C
No. 3 - POTTER MIs Aflson
No. 4 - LEAFY Mr .J (Broken Hill City Council)
No. 5 - CHEETHAM Mr David
No. 6 - GORDON Ms R
No. 7 - FLOWERS J
No. 8 - WOOD Mr F
No. 9 - O'CONNOR M/s Margaret
No. 10 - MEDLIN M/s Clare
No. 11 - KELLY HA
No. 12 - KEAY Dr Cohn S
No. 13 - CAIRNES Ms LB
No. 14 - MORANDIN M/s Loretta
No. 15 - NAPPA Mrs Bridget and Mr Joseph
No. 16 - BYRNE CIr Sam
No. 17 - JOHNSON Mrs F
No. 18 - MACOARTHY M/s Ida
No. 19 - HURST Mr Paul
No. 20 - JOHNSON Mr Mark
No. 21 - MCCARTHY Ms Sue
No. 22 - MARSHAL M Beal and Mr Marcus
No. 23 - LLOYD Mr R G
No. 24 - MCLELLAN M/s Margaret
No. 25 - 5088 Mr Micheal
No. 26 - GREEN Mr Gerald
No. 27 - STOBART M/s Martina
No. 28 - WARWICK Mr Greg
No. 29 - LOCKE C
No. 30 - SCHILIN M/s Julie
No. 31 - DURNEY M/s Dons
No. 32 - RAIG Mesdames Lorna Gilmore and Lucy
No. 33 - STAFFORD Mr Simon
No. 34 - HUMBLE Mr Gary
No. 35 -JOHNSON Mr Keith
No. 36 - BOWLER P
No. 37 - MATTHEWS Clr Greg (Dubbo City Council)
No. 38 - MCGREGOR Mr Don
No. 39 - MCGREGOR Mrs Mary
No. 40 - PAVLAKOVIC M/s Nina
No. 41 - O'REILLY M/S Helen
No. 42 - O'KEEFE Mr Scott
No, 43 - HARRIS M/s Beatrice

No. 44 - DIXON Sandy
No. 45 - RICE M/s Heather
No. 46 - TULLOCH Cir Ma! (Holroyd City Council)
No. 47 - SCHLOLTMANN M/s Eva-Maria
No. 48 - WESTCOTT Mr Rob
No. 49 - WALLON-SMITH R
No. 50 - DOUGHERTY Sanny
No. 51 - KOHLHAGEN J
No. 52 - DODDS M/s Sofia
No. 53 -THOMAS Mr Graham
No. 54 - HOGARTH Mr William
No. 55 - HANICH Mr Quentln
No. 56 - PATERSON Maresh
No. 57 - KINGSTON Ms Libby
No. 58 - OCHOA M/s Mara
No. 59 - SHEARING Clr David (Orange City Council)
No. 60 - ROWSE Mr Evan
No. 61 - TURNER M/s Moya
No. 62 - HUBBARD M/s Rebecca
No. 63 - MILLER Mr Nick
No. 64 - KENA K
No. 65 - DIXON Mr Mark
No. 66 - DIXON Mrs Vanessa
No. 67 - BURNAM BURNAM M/s Marelle
No. 68 - HARRISON Mr Max
No. 69 - MARTINS H.
No. 70 - BURNAM BURNAM Umbarra
No. 71 - BONAKEY Mr George
No. 72 - GIRLING M/s Sylvia
No. 73 - GEANEY T
No. 74 - GEANEY P
No. 75 - HEUSTON M/s Sandra
No. 76 - HASSIN M/s Linda
No. 77 - HASSIN Mr Joel
No. 78 - MCRAE M/s Elizabeth
No. 79 - DRAKE Mr Trevor
No. 80 - DUN M/s Shirley
No. 81 - WALLER Ms Wendy (Australian Labor Party – Green Valley Branch)
No. 82 - IVORY M/s Megan
No. 83 - PHILLIP M/s Valeria
No. 84 - FREDMAN Mr Nicholas
No. 85 - WINKLER M/s Josephine
No. 86 - FELY M/s Trlna
No. 87 - BLAKNEY M/s Claire
No. 88 - MURPHY Mr K M (Narrandera Shire Council)
No. 89 - RYBCZYNSKI Pohek
No. 90 - CROSSLEY M/s Anna
No. 91 - SABINE Professor Terence (University of Technology, Sydney)
No. 92 - HARTMAN Ms Carol

No. 93 - HENDERSON M/s Deborah
No. 94 - KENNEDY Mr Danny
No. 95 - WEBB M/s Natasha
No. 96 - WEBSTER M/s Barbara
No. 97 - DOOLEY Mrs Cheryl and Mr Stephen
No. 98 - JOHNSTON P L
No. 99 - JAFIGLIOLA Mr Juan
No. 100 - ELLIOT Mr Tony
No. 101 - O'DONNELL Mr Terry
No. 102 - MCDADE CA
No. 103 - MURCHIE MT
No. 104 - SINGH Ramemdra
No. 105 - LE Mr Nguyen
No. 106 - BUCCI Gabe
No. 107 - DAVIES Mr Paul
No. 108 - CHRISTON J
No. 109 - ROBERTS Mr Daryle
No. 110 - PAEWHENUA Lyn
No. 111 - AHMED Mr Faiz
No. 112 - SHARMA Avi
No. 113 - OMEROS Mr Nicholas
No. 114 - DELLA SANTA M/s Daniela
No. 115 - PIKE Mr Trent
No. 116 - MONTGOMERY A
No. 117 - BROWN Mr Douglas D
No. 118 - DODD Mr Dallas
No. 119 - MUSSARED M/s Cate
No. 120 - GRAHAM M/s Alice
No. 121 - RICONO-GARRETT M/s Doris
No. 122 - MARSH M/s Janet
No. 123 - WEBSTER Mr Larry J
No.124 - ROBERTS C
No. 125 - CRISP MIs Fiona
No. 126 - SHILTON Mr Cameron
No. 127 - CUMMING Mr Paul
No. 128 - DIXON Rainbow
No. 129 - COOK M/s Caroline
No. 130 - WOOLCOCK M/s Buffy
No. 131 - MITCHELL Mr Scott
No. 132 - BURTON-BRADLEY M/s Elodie
No. 133 - MCLEAN M/s Julia
No. 134 - GRAHAM Mr John
No. 135 - AISLROPE M/s Jane
No. 136 - DUNCAN Mr Brice
No. 137 - FIRNS Elwen
No. 138 - SEPHTON M/s Rene
No. 139 - MULRANEY Mr Blake
No. 140 - LINDSAY Mr Malcolm
No. 141 - HEYWOOD M/s Ellen

No. 142 - GUILDNER M/s Deb
No. 143 - FAZALBHOY Faiz
No. 144 - IREDALE MIs Breanna
No. 145 - SCHUDMAK Mr Andrew
No. 146 - THORPE Sayne
No. 147 - MACQUEEN M/s Ashley
No. 148 - MCLEAN Mrs Stephanie
No. 149 - GRAY Lindsay
No. 150 - DOHERTY Mr Denis
No. 151 - TO Ms Emma
No. 152 - LOW Mr Adrian
No. 153 - MILLEN Mr Thomas
No. 154 - RICARDO M/S Erin
No. 155 - DYSON M/s Sarah
No. 156 - HECK Mr Ross
No. 157 - DRYSDALE Mr Martyn
No. 158 - DUFFUS M/s Mija
No. 159 - KENNEDY M/s Emma
No. 160 - KEENE M/s Natalie
No. 161 - MARTINS M/s Kim
No. 162 - BOLL M/s Brigitte
No. 163 - CUTTS Mr Mark~
No. 164 - PEASE Mr Jeremy
No. 165 - COLLETT M/s Gemma
No. 166 - VILA FERNANDES M/s Lucy
No. 167 - YOUNG M/s Elizabeth
No. 168 - SIMPSON M/s Melanie Jade
No. 169 - NORTH Mr Ben
No. 170 - PITT Raku
No. 171 - COMMINS Mr Gareth
No. 172 - MITCHEL Rihella
No. 173 - ISLES M/s Michelle
No. 174 - CARLESS M/s Rebecca
No. 175 - MCLEOD Mr Jason
No. 176 - FINLAYSON M/s Melissa
No. 177 - STAINES M/s Anne
No. 178 - ORFORD Mr Ben,
No. 179 - MURRAY M/s Rachel
No. 180 - GOLT M/s Libby
No. 181 - GREALY M/s Kate
No. 182 - GRAY M/s Lindsay Jane
No. 183 - BRASTED Mr John
No. 184 - FARROW POTTS M/s Amy Jo
No. 185 - KING M/s Elise
No. 186 - ALEESON M/s Rachel
No. 187 - ZEUNEPT Mr Josh
No. 188 - COLLIE MIs Clair
No. 189 - HUMPHRREYS M/s Claire
No. 190 - LONBOY Mr Martin

No. 191 - RUSSELL Mr Remus
No. 192 - GLENN M/s Eleanor
No. 193 - MARTIN Mr Nathan
No. 194 - MCLACHLAN M/s Jessica
No.195 - KILPATRICK PW
No. 196 - PASTALATZIS Mr Nick
No. 197 - BENTLEY Mr Michael
No. 198 - LUCKMAN Kim
No. 199 - ILETT India
No. 200 - O'CONNELL Ms Genevieve
No. 201 - MCGREGOR M A (PANR)
No. 202 - AND REN MP Mr Peter
No. 203 - MARQUEZ-OBEID MIS Marlene
No. 204 - TREZISE Mr Dennis (Holroyd City Council)
No. 205 - MADIGAN M/s Michelle
No. 206 - AMBLER M/s Susan
No. 207 - BUHLER Mr Rene (Australian Buddhist Vihara Institute)
No. 208 - VALE MP The Hon Danna
No. 209 - DOWSON M
No. 210 - MEILSON, Mr Graham & MULLAN, M/s Kerry
No. 211 - HOLLAND Miss Michelle
No. 212 - HOLLAND Dr Ian
No. 213 - HANNA Mr Graeme L
No. 214 - MIRANDA Mrs J
No. 215 - CRANE Ms Mary
No. 216 - TICKNER Mr G A J (Gundagai Shire Council)
No. 217 - BARTLETT MP Mr Kerry
No. 218 - MATTHEWS M/s Michelle
No. 219 - WILLIAMS V M
No. 220 - SHAW Mrs Dawne
No. 221 - BILLEH M/s Georgette
No. 222 - KNOX Mr Peter
No. 223 - TREREE MIs Trisha
No. 224 - TURNER WA
No. 225 - OSECKAS Mr Tim
No. 226 - HALLENAN Mr Jim
No. 227 - RAPTIS Mrs Christine
No. 228 - STONE M
No. 229 - COLLINS Mr Ryan
No. 230 - MIRANDA P
No. 231 - BARNES M/s Anna
No. 232 - MCLAREN M/s Julia
No. 233 - ARMITAGE OAM M/s Barbara (Blackheath Area Neighbourhood Centre Inc)
No. 234 - O'BRIEN M/s Loretta (Friends of the Earth Australia)
No. 235 - GYA Ms Giji (Medical Association for Prevention of War, Australia (MAPW))
No. 236 - IRATI WANTI CAMPAIGN OFFICE (Senior Aboriginal Women's Council)
No. 237 - THOMAS Mr Christopher
No. 238 - LANE M/s Mary-Roby
No. 239 - MECKEL Ms Tina

No. 240 - BUM LER Ms Jane (Smiling Heart Sangha)
No. 241 - DEMPSEY Mr Adam
No. 242 - GLUEK Mrs Maggie
No. 243 - ROBERTSON Mr Ian (Departmental and Environmental Professions' Association)
No. 244 - ZDENKOWSKI Mr George
No. 245 - MISDALE Mr Mathew
No. 246 - POULSON Ms J
No. 247 - DEBUS MP The Hon Bob (Member for the Blue Mountains and Minister for the Environment)
No. 248 - JOHNSON Dr Dianne
No. 249 - BROUGH Mr Jim
No. 250 - FAURE-BRAC Vi (Nirvana School of Yoga)
No. 251 - MARTINS Mr Dave
No. 252 - JENNY M/s Martins
No. 253 - MARTINS Mr Nathan
No. 254 - DIXON Mr Bruce
No. 255 - DIXON M/s Betty
No. 256 - DIXON Mr Norman
No. 257 - HUDSON Mr Lee
No. 258 - LEVICK M/s Dianne
No. 259 - GEANEY Renee and Terrie
No. 260 - MCKAY M/s Marg
No. 261 - HARRISON M/s Cheryl
No. 262 - MCDONALD M/s Joy
No. 263 - RAPTIS M/s Helen
No. 264 - DOWSETT Mr Samuel
No. 265 - LB FEUVRE M/s Juliet
No. 266 - DAVIS M/s Diana
No. 267 - FOLEY M/s Katie
No. 268 - GILBERT M/s Marcia
No. 269 - EDWARDS Mr David
No. 270 - MCHUTCHISON M/s Jill
No. 271 - CAVAGNA MIs Amy
No. 272 - WATTS Corey
No. 273 - VAN DER POEL M/s Annie
No. 274 - SIMPSON M/S Virginia
No. 275 - FOOOIJTY Mr Michael
No. 276 - MOLAN M/s Anna
No.277 - SHANNON M/s Patricia
No. 278 - MORRISON Mr Andrew
No. 279 - BENTLEY Mr Julian
No. 280 - SHERWIN Mr Charlie
No. 281 - AMBROSE M
No. 282 - AFONSO M/s Sara
No. 283 - BELL Mr Kevin (Blue Mountains Conservation Society no)
No. 284 - PARKER Mr Michael B J
No. 285 - HOWARD OA MC ESM Major General B W (New South Wales State Emergency Management Committee)
No. 286 - WILSON OAM Mrs Hazel

No. 287 - CONFIDENTIAL
No. 288 - VLAMITSOUPOULOS Mr John
No. 259 - GYLANY M/s Sara (Member of the Blue Mountains Nuclear Free Zone Group)
No. 290 - TEDDER Mr James L O
No. 291 - CULEN Mr Miok
No. 292 - GILES M/s Emma
No. 293 - CARROLL MIS Leanne
No. 294 - HOPE Mr Jason
No. 295 - KERR M/s Jenny
No. 296 - SLAVNIC Mrs Snezana and Mr Bosko
No. 297 - LA GRECA M/s Lisa
No. 298 - KATSEN Mm
No. 299 - CORN SM M/s Janette Sandra
No. 300 - LANGWORTHY M'?s NIcolle
No. 301 - MILE-ALLAN MIS Nicole
No. 302 - BENT Mr Ian
No. 303 - SMITH Mr Keith
No. 304 - SMITH M/s Loraine
No. 305 - GAIP S
No. 308 - WATERS Mr Ben
No. 307 - SMITH M/s Aleena
No. 308 - EPSTEIN Mr Chris
No. 309 - MAHER M/s Margaret B
No. 310 - MORUSZCZAK Kasia
No. 311 - MILDER M/s Nicole
No. 312 - MAJOR M/s Glinda
No. 313 - COOPER Mr Stuart
No. 314 - CAPM Mr Tim
No.315 - WINTERS Mr Tim
No. 316 - HALL MrToby
No. 317 - 'CONFIDENTIAL'
No. 318 - JOHANSEN Kjartan
No. 319 - HANCOCK Mr Kevin
No. 320 - SMITH Mr Marti
No. 321 - FLYNN Mr Paul
No. 322 - CAMPBELL-BEATY W
No. 323 - JAMIE AND JAMES
No. 324 - OGSTON M/s Helen
No. 325 - KELLY Mrs Lisa
No. 326 - STOKES Mr Don
No. 327 - SPERANZA M/s Laura
No. 328 - VOGT MIS Brooke
No. 329 - NILSSON M/s Claire
No. 330 – FRAIEL Mr J
No. 331 - LORD M/s Christina
No. 332 - MITCHELSON D
No. 333 - TOOTH Ms Ifeanna
No. 334 - GREGG M/s Angela
No. 335 - FOX M/s Anne

No. 336 - ANGEL M/S Laura
No. 337 - NOONAN Mr David (Australian Conservation Foundation)
No. 338 - LONG MIS Anne
No. 339 - SHARMAN A
No. 340 - REPERELLI Sinili
No. 341 - ROCKWELL M/s Jess
No. 342 - HURST M/s Katie
No. 343 - SHADDICK Mr Dale
No. 344 - EDGE G
No. 345 - MARKWICK Mr Jason
No. 346 - MARKWICK M
No. 347 - SHADDICK M/s Alice
No. 348 - THUELFALL Alex
No. 349 - MARTIN Jaye Katha
No. 350 - SMITH Dr Garry (Sutherland Shire Council)
No. 351 - TAYLOR Mr Brenton (Local Government & Shires Associations of NSW)
No. 352 - GARNETT Professor Helen (ANSTO)
No. 353 - BALL Mr Ian (Police Association of NSW)
No. 354 - MCCULLY Mr Garry (Liverpool City Council)
No. 355 - SETTER M
No. 356 - CRAM Mr P S (Edmund Rice Centre)
No. 357 - TIMMERMAN Mr Julias (Association of Concerned Mid-Mountains Residents)
No. 358 - VALLANCE Flavian
No. 359 - HISING MIS Karen
No. 360 - REYNOLDS Mr Ian (Blacktown City Council)
No. 361 - BUTLER Mr George
No. 362 - TIMMERMAN Mr Julias & GROVER M/s Felicity
No. 363 - RNJAK M/s Divna
No. 364 - FIDLER Terry
No. 365 - WILLEMEN Mr B J & Mrs A B
No. 366 - BRINK M/s Georgina
No. 367 - MCGAURAN MP The Hon Peter
No. 368 - RAEBURN Mr Bryan
No. 369 - RNJAK M/s Olga
No. 370 - GRAJEWSKI Mr Paul
No. 371 - PFITZNER J
No. 372 - NUNN M/s Anne
No. 373 - NUNN MIS Ellie
No. 374 - LYDDIETH Mr Jason
No. 375 - SHANTON Cally
No. 376 - MARCOS Mr Jonathan Morris
No.377 - MURRAY Mr Iain
No. 378 - SHORE Mr Adam
No. 379 - RNJAK M/s Mladenka
No. 380 - VAN OPDORP M/s Suzanne
No. 381 - SMITH M/s Elaine
No. 382 - HUDSON M/s Tracey
No. 383 - DECKER Mr Ian
No. 384 - TOMCZAK M/s Christine

No. 385 - TIEV Mr Robert
No. 386 - JONES M/s Vanessa
No. 387 - BANKS Mr Tim
No. 388 - JONES Mr A
No. 389 - EGAN M/s Lynette
No. 390 - WILLIAMS Mr Richard
No. 391 - KENDAL D M
No. 392 - CHANNING M/s Geraldine
No. 393 - LEWIS K
No. 394 - NICHOLLS Mr Matthew P
No. 395 - WIGGIN Mr John C (Australian Conservation Foundation- Central Coast Branch)
No. 396 - CARR J
No. 397 - PAYNE M/s Janet
No. 398 - MILLER M/s Sandra
No. 399 - MACKINNON M/s Sue
No. 400 - JUSUP Mr Neville
No. 401 - AUK Ozlem
No. 402 - PRESTON MIs Carol
No. 403 - BRYANT MIs Margaret
No. 404 - VINCENT M/s Eve
No. 405 - OCONNOR M/s Natalie
No. 406 - BERESFORD M/s Anny
No. 407 - DANAUN Ms Luon
No. 408 - ROBERTS Mr Drew
No. 409 - SAVERNINE MIS Samantha
No. 410 - LAND M/s Ciare
No. 411 - HAMILTON MIs Joan
No. 412 - MIRANDA M/s Claudia
No. 413 - KEMP Mr Chris
No. 414 - LALICH Clr Nick (Fairfield City Council)
No. 415 - MARTYN M/s Alison
No. 416 - CROZIER B
No. 417 - WATERFORD Mesdames Dianne Jacobus & Mary (Blue Mountains Community Interagency)
No. 418 - BULL Mr Greg (Mountains Community Resource Network Inc.)
No. 419 - CAINES Mr Anthony
No. 420 - DWYER M/s Catherine
No. 421 - WALCH Mr Geoff
No. 422 - HENRY Mr James
No. 423 - THORNLEY M/s Jan
No. 424 - SMITH F J
No. 425 - WHITE Mr Colin
No. 426 - VORON OFF Mr Daniel
No.427 - PEPPER B
No. 428 - WINSTON G
No. 429 - GUERIN Mr Donovan
No. 430 - WINSTON J A
No. 431 - CROFTS M/s Joan

No. 432 - JACOBUS Ms Leslie Sammon & Dianne (Blue Mountains Nuclear Free Zone Group)
No.433 - EGAN W
No. 434 - PRICEMAN Mr Michael (Sutherland Shire Environment Centre)
No. 435 - GIBBS M/s Melissa (SSROC)
No. 436 - MASON Mr David
No. 437 - CRAFOORD M/s Pam (Working Together Better' Community Network)
No. 438 - MANIATIS Mr George (NSW Fire Brigade Employees Union (FEEU))
No. 439 - COURTNEY Mr James (Greenpeace)
No. 440 - ROWELL Mr Simon
No. 441 - PTOLEMY Mr Mark
No. 442 - TSOULOS M/S Jeannette
No. 443 - SAMMON Lesley
No. 444 - MARTINI Mr Tony (Blue Mountains City Council)
No. 445 - KOBAS Mr Con
No. 446 - SIMM K
No. 447 - PUCELLA Mr Jose
No. 448 - MCDONALD M/s Maria
No. 449 - MCDONALD Mr David
No. 450 - MCDONALD M/s Anna
No. 451 - MCDONALD M/s Alison
No. 452 - ILLER Mr Eric
No. 453 - STREET M/s Tiffany
No. 454 - WILSON M/s Elizabeth
No. 455 - MCFEAT F Azuhie & G
No. 456 - LOY Mr John (ARPANSA)
No. 457 - CLAYBOURN M/s Jane
No. 458 - GRAVISON Mr Brian (Katoomba Neighbourhood Centre)
No. 459 - SECKOLD M/s Lisa
No. 460 - PSALTIS Mana
No. 461 - GRINGINGER Mr Peter
No. 462 - PICCOLI MP Mr Adrian (Member for Murrumbidgee)
No. 463 - HUBBARD G & S
No. 464 - LEVY M/s Sarah
No. 465 - DIXON MIs Lorraine
No. 466 - ALLARD Mr Peter
No. 467 - MCCARTHY MIs Catherine
No. 468 - BRADFORD Mrs M
No. 469 - CLYDE Nic
No. 470 - MCDONELL Clr Ken (Clr from Sutherland Shire Council)
No. 471 - ROZ Mr Simon
No. 472 - HODGSON N
No. 473 - BARNETT RSJ Sr Jan (Sisters of St Joseph)
No. 474 - CORBYN M/s Carolyn Lisa (Environmental Protection Authority)
No. 475 - HEWETT Mr & Mrs F
No. 476 - SCULLY MP The Hon Carl
No. 477 - THOMPSON Mr Jeff (Manager Strategic Environmental Planning)
No. 478 - MENDOZA Mr Leonard & Mrs Maureen
No. 479 - CLARKE M/s Wendy

No. 480 - TULLOCK M/s K
No. 481 - EARNSHAW Mr Cohn (The Council of the City of Wagga Wagga)
No. 482 - KILPATRICK Mr Karl Arthur
No. 483 - VIEIRA JUNGSTEDT Mr Vicente
No. 484 - BOWMAN Ms A
No. 455 - SCHOLTEN Mr Robert
No. 456 - DONALD Mr F L (Began Shire Council)
No. 487 - LEMOINE Mrs P D
No. 488 - LEBOS Mr Jorge A
No. 489 - NEVILLE Mr M G (Griffith City Council)
No. 490 - OVIEDO Mr Warri
No. 491 - TREGORING Ms Kim
No. 492 - LLOYD Mr Jim (Reid Federal Electorate Council)
No. 493 - MOWLE Mr Robert (Mulwaree Shire Council)
No. 494 - KAMINSKI Mr Glenn
No. 495 - LAMBERT Clr Les (Narromine Shire Council)
No. 496 - NICHOLLS Mr Luke (Western Sydney Regional Organisatlon of Councils (WSROC))
No. 497 - MCCORMACK Mr Alan (Central West Regional Organisation of Councils (CENTROC))
No. 498 - lEMMA MP The Hon Morris (Minister for Health)
No. 499 - GREEN Mr Kevin
No. 500 - MCLEAN M/s Lyn

APPENDIX TWO – LIST OF WITNESSES AT PUBLIC HEARINGS

Thursday 11 September 2003

Clr Kenneth James McDonnell, Councillor, Sutherland Shire Council
Dr Garry John Smith, Principal Environmental Scientist, Sutherland Shire Council
Clr Genevieve Rankin, Councillor, Sutherland Shire Council
Clr Phillip Blight, Mayor, Sutherland Shire Council
Mr James Nolan, Legal Adviser to the Sutherland Shire Council

Mr Lubi Dimitrovski, Manager, Waste Operations, Australian Nuclear Science and Technology Organisation
Mr Steven McIntosh, Acting Director, Government and Public Affairs, Australian Nuclear Science and Technology Organisation
Dr John Harries, Acting Director, Environment, Australian Nuclear Science and Technology Organisation

Mr Michael Priceman, Convenor, Nuclear Study Group, Sutherland Shire Environment Centre

Ms Melissa Gibbs, Executive Director, Southern Sydney Regional Organisation of Councils

Mr Simon Smith, Executive Director, Policy, Economics and Environmental Reporting, NSW Environment Protection Authority

Friday 19 September 2003

Mr James Courtney, Nuclear Campaigner, Greenpeace. Mr Courtney tabled five documents (Doc. Nos. 1-5).

Maj Gen Brian William Howard, Chairman, State Emergency Management Committee
Mr Jim Hamilton, Chief Superintendent, NSW Fire Brigades

Clr Alan Pendleton, Mayor, Blacktown City Council
Clr Nick Lalich, Mayor, Fairfield City Council
Clr Malcolm Tulloch, Mayor, Holroyd City Council
The witnesses tabled one document each (Doc. Nos. 6-8).

Clr Cecilia Anthony, Liverpool City Council
Ms Liz Jeremy, Manager, Natural Environment, Liverpool City Council

Dr Bill Williams, Vice-President, Medical Association for Prevention of War

Mr David Noonan, Campaign Officer, Australian Conservation Foundation. Mr Noonan tabled one document (Doc. No. 9)

Mr Greg Black, Assistant Secretary, Police Association of NSW and Mr Bob Morgan, Organiser, Police Association of NSW. Mr Black tabled one document (Doc. No. 10)

Dr Ian Holland, Curtin resident

Ms Alison Megarrity, MP, Member for Menai

Friday 26 September 2003

Mr Frank Garofalow, Manager, Environmental Management, Blue Mountains City Council

The Hon. Bob Debus, MP, Member for the Blue Mountains, and Minister for the Environment NSW

Dr John Loy, Chief Executive Officer, Australian Radiation Protection and Nuclear Safety Agency (ARPANSA

Mr Darryl Snow, President, Fire Brigade Employees Union

Ms Jeanette Carroll, Member, Blue Mountains Nuclear Free Zone Group
Ms Dianne Jacobus, Member, Blue Mountains Nuclear Free Zone Group
Mr Mark Lutherborrow, Member, Blue Mountains Nuclear Free Zone Group

Mrs Barbara Armitage, Management Committee Member, Blackheath Area Neighbourhood Centre
Ms Pamela Crafoord, Representative, Working Together Better
Mr Brian Gravison, Chairperson, Katoomba Neighbourhood Centre
Ms Mary Waterford, Mountains Community Resource Network

Mr James Angel, Mayor, Blue Mountains City Council

Tuesday 7 October 2003

Mr Peter Oldsen, Manager, Environmental Services, Broken Hill City Council. Mr Oldsen tabled one document (Doc. No. 1)
Clr Francis McKinnon, Councillor, Broken Hill City Council
Clr Gregory Matthews, Mayor, Dubbo City Council
Mr Steven Sykes, Director, Enterprise Services, Orange City Council

Mr Craig Wood, Broken Hill
Ms. Barbara Webster, Broken Hill

Clr Leslie Lambert, Deputy Mayor, Narromine Shire Council

Dr Jim Green, Friends of the Earth

Dr Caroline Perkins, Director, Radioactive Waste Management, Commonwealth Department of Education, Science and Training
Dr Keith Lokan, Scientific Adviser, National Repository Project, Commonwealth Department of Education, Science and Training

Wednesday 22 October 2003

Clr Phyllis Miller, President, Shires Association of NSW
Clr Sara Murray, President, Local Government Association of NSW
Mr Robert Verhey, Strategy Manager – Environment, Local Government and Shires Association of NSW

Prof. Barry Allen, Yowie Bay resident

Dr Colin Keay, Retired Associate Professor of Physics
Mr Graeme Hanna, former employee of the Australian Nuclear Science and Technology Organisation

Mr Graeme Tickner, General Manager, Gundagai Shire Council
Mr Leon Patterson, Manager, Shire Engineering

Dr Garry Smith, Principal Environmental Scientist, Sutherland Shire Council
Clr Genevieve Rankin, Councillor, Sutherland Shire Council
Dr John Harries, Acting Director – Environment, Australian Nuclear Science and Technology Organisation
Mr Steven McIntosh, Government Liaison Officer, Australian Nuclear Science and Technology Organisation

APPENDIX THREE – MINUTES OF COMMITTEE PROCEEDINGS

PARLIAMENT OF NEW SOUTH WALES
JOINT SELECT COMMITTEE INTO THE TRANSPORTATION AND STORAGE OF NUCLEAR WASTE

Minutes of Proceedings of the Joint Select Committee into the Transportation and Storage of Nuclear Waste

Meeting No. 1

Thursday 29 May 2003 at 1.00 pm

Parliament House

Members Present

Mr Brown, Mr Cohen, Ms Judge, Mr McGrane, Mr Primrose and Mr Slack-Smith.

Apology

An apology was received from Mr Lynn.

The Clerk of the Legislative Assembly opened the first meeting of the committee and read the following extracts from the Votes and Proceedings of the Legislative Assembly—

Thursday 8 May 2003, entry 17 (12) —

"Joint Select Committee into the Transportation and Storage of Nuclear Waste

(1) That a joint select committee be appointed to consider and report upon proposals by the Commonwealth Government to transport nuclear waste through and potentially store nuclear waste within New South Wales, with specific reference to the following matters:

(a) logistical arrangements associated with the proposals, including sourcing, transport and storage of waste;

(b) health and safety risks associated with the transportation and storage of nuclear waste in New South Wales;

(c) extent of possible resource implications associated with the transportation and storage of nuclear waste within New South Wales; and

(d) any other relevant matter.

(2) That the committee consist of seven members, as follows:

(a) three from the Government, being two members of the Legislative Assembly and one a member of the Legislative Council; and

(b) two from the Opposition, being one a member of the Legislative Assembly and one a member of the Legislative Council; and

(c) two Independent or cross-bench members, being one a member of the Legislative Assembly and one a member of the Legislative Council.

(3) That the members be nominated in writing to the Clerk of the Legislative Assembly and Clerk of the Legislative Council by the relevant party leaders and the Independent and cross-bench members respectively by 28 May 2003. In the absence of any agreement concerning Legislative Council representation on the committee the matter is to be determined by that House.

(4) That at any meeting of the committee four members shall constitute a quorum provided that the committee meets as a joint committee at all times.

(5) That the committee have leave to sit during the sittings or any adjournment of either or both Houses; to adjourn from place to place; to make visits of inspection within New South Wales and have power to take evidence and send for persons, papers, records and things, and to report from time to time.

(6) (a) That should either House stand adjourned and the committee agree to any report before the House resumes sitting, the committee have leave to send any such report, minutes of proceedings and evidence taken before it to the Clerk of each House.

(b) A report presented to the Clerks is:

(i) on presentation, and for all purposes, deemed to have been laid before the House,
(ii) to be printed by authority of the Clerk,
(iii) for all purposes, deemed to be a document published by order or under the authority of the House, and
(iv) to be recorded in the official proceedings of the House.

(7) That the committee report by 5 December 2003."

Tuesday 27 May 2003 entry 13—

"Joint Select Committee into the Transportation and Storage of Nuclear Waste Mr Mills, Acting Speaker reported, the following message from the Legislative Council:

MR SPEAKER

The Legislative Council desires to inform the Legislative Assembly that it has this day agreed to the following resolution:

That this House agrees to the resolution in the Legislative Assembly's Message of Thursday 8 May 2003 relating to the appointment of a Joint Select Committee into the Transportation and Storage of Nuclear Waste.

That the time and place of the first meeting of the Committee be at 1.00 pm on Thursday 29 May 2003 in the Waratah Room.

The Legislative Council also desires to inform the Legislative Assembly that the following Members have been appointed to serve as Members of the Legislative Council on the Committee:

Mr Cohen

Mr Lynn

Mr Primrose

Legislative Council MEREDITH BURGMANN
22 May 2003 President"

Election of Chairman

Resolved, on the motion of Mr Brown, seconded by Ms Judge:

"That Mr Primrose be elected Chairman of the Committee".

Mr Primrose made his acknowledgment to the committee.

Election of Vice-Chairman

Resolved, on the motion of Ms Judge, seconded by Mr Primrose:

"That Mr Brown be elected Vice-Chairman of the Committee".

Mr Brown made his acknowledgment to the committee.

Procedural Motions

Resolved, on motion (in globo) of Mr Brown, seconded by Mr Slack-Smith:

(a) That arrangements for the calling of witnesses and visits of inspection be left in the hands of the Chairman and the Committee Manager to the Committee.

(b) That, unless otherwise ordered, parties appearing before the Committee shall not be represented by any member of the legal profession.

(c) That, unless otherwise ordered, when the Committee is examining witnesses, the press and public (including witnesses after examination) be admitted to the sitting of the Committee.

(d) That persons having special knowledge of the matters under consideration by the Committee may be invited to assist the Committee.

(e) That press statements on behalf of the Committee be made only by the Chairman after approval in principle by the Committee or after consultation with Committee members.

(f) That, unless otherwise ordered, access to transcripts of evidence taken by the Committee be determined by the Chairman and not otherwise made available to any person, body or organisation: provided that witnesses previously examined shall be given a copy of their evidence; and that any evidence taken in camera or treated as confidential shall be checked by the witness in the presence of the Committee Manager to the Committee or another officer of the Committee.

(g) That the Chairman and the Committee Manager to the Committee be empowered to negotiate with the Speaker through the Clerk of the Legislative Assembly for the provision of funds to meet expenses in connection with advertising, operating and approved incidental expenses of the Committee.

(h) That the Chairman be empowered to advertise and/or write to interested parties requesting written submissions.

(i) That upon the calling of a division or quorum in the House during a meeting of the Committee, the proceedings of the Committee shall be suspended until the Committee again has a quorum.

(j) That the Chairman and the Committee Manager make arrangements for visits of inspection by the committee as a whole and that individual members wishing to depart from these arrangements be required to make their own arrangements.

(k) That pursuant to Standing Order 338, evidence, submissions or other documents presented to the committee which have not been reported to the House not be disclosed or published by any Member of the Committee or by any other person.

General Business

a. The Chairman advised the committee he would arrange the net meeting for a day and time after the secretariat had been allocated. In the meantime the Chairman asked committee members to identify possible witnesses and site visits and to think about a possible timetable for the inquiry.

b. Resolved, on motion of Mr Brown, seconded by Ms Judge:

"1.That the terms of reference of the committee be advertised with a call for submissions; and,

2. That the advertisement be placed beyond the *The Sydney Morning Herald* and *The Daily Telegraph.*"

The committee adjourned at 1.20 pm until a day and time to be fixed.

Chairman

Clerk-Assistant (Committees)

PARLIAMENT OF NEW SOUTH WALES
JOINT SELECT COMMITTEE INTO THE TRANSPORTATION AND STORAGE OF NUCLEAR WASTE

Minutes of Proceedings of the Joint Select Committee into the Transportation and Storage of Nuclear Waste

Meeting No. 2

Thursday, 26 June 2003 at 1:00 pm
Waratah Room, Parliament House

1. Members Present

Mr Brown, Mr Cohen, Ms Judge, Mr Lynn, Mr McGrane, Mr. Primrose and Mr. Slack-Smith

2. Confirmation of Minutes of Previous Meeting

Resolved, on the motion of Ms. Judge, seconded by Mr Slack-Smith, that the minutes of the previous meeting (Meeting No.1, 29 May 2003) be confirmed without amendment.

3. Committee Secretariat

The Chair advised that a Secretariat had now been allocated to the Committee and introduced staff to the Committee.

4. Identification of Interested Parties

Resolved, on the motion of Ms. Judge, seconded by Mr Lynn, that the Committee write to that those organisations listed in the document tabled by Mr Cohen, those identified by Ms Judge (TEC, affected regional local council organisations, and bushcare groups) and any others identified by the Chair and Secretariat to invite them to make a submission.

Members could contact the Secretariat directly with any other suggestions.

5 Lucas Heights Site Visit

The Chair advised the Committee of correspondence he had received from the Mayor of Sutherland Shire Council Members requesting the Committee consider inspecting the ANSTO site at Lucas Heights along with representatives of the local community in attendance.

The Committee discussed the proposal and

Resolved, on the motion of Ms. Judge, seconded by Mr Slack-Smith, that the Committee write to ANSTO requesting an inspection of the ANSTO site (to gain an understanding of the overall operation but with a specific focus on the management of the nuclear waste), that the Committee would not be accompanied by community representatives and that the Sutherland community would have the opportunity to brief the Committee at another time. In writing to ANSTO it was to be asked if there were any other nuclear waste sites in New South Wales.

The Committee agreed that July 15 would be a suitable date for the inspection.

6. Regional/Metropolitan Advertising

The Committee considered options for further advertising and

Resolved, on the motion of Mr Lynn seconded by Mr Brown that the inquiry be advertised in newspapers identified by the secretariat.

The Secretariat advised that as a matter of procedure the implementation of this resolution would be subject to Speaker's approval.

7. Inquiry Timetable and Public Hearing Details

The Committee discussed possible timeframes for the inquiry. It was agreed that hearings should take place in Sutherland and other regional centres. Mr Cohen suggested Katoomba and Dubbo. There was general agreement on holding hearings in Dubbo. Mr Slack-Smith raised the issue of hearings along the secondary transport route.

Resolved, on the motion of Ms Judge seconded by Mr Lynn that, as the source of submissions would provide a good indication of the levels of regional interest, the final selection of locations for hearings be determined after submissions closed and that Committee funds be expended as necessary for the reasonable costs of travel for identified witnesses to attend hearings.

The Committee agreed to the timeframes tabled noting that they were always somewhat fluid. Mr Cohen advised of his preference for hearings to be held as close as possible to each other. The Committee agreed that staff would identify possible dates after consulting Members' diaries.

8. Next Meeting

To be advised.

Meeting adjourned at 1:35 pm.

Peter Primrose MLC
Chairman

Ian Thackeray
Committee Manager

PARLIAMENT OF NEW SOUTH WALES
JOINT SELECT COMMITTEE INTO THE TRANSPORTATION AND STORAGE OF NUCLEAR WASTE

Minutes of Proceedings of the Joint Select Committee into the Transportation and Storage of Nuclear Waste

Meeting No. 3

Tuesday, 14 July 2003 at 10:00am
ANSTO Facility, Lucas Heights

1. Members Present

Mr Cohen, Ms Judge, Mr Lynn, Mr. Primrose and Mr. Slack-Smith

2 Lucas Heights Site Visit

The Committee met with the Executive Director of ANSTO, Professor Garnett, and other members of staff. Material was distributed. Members were briefed on operations of the site, particularly as they related to storage and transport of waste. Discussion ensued.

The Committee then inspected various parts of the operation including the Hot Cells, despatch areas for isotopes and the low level storage. Members also observed the construction of the new reactor.

3. Next Meeting

Thursday 14 August, 10.00 am

Meeting adjourned at 1:15 pm.

Peter Primrose MLC
Chair

Ian Thackeray
Committee Manager

PARLIAMENT OF NEW SOUTH WALES
JOINT SELECT COMMITTEE INTO THE TRANSPORTATION AND STORAGE OF NUCLEAR WASTE

Minutes of Proceedings of the Joint Select Committee into the Transportation and Storage of Nuclear Waste

Meeting No. 4

Thursday, 11 September 2003 at 9:30am
Council Chambers, Sutherland Shire Council

1. Members Present

Mr Brown, Mr Cohen, Mr Lynn, Mr McGrane and Mr. Primrose

2. Apologies

Ms Judge, Mr Slack-Smith

3. Public Hearings – Inquiry into the Transportation and Storage of Nuclear Waste

The public was admitted.

Cr Kenneth James McDonnell, Councillor, Sutherland Shire Council, and Dr Garry John Smith, Principal Environmental Scientist, Sutherland Shire Council, sworn and examined. Evidence concluded, the witnesses withdrew.

Cr Genevieve Rankin, Councillor, Sutherland Shire Council; Cr Phillip Blight, Mayor, Sutherland Shire Council; and Mr James Nolan, Legal Adviser to the Sutherland Shire Council, affirmed and examined. Evidence concluded, the witnesses withdrew.

Mr Lubi Dimitrovski, Manager, Waste Operations, Australian Nuclear Science and Technology Organisation, sworn and examined. Evidence concluded, the witness withdrew.

Mr Steven McIntosh, Acting Director, Government and Public Affairs, Australian Nuclear Science and Technology Organisation; and Dr John Harries, Acting Director, Environment, Australian Nuclear Science and Technology Organisation, affirmed and examined. Evidence concluded, the witnesses withdrew.

Mr Michael Priceman, Convenor, Nuclear Study Group, Sutherland Shire Environment Centre, affirmed and examined. Evidence concluded, the witness withdrew.

Ms Melissa Gibbs, Executive Director, Southern Sydney Regional Organisation of Councils, affirmed and examined. Evidence concluded, the witness withdrew.

Mr Simon Smith, Executive Director, Policy, Economics and Environmental Reporting, NSW Environment Protection Authority, affirmed and examined. Evidence concluded, the witness withdrew.

4. Submissions – Inquiry into the Transportation and Storage of Nuclear Waste

The Committee RESOLVED on the motion of Mr Cohen, seconded Mr Lynn, that the submissions received by 11 September which are deemed not to be confidential be made public.

Meeting adjourned at 4:00 pm.

5. Next Meeting

Friday 19 September at a time to be advised.

Peter Primrose MLC
Chairman

Ian Thackeray
Committee Manager

PARLIAMENT OF NEW SOUTH WALES
JOINT SELECT COMMITTEE INTO THE TRANSPORTATION AND STORAGE OF NUCLEAR WASTE

Minutes of Proceedings of the Joint Select Committee into the Transportation and Storage of Nuclear Waste

Meeting No. 5

Friday, 19 September 2003 at 9:30am
Jubilee Room, Parliament House

1. Members Present

Mr Brown, Mr Cohen, Ms Judge, Mr Lynn, Mr McGrane, Mr. Primrose and Mr Slack-Smith

2. Public Hearings – Inquiry into the Transportation and Storage of Nuclear Waste

The public was admitted.

Mr James Courtney, Nuclear Campaigner, Greenpeace, sworn and examined. Evidence concluded, the witness withdrew. The witness tabled five documents (Doc. Nos. 1-5).

Maj Gen Brian William Howard, Chairman, State Emergency Management Committee, and Mr Jim Hamilton, Chief Superintendent, NSW Fire Brigades, sworn and examined. Evidence concluded, the witnesses withdrew.

Cr Alan Pendleton, Mayor, Blacktown City Council; Cr Nick Lalich, Mayor, Fairfield City Council; and Cr Malcolm Tulloch, Mayor, Holroyd City Council, sworn and examined. Evidence concluded, the witness withdrew. The witnesses tabled one document each (Doc. Nos. 6-8). Cr Cecilia Anthony, Liverpool City Council and Ms Liz Jeremy, Manager, Natural Environment, Liverpool City Council, affirmed and examined. Evidence concluded, the witnesses withdrew.

Dr Bill Williams, Vice-President, Medical Association for Prevention of War, affirmed and examined. Evidence concluded, the witness withdrew.

Mr David Noonan, Campaign Officer, Australian Conservation Foundation, affirmed and examined. Evidence concluded, the witness withdrew. The witness tabled one document (Doc. No. 9).

Mr Greg Black, Assistant Secretary, Police Association of NSW and Mr Bob Morgan, Organiser, Police Association of NSW, sworn and examined. Evidence concluded, the witnesses withdrew. The witnesses tabled one document (Doc. No. 10).

Dr Ian Holland, Curtin ACT, affirmed and examined. Evidence concluded, the witness withdrew.

Ms Alison Megarrity, MP, Member for Menai, affirmed and examined. Evidence concluded, the witness withdrew.

Meeting adjourned at 4:00 pm.

3. Next Meeting

Friday 26 September at a time to be advised.

Peter Primrose MLC	Ian Thackeray
Chairman	Committee Manager

PARLIAMENT OF NEW SOUTH WALES
JOINT SELECT COMMITTEE INTO THE TRANSPORTATION AND STORAGE OF NUCLEAR WASTE

Minutes of Proceedings of the Joint Select Committee into the Transportation and Storage of Nuclear Waste

Meeting No. 6

Friday, 26 September 2003 at 10:00am
Blue Mountains City Council, Katoomba NSW

1. Members Present

Mr Cohen, Ms Judge, Mr McGrane, and Mr. Primrose

2. Public Hearings – Inquiry into the Transportation and Storage of Nuclear Waste

The public was admitted.

Mr Frank Garofalow, Manager, Environmental Management, Blue Mountains City Council, sworn and examined. Evidence concluded, the witness withdrew.

The Hon. Bob Debus, MP, Member for the Blue Mountains, and Minister for the Environment NSW, sworn and examined. Evidence concluded, the witness withdrew.

Dr John Loy, Chief Executive Officer, Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), affirmed and examined. Evidence concluded, the witness withdrew.

Mr Darryl Snow, President, Fire Bridage Employees Union, affirmed and examined. Evidence concluded, the witness withdrew.

Ms Jeanette Carroll, Member, Blue Mountains Nuclear Free Zone Group; Ms Dianne Jacobus, Member, Blue Mountains Nuclear Free Zone Group; and Mr Mark Lutherborrow, Member, Blue Mountains Nuclear Free Zone Group, affirmed and examined. Evidence concluded, the witnesses withdrew.

Mrs Barbara Armitage, Management Committee Member, Blackheath Area Neighbourhood Centre; Ms Pamela Crafoord, Representative, Working Together Better; Mr Brian Gravison, Chairperson, Katoomba Neighbourhood Centre; and Ms Mary Waterford, Mountains Community Resource Network, affirmed and examined. Evidence concluded, the witnesses withdrew.

Mr James Angel, Mayor, Blue Mountains City Council, affirmed and examined. Evidence concluded, the witness withdrew.

Meeting adjourned at 3:10 pm.

3. Next Meeting

Tuesday 7 October 2003 at a time to be advised.

Peter Primrose MLC
Chairman

Ian Thackeray
Committee Manager

PARLIAMENT OF NEW SOUTH WALES
JOINT SELECT COMMITTEE INTO THE TRANSPORTATION AND STORAGE OF NUCLEAR WASTE

Minutes of Proceedings of the Joint Select Committee into the Transportation and Storage of Nuclear Waste

Meeting No. 7

Tuesday, 7 October 2003 at 11:45am
Dubbo Civic Centre, Dubbo NSW

1. Members Present

Mr Brown, Mr Cohen, Ms Judge, Mr Lynn, Mr McGrane, Mr Primrose and Mr Slack-Smith

2. Public Hearings – Inquiry into the Transportation and Storage of Nuclear Waste

The public was admitted.

Mr Peter Oldsen, Manager, Environmental Services, Broken Hill City Council; Mr Francis McKinnon, Councillor, Broken Hill City Council; Mr Gregory Matthews, Mayor, Dubbo City Council, sworn and examined. Mr Steven Sykes, Director, Enterprise Services, affirmed and examined. Evidence concluded, the witnesses withdrew. Mr Oldsen tabled one document (Doc. No. 1).

Mr Craig Wood, Broken Hill resident, and Ms. Barbara Webster, Broken Hill resident, affirmed and examined. Evidence concluded, the witnesses withdrew.

Mr Leslie Lambert, Deputy Mayor, Narromine Shire Council, sworn and examined. Evidence concluded, the witness withdrew.

Dr Jim Green, Friends of the Earth, affirmed and examined. Evidence concluded, the witness withdrew.

Dr Caroline Perkins, Director, Radioactive Waste Management, Commonwealth Department of Education, Science and Training, and Dr Keith Lokan, Scientific Adviser, National Repository Project, Commonwealth Department of Education, Science and Training, affirmed and examined. Evidence concluded, the witnesses withdrew.

Meeting adjourned at 4:20 pm.

3. Next Meeting

Wednesday 22 October at a time to be advised.

Peter Primrose MLC Chairman	Ian Thackeray Committee Manager

PARLIAMENT OF NEW SOUTH WALES
JOINT SELECT COMMITTEE INTO THE TRANSPORTATION AND STORAGE OF NUCLEAR WASTE

Minutes of Proceedings of the Joint Select Committee into the Transportation and Storage of Nuclear Waste

Meeting No. 8

Wednesday, 22 October 2003 at 10:00am
Jubilee Room, Parliament House

1. Members Present

Mr Brown, Mr Cohen, Ms Judge, Mr Lynn, Mr McGrane, Mr Primrose and Mr Slack-Smith

2. Public Hearings – Inquiry into the Transportation and Storage of Nuclear Waste

The public was admitted.

Cr Sara Murray, President, Local Government Association of NSW, sworn and examined. Mr Robert Verhey, Strategy Manager – Environment, Local Government and Shires Association of NSW, and Cr Phyllis Miller, President, Shires Association of NSW, affirmed and examined. Evidence concluded, the witnesses withdrew.

Prof. Barry Allen, Yowie Bay resident, sworn and examined. Evidence concluded, the witness withdrew.

Dr Colin Keay, Retired Associate Professor of Physics, and Mr Graeme Hanna, former employee o the Australian Nuclear Science and Technology Organisation, affirmed and examined. Evidence concluded, the witnesses withdrew.

Mr Graeme Tickner, General Manager, Gundagai Shire Council, and Mr Leon Patterson, Manager, Shire Engineering, sworn and examined. Evidence concluded, the witnesses withdrew.

Dr Garry Smith, Principal Environmental Scientist, Sutherland Shire Council, on former oath, examined. Cr Genevieve Rankin, Councillor, Sutherland Shire Council; Dr John Harries, Acting Director – Environment, Australian Nuclear Science and Technology Organisation; and Mr Steven McIntosh, Government Liaison Officer, Australian Nuclear Science and Technology Organisation, on former affirmation, examined. Evidence concluded, the witnesses withdrew.

3. Next Meeting

To be advised. Meeting adjourned at 3:34 pm.

Peter Primrose MLC
Chairman

Ian Thackeray
Committee Manager

PARLIAMENT OF NEW SOUTH WALES
JOINT SELECT COMMITTEE INTO THE TRANSPORTATION AND STORAGE OF NUCLEAR WASTE

Minutes of Proceedings of the Joint Select Committee into the Transportation and Storage of Nuclear Waste

Meeting No. 9

Friday, 14 November 2003 at 10:00am
Meeting Room 1043, Parliament House

1. Members Present

Mr Brown, Ms Judge, Mr McGrane, Mr. Primrose and Mr. Slack-Smith

2. Apologies

Mr Cohen, Mr Lynn

3. Confirmation of Minutes of Previous Meeting

Resolved, on the motion of Ms Judge, seconded by Mr Brown, that the minutes of the previous meetings (Meetings No.2 to No. 8) be confirmed without amendment.

3. Correspondence

Resolved, on the motion of Mr Brown, seconded by Mr Slack-Smith, that correspondence be noted.

4. Report Tabling Date

The Committee discussed the proposal, identifying a number of reasons in favour of it.

Resolved, on the motion of Mr Brown, seconded by Ms Judge, that the tabling date be extended to Tuesday 17 February and that the Chair write to the Leader of the House (Legislative Assembly) to obtain the necessary approval from the Parliament.

5 Bulletin Article

The Chair advised the Committee that the Bulletin Article on Lucas Heights had been circulated for its information.

6. Report

The Chair and the Committee Manager briefed the Committee on the outline and key questions. The Chair advised the Committee that he did not see the report as finding some technical solution to radioactive waste, rather it would be the findings of non-experts.

The Chair invited all Members to provide information and ideas directly to the Committee Manager for consideration in the drafting of the report.

10. Future Meeting Dates

In the light of the change to the reporting date, the Chair advised that the current schedule of meetings would be reviewed and that the Secretariat would circulate calendars to identify future meeting dates for the consideration of the Report.

Meeting adjourned at 10.15 am.

Peter Primrose MLC	Ian Thackeray
Chairman	Committee Manager

PARLIAMENT OF NEW SOUTH WALES
JOINT SELECT COMMITTEE INTO THE TRANSPORTATION AND STORAGE OF NUCLEAR WASTE

DRAFT Minutes of Proceedings of the Joint Select Committee into the Transportation and Storage of Nuclear Waste

Meeting No. 10

Tuesday, 10 February 2004 at 10:30am
Meeting Room 1153, Parliament House

1. Members Present

Mr Brown, Mr Cohen, Ms Judge, Mr McGrane, Mr. Primrose and Mr. Slack-Smith

2. Apologies

Mr Lynn

3. Confirmation of Minutes of Previous Meeting

Resolved, on the motion of Mr Slack-Smith, seconded by Mr Brown, that the minutes of the previous meeting (Meeting No.9) be confirmed without amendment.

4. Consideration of Draft Report

The Committee discussed the recommendations and executive summary and agreed to a number of amendments.

Resolved, on the motion of Mr Brown, seconded by Mr McGrane, THAT the recommendations as amended be part of the committee's final report.

The Committee that the suggested amendments be incorporated into the executive summary by the secretariat and they be discussed at a later time.

The draft report was discussed and a number of amendments agreed to by the committee.

The meeting adjourned at 4.00pm to reconvene the following day.

The meeting reconvened on Wednesday 11 February at 10.30am.

The committee discussed the amended executive summary.

Resolved, on the motion of Mr Cohen, seconded by Mr Slack-Smith, that the executive summary as amended be part of the committee's final report.

The committee discussed the draft report and agreed to a number of amendments.

Resolved, on the motion of Mr Cohen, seconded by Mr Brown THAT the draft report as amended be the Report of the Committee and that it be signed by the Chairman and presented to the Parliament, together with minutes of the meetings and evidence.

Resolved on the motion of Mr Brown, seconded Mr Cohen, THAT the Chairman and Committee Manager be permitted to correct any incidental stylistic or typographical errors that are identified while preparing the Report for printing.

Committee Members thanked the Chairman and staff.

There being no other business, the meeting concluded.

Peter Primrose MLC	Ian Thackeray
Chairman	Committee Manager

APPENDIX FOUR – GLOSSARY AND ACRONYMS

ACRONYMS

ACF	Australian Conservation Foundation
ANSTO	Australian Nuclear Science and Technology Organisation
ARPANSA	Australian Radiation Protections and Nuclear Safety Agency
DEST	Federal Department of Education Science and Training
EPA	New South Wales Environment Protection Authority – now known as Department of Environment and Conservation
HLW	High Level Waste
IAEA	International Atomic Energy Agency
ILW	Intermediate Level Waste
LLILW	Long Lived Intermediate Level Waste
LLW	Low Level Waste
MAPW	Medical Association for the Prevention of War
NSWFBEU	New South Wales Fire Brigade Employees Union
SEMC	(NSW) State Emergency Management Committee
SLILW	Short Lived Intermediate Level Waste

GLOSSARY

Accelerator
A device that accelerates charged atomic particles to very high speeds.

Activity (of a substance)
The number of disintegrations per unit of time taking place in a radioactive material. The unit of activity is the becquerel (Bq), one disintegration per second.

Alpha Particle
A positively charged particle emitted from the nucleus of an atom during radioactive decay. Consists of 2 protons and 2 neutrons (a helium-4 nucleus). Although alpha particles are normally highly energetic, they travel only a few centimetres in air and are stopped by a sheet of paper or the outer layer of dead skin.

Atom
A particle of matter that cannot be broken up by chemical means. Atoms have a nucleus consisting of positively charged protons and uncharged neutrons of about the same mass. In a neutral atom the positive charges of the protons in the nucleus are balanced by the same number or negatively charged electrons in motion around the nucleus.

Background radiation
The ionising radiation in the environment to which we are all exposed. It comes from many sources including outer space, the sun, the rocks and soil under our feet, the buildings we live in, the air we breathe, the food we eat, and our own bodies.

Becquerel (Bq)
Unit of activity equal to one radioactive disintegration per second. Replaces the curie (Ci): 1 C1 = $3.7x10^{10}$ Bq.

Beta particle
A particle emitted from an atom during radioactive decay. Beta particles are electrons with either negative or positive electric charge. High energy beta particles may travel metres in air and several millimetres into the human body; low energy betas are unable to penetrate the skin. Most beta rays may be stopped by a small thickness of a light material such as aluminium or plastic sheeting.

Chain Reaction
A reaction that generates its own repetition. In a reactor neutrons released from an atom (say U235) split other atoms releasing more neutrons, this in turn further splits more atoms.

Contamination
A deposit of dispersed radioactive material on or within any other medium such as land, sea, air, structures, people etc.

Control rods
Rods, plates or tubes of steel or aluminium containing boron, cadmium or some other strong absorber of neutrons. They are used to control the rate of the nuclear reaction in a reactor.

Coolant
A fluid circulated through a nuclear reactor to remove or transfer heat. Common coolants are water, air and carbon dioxide.

Core, reactor
That region of a nuclear reactor in which a chain reaction can take place.

Criticality
The point at which a reactor reaches a self sustaining chain reaction.

Cyclotron
A machine to accelerate charged atomic particles to high energies by the application of electromagnetic forces. The accelerated particles may be used to bombard suitable target materials to produce radioisotopes.

Decay, radioactive
The spontaneous disintegration of unstable (radioactive) atoms called radionuclides until they reach a stable form. The process results in the release of alpha or beta particles, or gamma radiation.

Decommissioning
In relation to a nuclear reactor, its shutdown, dismantling and eventual removal.

Dose Equivalent
The absolute measurement of exposure to a dose of ionising radiation depends upon the type of particle and the body tissue with which it interacts - hence the conversion to *dose equivalent*, which has units of Rem (now Sievert)

Dosimeter (or Dosemeter)
A device such as a film badge used to measure the radiation dose a person receives over a period of time.

Dose limits
The maximum radiation dose that a person may receive over a stated period of time. International recommended limits, adopted by Australia, are that radiation workers should not excess 20 mSv per year, and members of the public should not receive more than 1 mSv per year.

Electron
The negatively charged particle that is a common constituent of all atoms. Electrons surround the positively charged nucleus and, in a neutral atom, determine the chemical properties of the atom. Electrons are emitted in radioactive decay.

Enrichment
Any process by which the content of a specified isotope in an element is increased. Uranium, as a reactor fuel, usually has to be enriched – the natural isotopic abundance of uranium-235 (0.7%) has to be increased to about 3%. Material at 20% or greater enrichment is called high enriched uranium (HEU); below 20% it is low enriched uranium (LEU).

Fissile
An isotope capable of capturing a neutron and undergoing nuclear fission (eg U-235, Pu-239)

Fission
The process of splitting an atom to form smaller atoms, releasing neutrons, gamma radiation and heat/energy. It can be spontaneous but is usually due to a nucleus absorbing a neutron.

Fuel cycle, nuclear
The series of steps involved in supplying fuel for nuclear reactors and managing the waste products. It includes the mining, refining and enrichment of uranium, fabrication and enrichment of uranium, fabrication of fuel elements, their use in a reactor, chemical processing to recover the fissionable material remaining in the spent fuel, re-enrichment of the fuel material, and refabrication into more fuel elements.

Fuel rod
A single rod of fissionable material encased in cladding. Fuel rods are assembled into fuel elements.

Fusion
The formation of a heavier nucleus from two lighter ones (such as hydrogen isotopes) with an attendant release of energy (as in a fusion reactor).

Gamma radiation
Gamma radiation is a short wavelength electromagnetic radiation of the same physical nature as lights, x-rays, radio waves etc. However, gamma radiation is highly penetrating and depending on its energy, may require a considerable thickness of lead or concrete to absorb it. Since gamma radiation causes ionisation it constitutes a biological hazard. It is commonly used to sterilize medical products.

Half-life, radioactive
The length of time required for half of the nuclei in an isotope to decay to another form. Half-lives vary, according to the isotope, from less that a millionth of a second to more than a billion years.

Heavy water
Water containing significantly more than the natural proportion (one in 6500) of heavy hydrogen (deuterium) atoms to ordinary hydrogen atoms. Heavy water is used as a moderator in some reactors because is slows down neutrons effectively.

Hot cell
A heavily shielded enclosure for highly radioactive materials. It may be used for their handling or processing by remote means or for their storage.

Ion
An atom that has lost or gained one or more electrons, thus becoming charged.

Ionising radiation

Radiation released from radioactive atoms. When it hits another molecule or atom it converts them to a charged particle (ion). Ionising radiation is released by nuclear fission and is a form of energy. There are three types of ionising radiation – alpha, beta and gamma. Ionising radiation can damage living tissue.

Ionisation
Any process by which an atom, molecule or ion gains or loses radiation.

Irradiation
Exposure to ionising radiation.

Isotopes
A single element can have different forms, called isotopes, due to differences in the number of neutrons. Thus isotopes of the same element have the same atomic number (ie number of protons) but different mass numbers. Isotopes of the same element have the same chemical properties, but somewhat different physical properties.

Nuclear reactor
A structure in which a fission chain reaction can be maintained and controlled. It usually contains fuel, coolant, moderator, control absorbers and safety devices and is most often surrounded by a concrete biological shield to absorb neutron and gamma ray emission.

Nuclide
The atom of a specific isotope is called a nuclide.

Plutonium
An transuranic element formed in a nuclear reactor by neutron capture. It has several isotopes, some of which are fissile. Plutonium-239, produced by neutron irradiation of uranium-238, is used as fuel for power reactors or explosive for nuclear weapons.

Radiation
The emission and propagation of energy by means of electromagnetic waves or sub-atomic particles.

Radioactivity
The emission of ionising radiation from the decay of unstable atoms.

Radioisotope
An isotope that is radioactive. Most natural isotopes lighter than lead are not radioactive. Two important natural radioisotopes are carbon-14 and potassium-40.

Radionuclide
A term often used as an alternative to radioisotope.

Rem
Unit of Dose Equivalent. Now superseded by the Sievert (Sv) 1 Sv = 100 rems.

Reprocessing

The chemical treatment of spent reactor fuel to separate unused uranium and plutonium from fission products, other elements and each other. The recovered uranium and plutonium may them be recycled into new fuel elements.

Sievert
A measurement of dose equivalent. It is equal to the absorbed dose multiplied by a factor related to the type of radiation and its effect on a particular part of the body. It is the important unit used to assess the effects of ionising radiation on living cells. Usually measured in millisieverts, the whole-body dose that every person receives from natural background radiation in one years is 2 millisieverts. Replaces the rem: 1 Sv = 100 rem.

Spent fuel
Nuclear fuel elements in which fission products have built up and the fissile material depleted to a level where a chain reaction does not operate efficiently. Also referred to as irradiated fuel or high level waste

Synchrotron
A cyclotron in which the magnetic field strength increases with the energy of the particles to keep their orbital radius constant.

Uranium
A radioactive element with two isotopes that are fissile (uranium-235 and uranium-233) and two that are fertile (uranium-238 and uranium-234). Uranium is the basic raw material of nuclear energy.

Uranium, depleted (used before)
Uranium having less that the naturally occurring percentage of uranium-235 (0.7%). As a by-product of enrichment in the fuel cycle it generally has 0.20-0.25% uranium-235, the rest being unranium-238.

Uranium, enriched
Uranium in which the content of the fissile isotope uranium-235 has been increased above the 0.7% natural content. Enriched uranium with 2-4% of uranium-235 is a fuel for may power reactors, whereas high enriched uranium of up to 90% of uranium-235 is a fuel for fast breeder reactors and the explosive in nuclear weapons.

Vitrification
The incorporation of high-level radioactive waste into glass for long-term storage.

X-ray
Electromagnetic radiations with wavelengths much shorter than visible light but usually longer than gamma rays.

APPENDIX FIVE – NHMRC CODE

Table 1 Activity concentration limits for Category A waste

(Recommended values for 100 year and 200 year institutional control periods)

Radionuclide group	**Concentration limit (Bq.kg^{1})**	
	100 y	**200 y**
Tritium	$5x10^{8}$	10^{11}
Carbon	10^{7}	10^{7}
Alpha emitting radionuclides (including U-238, Pu-239, Am-241)	10^{5}	10^{5}
Thorium-232	10^{4**}	10^{4**}
Radium-226, Uranium*	$5x10^{3**}$	$5x10^{3**}$
Beta/gamma emitters with half lives > 5y	$5x10^{5}$	$5x10^{6}$
Beta/gamma emitters with half lives ≤ 5y	10^{9***}	10^{9***}

Note: * in secular equilibrium with progeny

** mass equivalent is 2.5g/kg (2500 ppm) thorium and 0.4 g/kg (400 ppm) uranium

*** in practice, consideration of surface dose rates from waste packages during transport and dandling operations lead to more restrictive values

Table 2 Activity concentration limits for Category B waste

(Recommended values for 100 year and 200 year institutional control periods)

Radionuclide group	**Concentration limit (Bq.kg^{1})**	
	100 y	**200 y**
Tritium	10^{10}	$5x10^{12}$
Carbon-14	$5x10^{7}$	$5x10^{7}$
Alpha emitting radionuclides (including U-238, Pu-239, Am-241)	10^{7}	10^{7}
Radium-226, Uranium*	$5x10^{5}$	$5x10^{5}$
Beta/gamma emitters with half lives > 5y	10^{8}	10^{9}
Beta/gamma emitters with half lives ≤ 5y	no limit*	no limit*

Note: * in practice, consideration of surface dose rates from waste packages during transport and dandling operations lead to more restrictive values

Table 1 Activity concentration limits for Category C waste

(Recommended values for 100 year and 200 year institutional control periods)

Radionuclide group	**Concentration limit (Bq.kg^{-1})**	
	100 y	**200 y**
Tritium	10^{10}	$5x\ 10^{12}$
Carbon	$5x\ 10^{7}$	$5x\ 10^{7}$
Alpha emitting radionuclides (including U-238, Pu-239, Am-241)	10^{7}	10^{7}
Radium-226, Thorium-232 & Uranium*	$5x10^{5**}$	$5x10^{5**}$
Beta/gamma emitters with half lives > 5y	10^{8}	10^{9}
Beta/gamma emitters with half lives $\leq$ 5y	no limit***	no limit***

Note: * in secular equilibrium with progeny

** mass equivalent is 125 g/kg (12.5%) thorium and 40 g/kg (4%) uranium

*** in practice, consideration of surface dose rates from waste packages during transport and dandling operations lead to more restrictive values

APPENDIX SIX – EPA CORRESPONDENCE ON SPENT FUEL

The definition of high-level nuclear waste in the DEC submission

The Chairman, The Hon. Peter Primrose MLC asked:

'What do you mean by "high level" [waste]?

DEC response

In its submission to the Committee, the DEC used the International Atomic Energy Agency's (IAEA) Safety Series No. 11 1-G-1 .1 *Classification of Radioactive Waste - A Safety Guide* (the Safety Guide). This document refers to the IAEA documents *Standardisation of Radioactive Waste Categories (1970)* and the *Underground Disposal of Radioactive Wastes (1981).* Section 301 of the Safety Guide refers to high level waste as *'spent reactor fuel, if it is declared a waste'.*

Sections 327 - 329 of the Safety Guide deal with the characteristics of high-level nuclear waste. Although the guide cautions that *'Specific activities for these waste forms are dependent on many parameters, such as the type of radionuclide, the decay period and the conditioning techniques.',* it advises that typical activity concentration levels for high-level waste are in the range of 5×10^4 TBq/m^3 to 5×10^5 TBq/m^3.

An additional property for the classification of high-level nuclear waste is its heat production, where *'...the lower value of about 2 kW/m^3 is considered reasonable to distinguish high-level waste from other radioactive waste classes, based on the levels of decay heat emitted by high-level waste such as those from processing spent fuels.'*

The fuel for HIFAR is 60% enriched in ^{235}U and by the time it is replaced, this level is around 43% enrichment in the spent fuel. The July 1998 environmental impact statement for the site licence for the replacement research reactor at Lucas Heights stated that 7.3 kilograms of uranium is generated each year as spent fuel from HI FAR.

From its radioactivity, heat production, and other physical characteristics, it is the view of the DEC that spent fuel should be considered high-level radioactive waste.

APPENDIX SEVEN – COUNCILS THAT ARE NUCLEAR FREE ZONES

Bankstown City Council
Blue Mountains City Council
Blacktown City Council
Botany Bay City Council
Campbelltown City Council
Canada Bay City Council
Canterbury City Council
Gosford City Council
Kiama City Council
Lake Macquarie City Council
Leichhardt City Council
Lismore City Council
Liverpool City Council
Manly City Council
Marrickville City Council
Newcastle City Council
Parramatta City Council
Shellharbour City Council
South Sydney City Council
Sutherland Shire
Warringah City Council
Waverley City Council

APPENDIX EIGHT – NSW FIRE BRIGADES CORRESPONDENCE

CO3/2144

New South Wales Fire Brigades
227 Elizabeth Street
Sydney NSW 2000
P.O. Box A249, Sydney South 1232

Telephone: (02) 9265 2999
Facsimile: (02) 9265 2988

09 October 2003 Our Ref: CHO 06317

Mr Ian Thackeray
Committee Manager
Joint Select Committee on the
Transportation and Storage of Nuclear Waste
Parliament House
Macquarie Street
SYDNEY NSW 2000

Re: Questions taken on notice

Mr Thackerary,

Please find below answers to questions taken on notice as a witness during the public hearing of the Joint Select Committee on the Transportation and Storage of Nuclear Waste in Sydney on Friday 19 September 2003.

Question from Ms V. Judge:

"Could you inform the Committee whether there have been any incidents involving any sort of level of radioactive spill, whether it is low, medium or high, in that area, at the airport or anywhere else in New South Wales, and do you keep a table of that, and when you are called out are there any records kept, and where are those records kept?"

Answer:

The NSW Fire Brigades, as with all other Australian Fire Services, uses the Australian Incident Reporting System (AIRS) for recording data of incidents attended. AIRS is divided into a number of sections and numerical codes that enables the capture of relevant information such as incident time, date and location, details of fire appliances and other emergency services and support agencies that attend the incident and details of actions taken.

In the case of hazardous materials incidents there is a separate section that has a number of codes that enable as far as possible accurate information to be recorded. This information is dependent on identification of the substance and correct code allocation.

To this end Code 443 of the AIRS Division 4 Hazardous Condition (not a fire) relates to "Radiological Leak, Radioactive Material".

A search of the AIRS database Code 443 revealed that the NSW Fire Brigades have responded to eight suspected radiological incidents since 2000. A breakdown of these incidents is attached.

On reviewing the information it appears that one incident was incorrectly coded (should be oil on roadway) and another was a concerned citizen who found a package with a radioactive sign on it. The remainder were calls to suspected low level radiation releases.

Of the remaining six incidents, two were at Mascot airport where there was a suspected leak of a radioactive substance, however no was leak detected. Two incidents involved devices to measure road density, where the outer container may have been damaged but no leak was evident.

The remaining two incidents were at Newcastle and related to the same incident at two different locations over two days. Reports are that a 200mm radioactive rod used as a radiation gauge was located in a truck and returned to owners.

Further specific information on these incidents maybe available, if required, from the Hazardous Materials Response Unit as this Unit also keeps internal records of calls attended.

Questions from the Chair:

(1) Across NSW how many Hazmat Units are there capable of dealing with a radiation spill?

Answer:

The current NSWFB capability for dealing with a radiation spill is based on current risk. The Primary Hazardous Materials Units at Greenacre, Newcastle and Wollongong have the necessary radiation detection equipment, personal monitoring dosimeters and training. In addition the fire stations at Engadine and Menai have radiation detection capabilities and have undertaken additional training to identify the extent of an incident that might occur at ANSTO, Lucas Heights.

The remaining 330 fire stations throughout NSW do not have radiation detection equipment or personal monitoring equipment. They are reliant on safe working practices using "time, distance and shielding" precautions. All of these locations have level A and level B personal protective equipment (PPE).

(2) Are the local Hazmat commanders and crews trained in such matter?

Answer:

The NSWFB utilises National Training Competency Module 2.16 Hazardous Materials for training personnel. This competency, in broad terms, provides

APPENDIX NINE – SUTHERLAND SHIRE COUNCIL SUBMISSION EXTRACT

Sutherland Shire Council Submission No. 350 Attachment 5: Centennial Consultancy

considered appropriate in the interests of community safety for transportation to be along cleared roads, or at least subject to escort arrangements that eliminate passing traffic or the risk of collision from on-coming vehicles; emergency services personnel should be informed in advance of plans to transport radioactive materials though specific districts, and the nature of the materials being transported should containers be breached through mechanical shock or fire.

Currently, quantities of highly-radioactive waste (in the form of fuel rods) are regularly transported from Lucas Heights to Sydney ports for transhipment to France for re-processing, and return. These movements are subject to high levels of security and secrecy – apparently because the materials involved could be utilised for the manufacture of nuclear weapons, and are therefore considered at risk of terrorist attack.

Given suggestions that intermediate level radioactive materials could also be utilised to make a 'dirty bomb', some may argue that the same security and secrecy arrangements should prevail in relation to transportation of radioactive waste to the proposed National Repository.

The Draft EIS indicates that the Commonwealth proposes to pursue the former strategy – that is, to move low level and short lived intermediate level waste under conditions of secrecy.

The Committee may wish to explore which parties take responsibility for this decision, and who will be accountable for this decision in the event of accident or incident.

One would expect that a detailed management plan would encompass, *inter alia*:

1. arrangements for the selection of suitable vehicles for transportation, and whether such vehicles would be owned or hired and controlled by relevant government agencies, or whether vehicles and drivers would be supplied by contractors;
2. arrangements for the training of drivers;
3. arrangements for the loading of cargo, and responsibilities for ensuring that the cargo was contained and secured before departure, and certification that the cargo did not contain liquid wastes;
4. arrangements or the testing of emissions prior to departure from source;
5. whether trucks would travel in groups (as a 'convoy') or singly;
6. maximum speed of travel of trucks conveying radioactive waste;
7. arrangements for the maximum 'shifts' to be taken by drivers en route;
8. the nature of escort arrangements throughout the journey;
9. whether roads would be closed to other traffic when shipments passed along highways and secondary roads;
10. general arrangements for the co-ordination of activities with NSW government agencies and NSW local councils regarding the transportation of nuclear waste;

11. the advice to be given to relevant agencies concerning impending transhipment of radioactive materials along the NSW road network (e.g. NSW Police Service, NSW Fire Brigades, Rural Fire Service, State Emergency Service, NSW Environment Protection Authority, local councils);
12. when and in what form such advice would be provided, and to what officers in those agencies;
13. arrangements for the training of emergency services and health services personnel;
14. the advice to be provided to agencies involved in the provision of health services (e.g. NSW Department of Health, NSW Area Health Boards, ambulance services and local hospitals) regarding appropriate responses in the event of accident or terrorist attack leading to spillages of radioactive materials;
15. minimum requirements for the upgrading of the capability of emergency response units to cope with the discharge of radioactive materials as a result of accident or terrorist incident;
16. how emergency response units would respond to incidents (e.g. closing roads, diverting traffic, evacuating residents from neighbouring areas, notifying health personnel, etc);
17. military involvement in security arrangements;
18. military involvement in responses to incidents;
19. delineation of responsibilities and the overall chain of command of a multi-agency response to the release of hazardous materials;
20. communication systems to be utilised in the event of adverse incidents, to ensure efficient execution of containment plans and the removal of hazards;
21. arrangements for the development of protocols for the application of equivalent processes to truck movements from Queensland and the ACT;
22. arrangements for the notification of relevant agencies in South Australia (the destination of the radioactive waste) about impending truck movements;
23. arrangements for the notification of relevant agencies in South Australia concerning points for the hand-over of responsibilities for escort and security services;
24. arrangements for the checking of containers and vehicles for radioactivity after they have discharged their cargoes by Commonwealth agencies, and for the sharing of findings with relevant NSW services agencies;
25. arrangements for the recording of data relating to the movement of radioactive materials and the recording of any accidents, or incidents (including spillages, leakages, etc. in transit).

Overall, the Commonwealth's proposals can be expected to impose considerable costs on the State of NSW. The Draft EIS does not attempt to quantify these costs, or to suggest how NSW would be compensated by the Commonwealth.

The following presents an assessment of minimum requirements to minimise risk associated with the transportation of radioactive materials across NSW.