Consultancy report

Radioactive Waste Store Feasibility Study – Stage One

Government of South Australia

EPA South Australia

R E P O R T

Radioactive Waste Store Feasibility Study – Stage One

Prepared for

Environment Protection Authority

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AIF – Assured Isolation Facility

ALARA - as low as reasonably achievable

ARPANS - Australian Radiation Protection and Nuclear Safety

ARPANSA - Australian Radiation Protection and Nuclear Safety Agency

CFR – Code of Federal Regulations (US)

DAC – Development Assessment Commission (SA)

DOE - United States Department of Energy

DR – Development Report

EIS - Environmental Impact Statement

EPBC – Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)

EPA - South Australian Environment Protection Authority

EP Act – Environment Protection Act 1993 (SA)

IAEA – International Atomic Energy Agency

ICRP – International Commission on Radiation Protection

ILRW - intermediate level radioactive waste

ISA – Integrated Safety Assessment

LLRW – low level radioactive waste

LILRW - low level and intermediate level radioactive waste

NHMRC - National Health and Medical Research Council

NRC – Nuclear Regulatory Commission (US)

Short-lived ILRW - intermediate level radioactive waste with a half-life of less than about 30 years

PER – Public Environment Report

PIRSA – Department of Primary Industry and Resources South Australia

RPC Act – Radiation Protection and Control Act 1982 (SA)

SA – South Australia

TNRCC – Texas Natural Resources Conservation Commission

URS - URS Australia Pty Ltd

US – United States of America

WAC - waste acceptance criteria

Background

The principal aim of South Australia's Radiation Protection and Control Act 1982 is to protect the people and the environment of South Australia from the harmful effects of radiation. The Minister for Environment and Conservation, the Hon. John Hill, is responsible for this Act, and has delegated certain powers, roles and functions to the Chief Executive of the Environment Protection Authority (EPA) and to officers of the EPA's Radiation Protection Division.

In August 2002 the South Australian Government announced that the EPA would conduct an audit of radioactive material for which the South Australian Government is responsible. Officers of the Radiation Protection Division conducted the audit in 2003, and the South Australian Radiation Protection Committee endorsed the resulting report, which was released in December 2003. The audit involved approximately two person-years of EPA resources, with inspections extending over a 7-month period.

On 15 November 2004, URS Australia Pty Ltd (URS) was engaged to conduct a study and report to the EPA on the feasibility of the Government of South Australia establishing a store for the safe handling, packaging and interim storage of radioactive waste.

In this Stage 1 Report on the feasibility study, we present:

- a review the quantities and types of radioactive waste under South Australian legislative control that are likely to require interim storage now and into the future;
- site selection criteria for an Interim Store, consistent with international best practice for safety and protection of people and the environment;
- design and structural criteria for the Interim Store, consistent with international best practice; and
- the approval processes and procedures to be addressed to establish the Interim Store.

Quantities and Types of Radioactive Waste

The review showed that the EPA audit was very thorough, applied sound methodology, and produced a defendable estimate of the volume of waste (22 m^3) that would require storage in 2003. This feasibility study attempted to go further and foresee requirements 50 years into the future. The study concluded that, for Interim Store design purposes, a figure of 100 m^3 should be used. This provides allowance for the existing waste, projected future waste, storage inefficiencies and the considerable uncertainty associated with such long-term projections.

Site Selection Criteria

Information on site selection criteria for low-level radioactive waste storage facilities was sought from around the world, and while some relevant guidance was found, the vast majority of the information available related to disposal facilities. As disposal facilities and storage facilities have some aspects in common, some of the criteria provided useful guidance. In general, however, as a storage facility (unlike a disposal facility) will have active management and control applied for the whole of its service life, some criteria can be significantly less stringent without compromising the level of safety provided.

Most of the site selection criteria available are not numerically precise statements, but rather general statements of what is not allowed, and what is preferred. As such, they are statements of general objectives rather than specific criteria.

From all this information, a set of criteria has been recommended. The criteria have also been assessed with respect to relative importance, and rankings have also been recommended.

Design and Structural Criteria

An assessment of the design and structural criteria indicate that, subject to appropriate site selection in accordance with the recommended criteria, the construction of a building for use as an Interim Store would present few technical challenges.

The Interim Store would be constructed in compliance with the Building Code of Australia and Australian Standards, and will be designed to ensure that workers, the general public and the environment will not be harmed by its operation.

Processes and Procedures

Owing to the publicly sensitive nature of any proposal involving radiation, the approval process will need to be managed with care and planning. A preliminary analysis indicated that an Interim Store proposal may not trigger the "nuclear actions" criterion of the Commonwealth's Environment Protection and Biodiversity Conservation Act 1999, as the quantity of radioactive waste may not be regarded as "excessive".

In addition, if the SA Government were to commit that the Store would be managed such that the threshold is not reached in the future, it would appear that the long-term use of the Store would be outside the EPBC definition. It is recommended that the EPA should seek legal advice as to whether the Store will be a nuclear action, and thus whether a referral is required.

With respect to South Australian law, there are a number of potential paths that could be taken to satisfy the approvals requirements, none of which present insurmountable obstacles. Information on each path, the range of approvals, permits and licenses required, and the approximate timing is presented in this report.

2.1 Background

The principal aim of South Australia's Radiation Protection and Control Act 1982 is to protect the people and the environment of South Australia from the harmful effects of radiation. The Minister for Environment and Conservation, the Hon. John Hill, is responsible for this Act, and has delegated certain powers, roles and functions to the Chief Executive of the EPA and to officers of the EPA's Radiation Protection Division.

In August 2002 the South Australian Government announced that the EPA would conduct an audit of radioactive material for which the South Australian Government is responsible. The Minister for Environment and Conservation requested the EPA to undertake the audit, with particular emphasis on material designated as waste, and to determine the nature and volume of the material and whether it was safely and securely stored.

The audit was conducted by officers of the EPA's Radiation Protection Division. Its report on the audit (EPA 2003)[i] was endorsed by the South Australian expert body on radiation protection issues, the statutory Radiation Protection Committee. The report was released in December 2003.

Two of the key recommendations for the future management of radioactive waste in South Australia, (Nos. 8 and 9) were:

> *That the government undertake a rigorous feasibility study of options for future management of South Australia's radioactive waste and that this study be commenced as soon as practicable.*
>
> *That the government investigate the feasibility of establishing a facility for the safe handling, packaging and interim storage of waste pending the establishment of appropriate facilities for long-term management.*

On 15 November 2004, URS was engaged to conduct a study and report to the EPA on the feasibility of the Government of South Australia establishing a store for the safe handling, packaging and interim storage of radioactive waste. The study is being conducted in two stages, each covering four topics. The stages and their topics, as well as the scope of the study, are described below.

2.2 Study Topics and Scope

2.2.1 Study Topics

The study topics for the two stages of the study are described below.

Stage 1

1. Review the quantities and types of radioactive waste under South Australian legislative control that are likely to require interim storage now and into the future.

2. Develop site selection criteria for an Interim Store, consistent with international best practice for safety and protection of people and the environment.

3. Develop design and structural criteria for the Interim Store, consistent with international best practice, including:
   - Security;
   - Containment, shielding and ventilation;
   - Safe handling and treatment; and
   - Interim storage of the range of radioactive wastes;

4. Define processes and procedures that would need to be addressed, including the stages (and timeframes) from pre-construction to operational to rehabilitation, including critical regulatory issues and public consultation.

Stage 2

5. Develop feasible options for locating an Interim Store, including a single purpose-built store, and the use of a number of stores.

6. Identify options for management of an Interim Store, including government agency and public/private company.

7. Identify potential risks and benefits for people and the environment of using a purpose-built Interim Store compared with the current storage arrangements, including transport of wastes to and from stores, and operations at the stores.

8. Determine the costs associated with establishing and running an Interim Store, and compare with those associated with the current storage arrangements.

2.2.2 Study Scope

The 2003 audit had particular emphasis on identifying radioactive material that was designated as waste, and on establishing the nature and volume of the material and whether it was safely and securely stored. For reference, the various radioactive waste classifications / categories, and their requirements for disposal, are described in Tables 2.1 and 2.2 below.

The scope of this feasibility study is more focused than that of the Audit, and includes:

- registered sealed sources in hospitals, universities and industry (Category B or S);
- unsealed radioactive material in hospitals, universities and other organisations (very low level or Category A); and
- miscellaneous radioactive material, including smoke detectors that contain radioactive material, geological samples held in core libraries and museums, and radioactive material used in secondary schools (Category A, B or S).

Table 2.1 Categories of Radioactive Waste

Classification / Category	Description
Very Low Level Radioactive Waste	• can be disposed of by the user under the Code of Practice for the Disposal of Radioactive Wastes by the User (1985). • having radioactivity content greater than for exempt waste but less than the upper limit specified in the user disposal code. • aimed at users of small quantities of radioactive materials. Thus, this class of waste does not cover bulk materials.
Category A	• covers solid radioactive waste with mainly beta- or gamma-emitting radionuclides of short half-life. • will generally comprise lightly contaminated items such as paper, cardboard, plastics, rags, protective clothing, glassware, laboratory trash or equipment, certain consumer products and industrial tools or equipment. • may also comprise lightly contaminated bulk waste from mineral processing or lightly contaminated soils.
Category B	• typically comprises gauges and sealed sources used in industry, medical diagnostic and therapeutic sources or devices, and small items of contaminated equipment. • covers solid waste and shielded sources with considerably higher activities of beta- or gamma-emitting radionuclides than Category A waste.
Category S	• typically comprise sealed sources, gauges or bulk waste which contains radionuclides at higher concentrations than are allowable under Categories A or B. • unacceptable for near-surface disposal and must be retained in storage until an alternative disposal method is available

Table 2.2 Storage / Disposal Requirements for Radioactive Waste Categories

Classification/Category		Type	Initial Destination	Final Destination
Very low level		Short & long lived	User disposal	
Low Level Radioactive Waste (LLRW)	A	Short & long lived	Interim store or suitable for immediate disposal in a near-surface repository	Disposal in a near-surface repository
	B	Short & long lived		
Intermediate Level Radioactive Waste (ILRW)	B	Short lived[1]		
	S	Short lived[2]	Interim store	Deeper burial in accordance with ARPANSA Guidelines (yet to be published)[3]
		Long lived		
High level		Not present in South Australia		Deep geological disposal

[1] All long-lived intermediate level wastes are Category S

[2] There are some Category S wastes that will decay to Category B status within the operational life of the interim store. These can then be reclassified and be disposed of in the near-surface repository

[3] It assumed that this waste will go to deeper underground disposal, however this does not form part of any existing studies or management plan.

This feasibility study does not include:

- uranium product, tailings and other radioactive materials resulting from past, current or future mining or processing activities;
- radioactive material in the process of being transported (including storage in transit) or already disposed of; and
- radioactive material under Commonwealth jurisdiction (as described in the Audit).

The scope of this feasibility study also did not include the inspection and evaluation of the safety and security of the radioactive materials.

2.3 Reporting

The overall feasibility study will be conducted in two stages as described above. This document covers the first stage of the study, namely:

1. the quantities and types of radioactive waste;
2. site selection criteria for an Interim Store;
3. design and structural criteria; and
4. the approval processes and procedures to be addressed to establish the Interim Store.

A second report that covers the remaining issues will follow at the completion of the study.

Background information on the nature of radiation and the international agencies that provide recommendations on exposure limits for input to Australian regulations, is discussed in detail in the audit report and is not repeated here.

3.1 Introduction

The key purpose of this part of the feasibility study is to identify the quantities and types of radioactive waste under the South Australian Government's legislative control that are likely to require storage, and the quantity of such waste that is likely to be generated and require storage for up to 50 years into the future. This effectively meant reviewing and updating the comprehensive audit conducted by the EPA in 2003.

3.2 Audit Methodology

3.2.1 Sources of information

The audit report indicated that the audit was conducted over a 7-month period and involved approximately two person-years of EPA resources. Since the 1980s, the Radiation Protection and Control Act 1982 has required that:

- sealed sources, as well as premises in which unsealed radioactive material is used, handled or stored, must be registered;
- people using or handling radioactive material must be licensed; and
- a public register of licences and registrations issued under the Act be developed.

This register was used in the audit to compile preliminary data on radioactive material. Each registered site was then inspected to ensure the data was comprehensive and up to date. The quantity of radioactive material and whether or not it was waste was determined at the time of each inspection. Some radioactive material has since left or arrived in South Australia, and new radioactive waste has been generated. The quantities of radioactive materials and their classification as waste were therefore variable to this extent.

The audit report notes, however, that data on radioactive substances that were present before the Act came into force (pre 1980s) may not be reliable, and there may be as yet unidentified radioactive substances (many of them waste) unknowingly being held by some organisations, which may emerge in future as requiring appropriate storage or disposal.

3.2.2 Classification of waste

The Audit defined three categories of radioactive waste of relevance to this study as outlined in Table 3.1 below.

Table 3.1 Classifications of Radioactive Waste used in the Audit

Registered sealed sources	Unsealed radioactive material	Miscellaneous radioactive material
Waste Category B or S	Waste Category A or very low level	Waste Category A, B or S
Typically in the form of a stainless steel capsule containing radioactive material.	In solid, liquid or gaseous forms, used in registered premises such as laboratories in universities, hospitals, and research and industrial organisations.	A range of radioactive material within the scope of this study but not mentioned in the other sections.
Typically used in: • radiation gauges for the monitoring or control of industrial processes; • borehole logging, for geophysical surveys of rock strata; • moisture/density meters, commonly used in civil engineering; • moisture probes, commonly used in agriculture; • industrial radiography, for non-destructive testing of metal welds and castings; and • radiation therapy and other medical uses.	Typically used in: • radioimmunoassays, used for a range of biochemical tests such as determining the constituents of blood (e.g. hormones and drugs); • medical diagnostic studies using radiopharmaceuticals to provide information about a specific organ or its function, and the localisation of tumours or abscesses; • medical treatment of certain tumours or diseased organs; • tracing of small leaks in complex systems such as large heat exchangers; and • tracking of flow in gas and oil wells.	Typically used in: • sealed sources of lower activity than that requiring registration (e.g. sources used in smoke detectors, static eliminators, and sources used for calibration and educational purposes); • radioactive waste resulting from uses of radioactive material for medical, industrial and scientific purposes in the past; • luminous devices containing radioactive material (e.g. radium paint on dials of clocks, compasses and aircraft instrument panels; and gaseous tritium light sources); • industrial radiography source containers that use depleted uranium; and • geological samples containing radioactive minerals.

The International Commission on Radiological Protection (ICRP) defines "waste" as any material that will be or has been discarded, being of no further use. The International Atomic Energy Agency (IAEA) defines radioactive waste as "material that contains or is contaminated with radionuclides at concentrations or radioactivity levels greater than clearance levels established by the appropriate authority and for which no use is foreseen" (Safety Series No. 111-F, 1995)[ii].

For the audit, rather than using these definitions, the owners of the radioactive substance determined whether or not it was waste based on their individual needs. Thus some of the substances identified in the audit as waste may well be functional and re-usable if an appropriate recycling facility were available.

Furthermore, some of the sources inspected were well beyond their nominal functional life but were not regarded by the owner as waste. Some 205 sealed sources (about 40%) were over 15 years old, currently in use and not regarded as waste. However, some of these sources may be redefined as waste if a suitable disposal path becomes available.

3.2.3 Estimates of volume

The audit team recognised that it was not reasonable to estimate the volume of the actual sources in many devices. Some sealed sources are integrated into their shielding/transport containers and it is difficult and not meaningful to determine the volume of the actual source. Others are simply very small.

In order to produce a consistent volume estimate, the actual packaged volume was used for large sources, and a nominal figure of 0.02 m^3 was attributed to each small source as the approximate volume of the source in conditioned form. This approach results in accurate estimates for large sources and conservative but reasonable estimates for small sources. The approach is thus realistic and is supported.

Note that for the purpose of design of an Interim Store, allowance will need to be made for redundancy in conditioning, packaging, and stacking.

In regard to stacking, if for example, 205 L drums are used as the preferred container, as much as 20% more volume will need to be allowed for stacking inefficiencies, to allow access for mechanical lifting devices and other voids, depending on how closely they are to be stacked.

3.3 Audit findings

The audit identified 134 sites where radioactive material was stored or used, of which 80 contained material that was regarded by the owners as radioactive waste. As of June 2003 there were:

- 684 sealed sources that were either registered or subject to applications for registration (plus 18 that were not inspected as they were based interstate).
- 172 premises that were either registered, or subject to applications for registration, most of which were laboratories where unsealed radioactive material in solid, liquid and gaseous forms was used.
- A wide range of radioactive material that did not fall into the types mentioned above, such as smoke detectors.

The total volume of low level and intermediate level radioactive waste (LILRW) identified in the audit is given in Table 3.2 below.

Table 3.2 Audit Estimates of LILRW Waste Volume

Waste type	Estimated volume (m^3)
Registered sealed sources	
ILRW	5
LLRW	3
Total sealed sources	8
Unsealed waste in laboratories	
Very low level[4]	<16
Miscellaneous waste	
Waste from past practices (LILRW)	5
Discarded smoke detectors (LLRW)	9
Total miscellaneous	14
Total (excluding very low level)	**22**

A summary of the data used to produce the estimates in Table 3.2 was provided to URS for review. In addition, a selection of the inspection records was reviewed and checked against the data in the summary. Given the nature and extent of the uncertainties discussed above, it was not appropriate to conduct a strict statistical analysis of the accuracy of the data and its transcription from the inspection records. It was noted however that there were no transcription errors related to the technical data in the selection checked by URS[5].

3.4 Future trends

3.4.1 Sealed Sources

The key trends for sealed sources that would put upward pressure on volume are the identification of additional legacy sources, and the declaration by owners that old sources are now regarded as waste. While some of these sources may be able to be returned to the manufacturer, many may require storage in an interim facility. With the global push for greater recycling and re-use of potential waste, however, some of these sources may be able to be returned to use in some form.

The Audit report indicates that there are 684 licenced sealed sources in South Australia, 488 of which are currently in use. Within 50 years, it would be reasonable to expect that these 488 sources currently in use would be beyond their working lives and require transport to their point of origin or to interim storage. This figure of existing licenced sources can be used to estimate the total quantity of sources requiring disposal, into the future.

[4] Maximum quantity stored pending disposal in accordance with the Code of Practice for the Disposal of Radioactive Wastes by the User (1985).

[5] Only one error was observed relating to an incorrect post code on one record.

If it is assumed that there is an ongoing demand in South Australia of about 500 in-service sources and a functional life of 15 years, the quantity requiring storage may be about 500÷15=33 per annum (approximately). Thus by 2050, 45 years hence, 45 x 33 or approximately 1500 sources may require storage. This figure would be reduced by any return or exchange for new arrangements that may be in place with suppliers.

3.4.2 Unsealed Waste

All of the existing waste in this category is classified as very low-level waste and may be disposed of under the Disposal by User Code. It is not expected that there will be significant changes during the next 50 years, other than if standards are tightened and this waste is required to be managed differently. Note that it is not intended that liquid radioactive waste will be accepted for storage in the Interim Store.

3.4.3 Miscellaneous Waste - Smoke detectors

The most significant addition to the uncertainties discussed above could potentially come from changes in the way waste smoke detectors are managed. The current estimate of volume found in the audit was 9 m^3 and it was noted that a further 15 m^3 per year may require management.

The situation is complicated by the current ad-hoc disposal arrangements:

- some smoke detectors are currently being disposed of by owners via domestic refuse;
- some suppliers based in other States are accepting the return of waste smoke detectors from South Australia;
- at least one supplier based in Adelaide is accepting the return of waste smoke detectors from other States; and
- some waste smoke detectors are being exported.

In the Statement on Disposal of Domestic Smoke Detectors (dated 1 November 2001), the Radiation Health Committee of the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) recommended the removal of restrictions on disposal of individual domestic smoke detectors because the:

- amount of radioactive material in each detector is extremely small (less than 40 kBq), and from environmental and public health perspectives the disposal of individual detectors with domestic rubbish does not represent any hazard;
- radioactive material is securely bound in a metal foil within the detector; and
- amount of naturally-occurring alpha-emitting radioactivity in normal soils is equivalent to a dozen or more smoke detectors in every cubic metre, thus the dispersal of smoke detectors, even in large numbers, through refuse and fill sites is not significant in comparison.

The disposal of waste smoke detectors has not been approved in South Australia, and each smoke detector carries a label stating ‘Return to supplier or Department of Health for disposal’.

Future trends in smoke detector use will be dominated by the recent move around Australia towards their mandatory installation in new houses; and the lag time of 5 to 10 years before recently installed and new detectors require replacement. Thus the volume of waste smoke detectors will certainly rise significantly unless disposal arrangements in South Australia are brought into line with ARPANSA recommendations, or other arrangements are made.

3.5 Updated Estimates of Waste Volume

Taking into account the discussion above, the estimates for each category of waste has been reassessed. The main changes to the volumes estimated in the audit are:

- allowance for additional sealed sources that are likely to become waste during the next 50 years (estimated to be 488 existing sources and approximately 1500 future sources);
- allowance for additional legacy sources to be identified (very pessimistically assumed to be equal to the currently identified volume);
- the untested assumption that smoke detectors will not be managed through an Interim Store.

The reassessment also assumes that very low level waste continues to be disposed of under arrangements that do not impact on an Interim Store. If the Interim Store was required to temporarily hold very low level waste, then additional storage space would be required. The outcome of the reassessment is provided in Table 3.3 below.

Table 3.3 Updated Estimates of Waste Volume (m^3)

Waste type	Estimated volume 2003	Estimated volume 2050
Registered sealed sources		
ILRW	5	24
LLRW	3	14
Total sealed sources	8	38
Unsealed waste in laboratories		
Very low level	<16	0
Total very low level	<16	0
Miscellaneous waste		
Waste from past practices (LILRW)	5	10
Discarded smoke detectors (LLRW)	9	0
Total miscellaneous	14	10
Total (excluding very low level)	**22**	**48**

As the figure of 48 m^3 is not technically challenging for a storage facility, it would be prudent to allow additional space for the possible temporary storage of very low level waste, and for conditioning, packing

and stacking inefficiencies. Allowing for these factors (say 30 m^3 for very low level waste and 20% for stacking inefficiencies) brings the estimate to approximately 100 m^3.

3.6 Uncertainties

Many of the uncertainties associated with the estimate published in the audit report are noted in the report. For the purpose of this study, however, where storage requirements for the next 50 years need to be estimated, additional uncertainties have been identified.

Some of these uncertainties would result in a higher total volume while others would lower the total. Each issue is summarised in Table 3.4 below.

Table 3.4 Impact of Uncertainties

Uncertainties	Comment	Impact on Updated Estimate
Redefinition of waste by owners	Owners of existing materials may redefine them as waste (will only impact on timing as all existing sources are assumed to be waste by 2050)	
Identification of additional legacy wastes	Assuming only half the existing legacy sources have been identified	+ 5 m^3
Recycling and re-use of devices	This may be a significant in reducing the number of new sources required	
Changes in classification of waste	If low level wastes have to be managed via the store, then space will be needed for its temporary storage. 30 m^3 would cover about double existing requirements.	+ 30 m^3
Smoke detector management	Smoke detectors cannot be managed via an Interim Store because the volumes would escalate too quickly	
Conditioning, packing and stacking efficiency	There is no Australian standard for conditioning waste as yet, and packing efficiency will be determined by the storage technology and geometry.	+ 20%

Note that the additional legacy wastes are already included in the updated estimate.

3.7 Conclusions

The 2003 EPA audit was very thorough and applied a consistent and reasonable methodology to the estimation of the total volume of waste that would be relevant to an Interim Store. In attempting to go further and foresee requirements 50 years into the future, additional uncertainties have been identified.

For Interim Store design purposes a figure of 100 m^3 would be justified. This would accommodate the known waste, future anticipated sealed source waste, and conditioning and packing inefficiencies. It would not accommodate smoke detectors or longer-term very low-level waste.

4.1 Introduction

The concept of a LILRW management facility that is designed to simply store the waste, for up to 50 years, is not in common use around the world. In most countries, LILRW is stored at the point of production until ready for transfer to a conditioning facility (if necessary) and then to a disposal facility[6]. The conditioning facilities are not designed for long-term storage.

Specific standards and codes of practice were sought for an interim storage facility but none could be found. There was much information, however, on LILRW disposal facilities that have many features in common with a long-term storage facility. In the United States the "Assured Isolation" concept has been developed, which applies to a storage and/or disposal facility.

This study therefore considers site selection criteria that:

- are applied to possession, processing, and storage facilities;
- could be applied to the Assured Isolation concept; and
- apply to LILRW disposal facilities.

Those criteria that are pertinent to a storage-only scenario are identified.

4.2 International Site Selection Criteria

The IAEA has issued a series of related standards and guidelines, but none specifically on site selection criteria for a LILRW storage facility. In the Safety Series 111-F a set of principles was published with which site selection criteria should be compatible. These are summarised below:

Principle 1: Protection of human health - Radioactive waste shall be managed in such a way as to secure an acceptable level of protection for human health.

Principle 2: Protection of the environment - Radioactive waste shall be managed in such a way as to provide an acceptable level of protection of the environment.

Principle 3: Protection beyond national borders - Radioactive waste shall be managed in such a way as to assure that possible effects on human health and the environment beyond national borders will be taken into account.

Principle 4: Protection of future generations - Radioactive waste shall be managed in such a way that predicted impacts on the health of future generations will not be greater than relevant levels of impact that are acceptable today.

[6] Near surface disposal is commonly used for LLRW and short-lived ILRW – deeper disposal is required for long-lived ILRW.

Principle 5: Burdens on future generations - Radioactive waste shall be managed in such a way that will not impose undue burdens on future generations.

Principle 6: National legal framework - Radioactive waste shall be managed within an appropriate national legal framework including clear allocation of responsibilities and provision for independent regulatory functions.

Principle 7: Control of radioactive waste generation - Generation of radioactive waste shall be kept to the minimum practicable.

Principle 8: Radioactive waste generation and management interdependencies - Interdependencies among all steps in radioactive waste generation and management shall be appropriately taken into account.

Principle 9: Safety of facilities -The safety of facilities for radioactive waste management shall be appropriately assured during their lifetime.

In Safety Series 111-G-3.1[iii], a set of site selection criteria for near surface LLRW disposal facilities was published. While the requirements of disposal are significantly more demanding than storage, these criteria provide useful guidance. The criteria are:

Geology - the geological setting at the site should contribute to the isolation of waste and the limitation of releases of radionuclides to the biosphere. It should also contribute to the stability of the disposal system and provide sufficient volume and engineering properties favourable for implementing disposal. Preference should be given to sites with a uniform and predictable geology which can be readily characterized through geological investigative techniques.

Hydrogeology - the hydrogeological setting of the site should include low groundwater flow and long flow paths in order to restrict the transport of radionuclides. Expected changes in important hydrogeological conditions (e.g. gradient) due to natural events and the disposal should be evaluated. Preference should be given to sites with a simple geological setting that could make characterizing or modelling of the hydrogeological system easy. The dispersion characteristics of the hydrogeological system may also be important and should be evaluated.

Geochemistry - the geochemistry of groundwater and the geological media should contribute to limiting the release of radionuclides from the disposal facility and should not significantly reduce the longevity of engineered barriers. Preference should be given to sites where geochemical conditions promote sorption and precipitation/co-precipitation of radionuclides potentially released from the disposal system and inhibit the formation of easily transportable chemical compounds of radionuclides.

Tectonics and Seismicity - the site should be located in an area of low tectonic and seismic activity such that the isolation capability of the disposal system will not be endangered. Areas of low tectonic and seismic activity should be selected in the regional analysis. Preference should be given to areas or sites where potential for adverse tectonic, volcanic or seismic events is sufficiently low that it would not affect the ability of the disposal system to meet safety requirements.

Surface Processes - surface processes such as flooding of the disposal site, landsliding or erosion should not occur with such frequency or intensity that they could affect the ability of the disposal system to meet safety requirements. The disposal site should be generally well drained and free of areas of flooding or frequent ponding. Accumulation of water in upstream drainage areas due to precipitation, snowmelt, failure of water control structures, channel obstruction or landsliding should be evaluated and minimized so as to decrease the amount of runoff which could erode or inundate the facility. Preference should be given to areas or sites with topographical and hydrological features which preclude the potential for flooding.

Meteorology - the site area meteorology should be characterized such that the effect of unexpected extreme meteorological conditions can be adequately considered in the design and licensing of the disposal facility. The potential for extreme meteorological events should be evaluated. Potential sites may be screened on the basis of the severity of the effects of such events.

Man-Induced Events - the site shall be located such that activities by present or future generations at or near the site will not be likely to affect the isolation capability of the disposal system. Areas in the immediate vicinity of major hazardous facilities, airports or transport routes carrying significant quantities of hazardous materials, should be evaluated. In addition, areas or sites should be evaluated where valuable geological resources or potential future resources, including groundwater suitable for irrigation or drinking, are likely to give rise to interference activities resulting in the release of radionuclides in quantities beyond the acceptable limits. A site should be considered less suitable where previous or future activities could create significant release pathways between the projected facility and the biosphere. Screening of potential sites should include consideration of the distance from such facilities and the associated impact.

Transportation of Waste - the site shall be located such that the access routes will allow transportation of waste with a minimal risk to the public. Parameters including cost, radiation exposure and accident potential associated with the transportation of waste to the disposal site should be taken into account.

Land Use - Land use and ownership of land should be considered in connection with foreseeable development and regional planning in the area of interest. Future uses of the land in the vicinity of the proposed site should be evaluated for potential impact on the operation and performance of the disposal facility, and vice versa. Jurisdiction over the land, or ownership, may in some countries be a significant factor with respect to economics and public acceptance. Early control or ownership of the site by the operator or government would simplify the site planning and evaluation efforts, shorten the time required for activation of the facility and reduce the problems associated with the withdrawal of land from other uses.

Population Distribution - The site should be located such that the potential hazard of the disposal system on the current population and projected future population is acceptable. Consideration should be given to avoiding areas of high population density. The selection of candidate sites should be performed on the basis of appropriate suitability factors, taking into account the likelihood of future disturbances and radiation protection aspects of the population potentially affected by the releases of radionuclides from the disposal facility.

Note that the site selection criteria are not numerically precise statements, but rather general statements of what is not allowed, and what is preferred – exclusionary and preference criteria. As such, these are statements of general objectives rather than criteria. This is also true of United States of America (US) and Australian "criteria" that follow.

4.3 US Site Suitability Requirements

4.3.1 Comparison of the Characteristics of Storage Facilities

Siting requirements that apply to storage-only facilities in the United States are generally much less demanding than those applicable to disposal facilities. This fact hinges on the intentions for final disposition of the waste managed at the facility and other issues that are relevant only at time following closure with waste left on-site. The presence or absence of the waste at the facility following decommissioning is a key factor in choosing siting criteria for radioactive waste management facilities.

For possession, processing, and storage facilities, the radiological hazards are present only as long as the waste remains in the facility. When the waste is removed and the facility decommissioned, no appreciable hazard remains. Thus the role of the site in protecting the public and the environment is important only through the operating life and a short decommissioning period. Therefore, the siting criteria for facilities licensed for possession and processing (including storage) are much less rigorous than those for disposal facilities.

For disposal facilities, where the waste will remain for centuries, providing assurance a priori that the public and the environment will be protected because the site will be actively managed and controlled for centuries is impossible, despite the fact that the facility may indeed remain secure. Thus, the conservative assumption that institutional control will be lost is a fundamental principle in the licensing of a radioactive waste disposal facility in the US.

Therefore, the philosophy has been adopted in the US that the site must be stable in the long-term and that decommissioned facility must not require ongoing active maintenance. In other words, the decommissioned facility must isolate the waste and provide adequate protection to the environment, members of the general public, and inadvertent intruders through reliance on passive features alone.

A prominent passive feature of the disposal system is the natural site at which the disposal facility is developed. Thus, criteria for developing a disposal facility place high priority on the selection of the site to ensure that the decommissioned facility will not create unacceptable radiological hazards.

4.3.2 Site Characteristic Requirements for Storage Facilities

As noted above, US regulatory agencies such as the US Nuclear Regulatory Commission (NRC) have imposed significantly different site suitability requirements on storage and disposal facilities. Siting requirements for one type of facility licensed for possession and processing only (namely, fuel cycle facilities; NRC-1986[iv] and NRC-2002[v]), are typical of those for all radioactive material possession and processing licenses.

These documents require little more than a description of site characteristics and state no site selection criteria. NRC-1986 requires only that the applicant provide "... a description of the geographic, demographic, meteorologic, hydrologic, seismologic, and geographic characteristics of the site and its surroundings."

Since NRC-1986 is quite dated, concern remains for the adequacy of such a simple requirement after nearly 20 years of technological and regulatory evolution. However, as late as 2002, the US NRC reiterated these same fundamental siting requirements in NRC-2002. In this document, the NRC did, however, elaborate upon the type of information expected for each topic in a licence application. This additional guidance is summarized in Table 4.1.

Table 4.1 US Site Description Requirements for Fuel Cycle Facility Licence Applications (NRC-2002)

General Requirement	Elaboration
Site Geography	Site Location: State, county, municipality, topographic quadrangle (eight 7 ½ minute quadrants, site boundary, and controlled area boundary. Major nearby highways Nearby bodies of water Any other significant geographic feature that my impact accident analysis within 1 mile of the site (e.g., ridges, valleys, specific geographic structures)
Demographics	Latest census results for area of concern Description, distance, and direction to nearby population centres Description, distance, and direction to nearby public facilities (e.g., schools, hospitals, parks) Description, distance, and direction to nearby industrial areas or facilities that may present potential hazards (including other nearby nuclear facilities) Uses of land within 1 mile for the facility (i.e., residential, industrial, commercial, agricultural) Uses of nearby bodies of water
Meteorology	Primary wind directions and average wind speeds Annual amount and forms of precipitation, as well as the design-basis values for accident analyses of maximum snow or ice load and probable maximum precipitation Type, frequency, and magnitude of severe weather (e.g., lightning, tornado, hurricane) and design-basis event summary descriptions for accident analysis
Hydrology	Characteristics of nearby rivers, streams, and bodies of water as appropriate. Depth to the water table and potentiometric surface map Groundwater flow direction and velocity for the site Characteristics of the uppermost aquifer Design-basis flood events used for accident analysis
Geology	Characteristics of soil types and bedrock Design-basis earthquake magnitudes and return periods used for accident analysis Descriptions of other geologic hazards (e.g., mass wasting)

The elaboration presented in Table 4.1 does not state requirements of site characteristics. Rather, the only requirement is that the characteristics of the site be described.

NRC-2002 states with slight additional clarification, that the site description is acceptable if the information elaborated in Table 4.1 above is provided. NRC-2002 also states that the descriptions will be acceptable if they include earthquake accelerations for the 250- and 500-year return earthquakes. It would be difficult indeed to infer siting criteria from the regulatory guidance provided by the NRC for such possession and processing facilities.

The licence applicant must make a demonstration that the facility will adequately protect the public, the environment, and facility workers. This demonstration will involve site characteristics. NRC-2002 describes the Integrated Safety Assessment (ISA) Summary that would make this demonstration for a possession licence. Guidance on preparing ISAs (NRC 2001[vi]), however, adds little further light on either the type of information that should be provided or on any criteria that should be considered applicable for a materials licence.

In an ISA, the applicant must demonstrate that the operation of the facility protects the safety of both facility workers and members of the general public that might be exposed to radiation or radioactive materials originating from the proposed facility. The radiation protection standards of Part 20 of Title 10 of the US Code of Federal Regulations (10 CFR 20) provide the only real measure of site characteristics. However, even this guidance is insufficient by itself to determine what are appropriate site characteristics.

The ISA will present analyses that demonstrate that the radiation protection standards of 10 CFR 20 are satisfied. This requires consideration of all modes of radiation exposure. The modes of exposure range from direct radiation (external gamma radiation) to ingestion and inhalation of radioactive materials released from or present in the facility. Site characteristics do not influence direct radiation exposures but are important factors in exposures resulting from ingestion and inhalation. The concentrations of radioactive materials in food, drink, and air are strongly influenced by releases from the facility and by such site characteristics as:

- Meteorology;
- Groundwater hydrology;
- Surface water hydrology; and
- Plant and animal uptake of radioactive materials.

In 1998, the US Department of Energy's (DOE) Low-Level Waste Management Program prepared a possible licensing strategy and review of issues related to a novel concept called an "Assured Isolation Facility" (DOE-1998[vii]).

An Assured Isolation Facility (AIF) is a facility that is sited, designed, and constructed to preserve the mutually exclusive options of (1) retrieving waste stored on-site and (2) converting the storage facility to disposal at some future date. The decision of whether to retrieve or convert was determined to be a business decision that is the responsibility of the facility developer.

However, from a regulatory perspective, the facility is a storage facility until such time as an application is received to convert it to a disposal facility. Thus, only siting criteria appropriate for a waste storage facility were judged to be applicable to the initial licensing of the AIF. Considering siting criteria suitable for a disposal facility was determined to be the option available to the facility developer.

DOE-1998 concludes that "... the AIF can and should be viewed as a materials licence facility comparable to those licensed in the past under 10 CFR Parts 30, 40, and 70, and the appropriate radiation protection guidance of Part 20."

In 2000, the Texas Natural Resources Conservation Commission (TNRCC) prepared a comprehensive overview of low-level radioactive waste management alternatives (TNRCC-2000[viii]). A major focus of this work was a review of criteria for the concept of an assured isolation facility. TNRCC's recommendations for siting criteria for an AIF that was developed with the intent to retrieve waste for disposal off-site are summarized as follows:

- Site the facility so that members of the general public, facility workers, other persons, and the environment are appropriately protected.
- Site characteristics provide assurance that disruptive events or processes are unlikely to affect the ability of the facility to meet its performance objectives during its operating life.
- The site is qualified on the basis of existing information without requiring exhaustive and invasive investigations.

Site characteristics as used above were further defined to involve geology, groundwater hydrology, surface water hydrology, meteorology, climatology, geography, and demography.

4.3.3 Site Characteristic Requirements for Disposal Facilities

Site suitability requirements for a LLRW disposal facility are stated in 10 CFR 61.

An important philosophy of LLRW disposal involves reliance on only site characteristics and passive features without active intervention or reliance on active measures. Many of the site suitability requirements for disposal exist because the final disposition of the waste is disposal at this site. Thus, in disposal facilities, isolation of the waste from the biosphere relies primarily on site characteristics and secondarily on engineered features of the constructed facility.

For the interim store facility, the final waste disposition is at a site other than the site of the interim store facility. Thus, those site suitability requirements that relate primarily to disposal and provide for dominant reliance on passive measures following facility decommissioning are less appropriate for the interim store facility.

4.3.4 Development of Site Characteristic Requirements for Interim Storage Facilities

The applicability of LLRW disposal site suitability requirements to the interim store facility is assessed in Table 4.2, based on the regulatory requirements of 10 CFR 61.

Table 4.2 Applicability of 10 CFR 61 Site Suitability Requirements to an Interim Store

10 CFR 61 Site Suitability Requirement	Applicability	Reason
Isolate wastes	No	Waste will be removed prior to facility decommissioning
Ensure that the long-term performance objectives are met	No	Waste will be removed prior to facility decommissioning
Releases produce dose less than 0.25 / 0.75 / 0.25 mSv/yr to the whole body, thyroid, and to any other organ of any member of the public	No	Applies primarily to Post-closure when no waste will be present at the facility; Release requirements during operations are addressed below
Protect against inadvertent intrusion	No	Post-closure requirement only, when no waste will be present
Protect during Operations	Yes	Related to 10 CFR 20 radiation protection standards that are applicable to all radioactive material licensees
Long-term stability of closed facility	No	Post-closure requirement only, when no waste will be present
The disposal site shall be capable of being characterized, modelled, analysed and monitored	Partially	Operations must be monitored; Characterization, modelling, and analysis not generally required in this manner for a storage-only facility
Projected population growth and future developments in vicinity of site are not likely to affect the ability of the disposal facility to meet the performance objectives	Yes, but only as they apply to operations	Related to radiation protection standard that is applicable to all radioactive material licensees
Avoid areas having known natural resources which, if exploited, would result in failure to meet the performance objectives	No	Encroachment controlled during operating life by existing institutional controls; No need for this restriction after waste is removed prior to decommissioning.
Site is well drained	No	Any site deficiencies can be addressed during the operating life with standard engineering practice and features and active measures.
Site is free of areas of flooding or frequent ponding	Yes	Any site deficiencies can be addressed during the operating life with standard engineering practice and features and active measures.
Waste disposal does not take place in a 100-year flood plain, coastal high-hazard area, or wetland	Yes	Typically required of new facilities.
Upstream drainage areas minimize the amount of runoff which could erode or inundate waste disposal units.	Partially	Any site deficiencies can be addressed during the operating life with standard engineering practice and features and active measures.

10 CFR 61 Site Suitability Requirement	Applicability	Reason
Disposal site provides sufficient depth to the water table that ground water intrusion, perennial or otherwise, into the waste will not occur.	No	Any site deficiencies can be addressed during the operating life with standard engineering practice and features and active measures.
The hydrogeologic unit used for disposal shall not discharge ground water to the surface within the disposal site.	No	Any site deficiencies can be addressed during the operating life with standard engineering practice and features and active measures.
Avoid areas where tectonic processes such as faulting, folding, seismic activity, vulcanism, or similar phenomena may occur with such frequency and extent to significantly affect the ability of the disposal site to meet the performance objectives	Partially	Recovery from catastrophic events should be considered but any site deficiencies can be addressed during the operating life with standard engineering practice and features and active measures.
Avoid areas where tectonic processes may preclude defensible modelling and prediction of long-term impacts.	Partially	Recovery from catastrophic events should be considered but any site deficiencies can be addressed during the operating life with standard engineering practice and features and active measures. Modelling of long-term impacts not relevant.
Avoid areas where surface geologic processes such as mass wasting, erosion, slumping, land-sliding, or weathering occur with sufficient such frequency and extent to significantly affect the ability of the disposal site to meet the performance objectives	Partially	Recovery from catastrophic events should be considered but any site deficiencies can be addressed during the operating life with standard engineering practice and features and active measures.
Avoid areas where surface geologic processes may preclude defensible modelling and prediction of long-term impacts.	Partially	Recovery from catastrophic events should be considered but any site deficiencies can be addressed during the operating life with standard engineering practice and features and active measures. Modelling of long-term impacts not relevant.
Disposal site is not located where nearby facilities or activities could adversely impact the ability of the site to meet the performance objectives [that apply during operations]	Yes	Radiation protection standard that is applicable to all radioactive material licensees
Disposal site is not located where nearby facilities or activities could significantly mask the environmental monitoring program.	Yes	Radiation protection standard that is applicable to all radioactive material licensees

Evaluation of site suitability requirements for storage and disposal facilities in the US leads to the recommendations summarized in Table 4.3. These requirements are considered applicable to the siting of a storage facility in the US:

Table 4.3 Summary of Siting Requirements Appropriate to Licensing of a Storage Facility in the United States.

Requirement	Characteristics to be Described for Storage Facility				
	Site Geography	Demographics	Meteorology	Hydrology	Geology
TNRCC Siting Requirement Recommendations for Assured Isolation Facility					
The site contributes to protecting members of the general public, facility workers, other persons, and the environment.			X	X	X
Disruptive events or processes are not likely to affect the ability to meet performance objectives during its operating life.			X	X	X
The site is qualified using existing information without exhaustive and invasive investigations.	X	X	X	X	X
Disposal Siting Requirement Applicable To Storage					
The site is capable of being monitored				X	X
Avoid areas where projected population growth and future developments in vicinity of site could affect the ability of the disposal facility to meet the performance objectives	X	X			
Avoid 100-year flood plain, coastal high-hazard area, and wetlands				X	
Avoid areas where tectonic processes may occur with such frequency and extent to significantly affect the ability of the disposal site to meet the performance objectives					X
Avoid areas where surface geologic processes occur with sufficient such frequency and extent to significantly affect the ability of the disposal site to meet the performance objectives			X		X
Avoid nearby facilities or activities that could compromise ability to meet performance objectives or identify releases from the facility	X	X			

4.4 Australian Site Selection Criteria

4.4.1 Introduction

The *Code of practice for the near-surface disposal of radioactive waste in Australia* (NHMRC 1992[ix]) states that "A near-surface repository site ideally should be located in an area with favourable meteorological, geological and geographical characteristics so that the radioactive waste, once in place, will be adequately isolated from the biosphere for the time that the radionuclides originally present, or their progeny, constitute a radiation hazard." There currently is no specific Australian Code of Practice for the interim storage of radioactive waste. The site selection criteria in the NHMRC 1992 Code are presented in Table 4.4.

Table 4.4 NHMRC 1992 Site Selection Criteria

Near Surface Disposal Site Selection Criteria	Issues
The facility site should be located in an area of low rainfall, should be free from flooding and have good surface drainage features, and generally be stable with respect to its geomorphology.	Low rainfall.
	Free from flooding.
	Good surface drainage.
	Stable geomorphology.
The water table in the area should be at a sufficient depth below the planned disposal structures to ensure that groundwater is unlikely to rise to within five metres of the waste, and the hydrogeological setting should be such that large fluctuations in water table are unlikely.	Water table at sufficient depth.
	Large fluctuations should be unlikely.
The geological structure and hydrogeological conditions should permit modelling of groundwater gradients and movement, and enable prediction of radionuclide migration.	Modelling of groundwater gradients and movement and thus radionuclide migration should have a high degree of certainty and reliability.
The disposal site should be located away from any known or anticipated seismic, tectonic or volcanic activity which could compromise the stability of the disposal structures and the integrity of the waste.	Away from seismic, tectonic or volcanic activity.
The site should be in an area of low population density and in which the projected population growth or prospects for future development are also very low.	Low population density, growth, and future development.
The groundwater in the region of the site which may be affected by the presence of a facility ideally should not be suitable for human consumption, pastoral or agricultural use.	Groundwater ideally not suitable for human consumption, pastoral or agricultural use.
The site should have suitable geochemical and geotechnical properties to inhibit migration of radionuclides and to facilitate repository operations.	Geochemical and geotechnical properties to inhibit migration of radionuclides, and to facilitate repository operations.
The site for the facility should be located in a region which has no known significant natural resources, including potentially valuable mineral deposits, and which has little or no potential for agriculture or outdoor recreational use.	No known significant natural resources. Potential for agriculture or outdoor recreational use.
The site should have reasonable access for the transport of materials and equipment during construction and operation, and for the transport of waste to the site.	Existing major roads and railways should provide reasonable access.
The site should not be in an area which has special environmental attraction or appeal, which is of notable ecological significance, or which is the known habitat of rare fauna or flora.	Special environmental attraction, notable ecological significance, known habitat of rare fauna or flora.
The site should not be located in an area of special cultural or historical significance.	Cultural or historical significance. Or proposed listing.
The site should not be located in reserves containing regional services such as electricity, gas, oil or water mains.	Regional services.
The site should not be located in an area where land ownership rights or control could compromise retention of long-term control over the facility.	Land ownership and retention of control.

The proposed Interim Store will have an operational life expectancy of 50 years, and will be designed to completely isolate the waste from the surrounding environment for this period of time. The site selection criteria will thus be quite different from those used to locate disposal sites. Nevertheless, many of the above criteria are also applicable to some extent to a storage facility.

4.5 Recommended Site Selection Criteria for an Interim Store

The high degree of overlap of the criteria from various sources is because the authorities that produce criteria for a particular local purpose tend to refer to and improve upon the same original sources. The criteria have therefore been analysed many times by specialists in the field, and should now be considered a very mature and comprehensive set of criteria for selecting suitable sites for near surface disposal.

As discussed above, however, the criteria for a storage only facility can be significantly less stringent without compromising levels of safety. Table 4.5 below shows some of the differences in the key characteristics of disposal facilities and storage facilities.

Table 4.5 Summary of Factors that Influence the Choice of Siting Criteria for Storage and Disposal Facilities.

Characteristic	Treatment/ Storage Facility	Disposal Facility
Final Disposition of Waste	Off-site disposal	On-site disposal
Duration of Period Requiring Adequate Protection	Decades	Centuries
Duration of Facility and Environmental Monitoring	Decades	Centuries
Reliance on Active Characteristics/Features during Operations	High	High
Reliance on Active Characteristics/Features following Decommissioning	Not applicable	Low
Reliance on Passive Characteristics/Features during Operations	High	High
Reliance on Passive Characteristics/Features following Decommissioning	Not applicable	High
Reliance on Site Characteristics	Low	High
Reliance on Engineered Features	High	Moderate
Reliance on Management and Administrative Controls	High during Operations	High during Operations
Potential for Residual Radioactivity following Decommissioning	Low	Moderate (Waste is left in place, albeit in disposed condition)
Construction	Common	High Quality; Most Durable
Performance Assessment Required for Licensing	Minimal	Extensive
Level of Quality Assurance in Design, Construction, Operation, and Closure	Moderate	High
Bases for Financial Assurance Requirements	Off-site waste disposal; Facility decommissioning; Short period for environmental monitoring after decommissioning	On-site waste disposal; Facility decommissioning; Extended period of environmental monitoring and custodial care of site after decommissioning; Potential need for corrective action

Considering all of the information obtained from both previous Australian and Overseas sources, it is recommended that the criteria listed in Table 4.6 below should be used to identify a suitable site for the Interim Store.

Table 4.6 Recommended Site Selection Criteria

Interim Store Selection Criteria	Issues
Safety of People The site should be in an area of low population density and in which the projected population growth or prospects for future development are also very low. The site should be relatively easy to secure and protect The site should not be located in an area of special cultural or historical significance.	Low population density, growth, and future development. Security. Cultural or historical significance or proposed listing.
The receiving environment The water table in the area should be at a sufficient depth below the planned disposal structures to ensure that groundwater is unlikely to rise to within half a metre of the floor, and large fluctuations in water table are unlikely. The site should not be in an area which has special environmental significance, or which is the known habitat of rare fauna or flora.	Water table at sufficient depth and large fluctuations should be unlikely. Special environmental attraction, notable ecological significance, known habitat of rare fauna or flora.
Geological/seismic hazards The site should be located away from any known or anticipated seismic, tectonic or volcanic activity that are likely to compromise the stability of the structures and the integrity of the waste during its operating life.	Away from seismic, tectonic or volcanic activity.
Local environmental hazards The facility site should be located in an area that is free from flooding (unlikely to flood during its operational life).	Free from flooding.
Operational Criteria The site should have reasonable access for the transport of materials and equipment during construction and operation, and for the transport of waste to the site.	Existing major roads and railways should provide reasonable efficient access.
Other Criteria The site should not be located in an area where land ownership rights or control could compromise retention of long-term control over the facility. The site should be located in an area where existing and potential land uses are mutually compatible.	Land ownership and tenure. Compatible with other local land uses.

4.6 Ranking of Criteria

The site selection process will need to consider all of the above criteria. Some criteria, however, are absolutely essential to the success of the facility while some others will have a relatively minor impact. The criteria have been assessed and ranked on a scale of A (most important during the operational life) to C (least important), in Table 4.7 below.

Table 4.7 Selection Criteria Ranking

Interim Store Selection Criteria	Discussion	Ranking
Safety of People		
Population density	While a store, compared with a disposal facility, will be much smaller and have a finite service life, it is still relatively important to locate it away from high population density areas.	B
Security	Very important issue given the current terrorism issues and public concerns	A
Cultural or historical significance	As the store will be very small and have a finite service life, this issue is of relatively low priority.	C
The receiving environment		
Water table	Groundwater intrusion into a storage facility would be very undesirable.	A
Rare fauna or flora	The store will be very small and have a finite service life so this issue is likely to be relatively easy to manage but important to address properly.	B
Geological/seismic hazards		
Seismic, tectonic or volcanic activity during operating life	Very important issue	A
Local environmental hazards		
Flooding during operating life	Very important issue	A
Operational Criteria		
Transport	Transport risks are well understood but need to be considered.	B
Other Criteria		
Land ownership and tenure	Very important issue	A
Land uses	The store will have very low potential to impact on other land uses in the area of the site	C

5.1 Introduction

The structural design criteria of the Interim Store are based on several assumptions as follows:

- A target volume of 100 m^3 of waste to be accommodated:
  - ILRW - 35 m^3;
  - LLRW - 20 m^3; and
  - Contingency - 45 m^3;
- A design life of at least 50 years;
- Clear Waste Acceptance Criteria (WAC) will be developed and suitable waste will be transported in a “conditioned” form suitable for transport and final disposal, such as in metal drums, to the facility by trucks; and
- The trucks will not enter inside the facility but be positioned so that a forklift will be able to off-load the drums and then place them in designated or segregated areas within the facility.

5.2 Description

A facility that would satisfy these requirements would be a single above ground building. The building would be constructed as two separate components, one as a storage facility and the other as an enclosure to the facility. A preliminary concept design is provided in Figure 5.1.

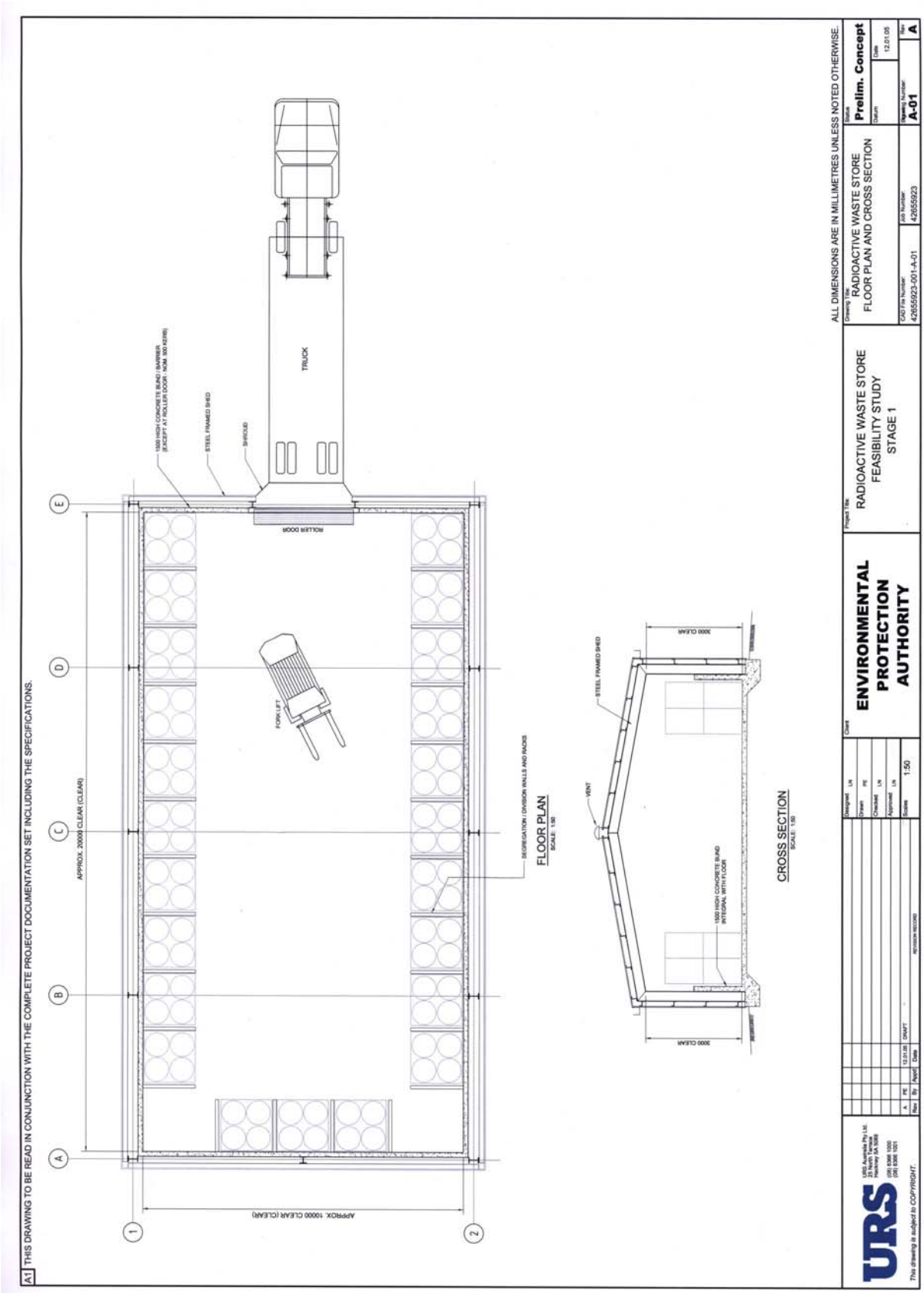

Figure 5.1 - Preliminary Concept Design

The storage facility would consist of a concrete base and concrete bund walls up to 1.5 m high all round except at the loading bay where a 500 mm high bund would be adopted. The bunds would serve as a collection for waste spillage and also to prevent damage to the building by the forklift. Within the facility, areas would be formed with concrete dividing walls and roofs to segregate the high radiation wastes, such as ILRW. The base would also incorporate a floor drain system with a sump to collect any potentially contaminated water.

The enclosure component of the building would consist of a steel framed shed that envelopes the storage facility. It would house ventilation, smoke and fire detection and suppression systems, and monitoring systems that would provide an early warning if any packages were to leak. It is considered that natural roof ventilation would be suitable, however a filtered ventilation system could be provided, and the elements periodically analysed for radioactivity.

The storage facility building would be enclosed within a perimeter security fence with a guard station at the gate to control access (if this is not practical, a system that provides similar levels of access control will need to be employed). Trucks arriving at the facility would be inspected at the gate and, if approved for entry, would be admitted into the facility and proceed to a loading area.

At the loading area, the waste would be offloaded from the trucks and carried by forklift to the appropriate waste storage area. High activity wastes, such as ILRW, would be segregated to a particular area of the building. All waste containers will be labelled indicating the class of radioactive waste.

5.3 Design and Structural Criteria

The structural criteria relating to the impacts or risks of wind and earthquake forces will be very dependant on site selection. Wind forces on a structure depend on the surrounding terrain, topography, the building shape and size and its orientation to the prevailing wind direction. Earthquake forces are, however, dependent on the regional geology, soil profile and proximity to major faults that form the basis for earthquake risk and the maximum ground motions to be experienced.

The AS/NZS 1170 series, Structural Design Actions, specifies general procedures and criteria for the structural design and is applicable to whole buildings or structures and their elements. The series has the following parts:

- Part 1: Permanent (dead load), imposed (live load) and other actions;
- Part 2: Wind actions;
- Part 3: Snow and ice actions; and
- Part 4: Earthquake actions.

The Interim Store will be designed to comply with all requirements of the Building Code of Australia and the 1170 series of standards.

5.4 Shielding and Ventilation

In order to satisfy the principle of ensuring radiation doses are as low as reasonably achievable (the ALARA principle), the Interim Store will be designed and operated in a way that:

- maximises the distance between the waste and people;
- minimises the time workers will need to be near the waste; and
- provides shielding where required.

Most of the waste stored at the Interim Store will not require special shielding due to the low levels of radiation involved. Nevertheless, the store will be designed so that the equivalent dose rate in any external area accessible to members of the public is as low as is reasonably achievable and less than 25 microsievert (µSv) per hour.

At ground level the internal walls will be made of concrete up to a height of 1.5m, thus providing some shielding to external areas of the site. In addition, access to the site and in particular the building, would only be available to authorised personnel who will be trained in radiation protection and the particular procedures to follow to minimise radiation exposure. Thus the potential need for shielding relates mainly to handling of ILRW.

As indicated in the description above, the building would be divided into areas formed with concrete dividing walls to segregate the high radiation wastes and provide shielding. The geometry of these walls will be designed to provide adequate shielding to workers within the building.

Waste acceptance criteria will be developed to ensure that no waste is stored in a form that presents a risk to the safety of the facility, such as liquid or gas leaks, and flammable, corrosive or combustible materials. Furthermore, as radon may be an issue, natural roof ventilation would be provided, and monitoring will be conducted to ensure that radon is not a hazard to workers or the environment. As noted in Section 5.2, a filtered ventilation system could be provided if necessary.

The design of the building, the operating system and the operational procedures employed by workers would need to ensure that:

- no member of the general public can receive a radiation dose of 1 mSv per year (lower if regulatory authorities apply a dose constraint);
- no worker will receive a radiation dose of 50 mSv per year or 100 mSv over 5 years; and
- radiation doses are in accordance with the ALARA principle.

5.5 Security

Depending on the location of the site, a security fence will probably form the first line of security for the facility. The fence should be clearly signposted so that inadvertent intruders are deterred.

The second line of security will be the physical strength of walls and access doors. The walls will be solid concrete up to 1.5 m. The doors will be strengthened to ensure that access is difficult even for determined intruders. All waste containers will be labelled indicating that the contents are radioactive, thereby providing an additional deterrent to intruders.

An alarm system would be designed to both inform security service providers, and to inconvenience intruders (loud alarms, flood lighting etc). Depending on the location, regular patrols of the site might be feasible.

Finally an operational system will be employed to ensure that on site facilities are not used to assist intruders. For example, no heavy lifting or cutting equipment would be kept on site, and forklifts would be brought in for use only during loading or unloading operations.

5.6 Safe Handling and Treatment

The systems will be designed to minimise the need to handle waste. Waste will be packaged in standardised containers (such as 205 L steel drums) that are clearly colour coded, numbered and labelled as radioactive material. An electronic database will record the waste information and storage location of each waste package placed in the facility.

Conditioned waste will then be stored in a state that is suitable for final disposal. There will be little need to transfer waste once it is stored within the facility, other than to remove it for final disposal or retrieval, should that be permitted.

It is envisaged that storage containers will be moved by a forklift that is brought to site only when transfers are required. Depending on the activity of the conditioned waste, special shielding may be required for moving some ILRW.

6.1 Commonwealth Approvals

6.1.1 Matters of national environmental significance

Under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC), actions that are likely to have a significant impact on a matter of national environmental significance are subject to a comprehensive referral, assessment, and approval process. The Act currently identifies seven matters of national environmental significance, one of which is nuclear actions.

The proposed Interim Store potentially falls within the EPBC definition of a nuclear action in that it seeks to establish a nuclear installation that is to accommodate an "excessive[7]" quantity of radioactive waste. EPBC Regulations 2.02 (1) and (2) set the activity levels above which an action would be deemed a nuclear action. The appropriate limit in this case is such that if the sum of: the sealed source activity values[8] divided by 10^9; and the unsealed source activity value divided by 10^6, are greater than 1, then the quantities are excessive and the establishment of a nuclear installation is a nuclear action.

The current total activity of the ILRW in South Australia is 6.8×10^{12} and it is planned to store this waste with unsealed wastes. The audit data contained insufficient detail on the activities of individual sources to do a specific calculation with respect to the exemption limits. However, even if all sources were Sr90 or Cs137, each with an exempted activity limit of 10^4, the sum of: the sealed source activity values divided by 10^9; and the unsealed source activity value[9] divided by 10^6, would be less than 1 (ie, $6.8 \times 10^{12}/10^4/10^9=0.68$).

Thus the current inventory of waste does not meet the definition of "excessive". Future wastes, however, particularly ILRW, could cause the threshold to be exceeded. If the combination of sources in the store in the longer term was to meet the definition of "excessive" then the Store would fall within the EPBC definition of a nuclear installation and thus the proposal to build an Interim Store will be a nuclear action.

However, if the SA Government were to commit that the Store would be managed in the future such that the threshold would not be reached, it would appear that the long-term use of the Store would be outside the EPBC definition. It is recommended that the EPA should seek legal advice as to whether the Store will be a nuclear action.

The discussion below is provided for completeness, in event that the legal advice is that the Store is considered to be a nuclear action.

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[7] The definition of "excessive" is complex and refers to Schedule 2 of the Australian Radiation Protection and Nuclear Safety (ARPNS) Regulations 1999.

[8] The activity values are calculated for each nuclide by dividing the activity of the nuclide by the activity mentioned in column 4 of Part 2 of Schedule 2 to the ARPNS Regulations for the nuclide.

[9] The activity values of unsealed sources is not known but thought to be relatively insignificant.

6.1.2 Decision on whether an action needs approval

A nuclear action will require approval from the Commonwealth Environment Minister if it has, will have, or is likely to have a significant impact on the environment. All nuclear actions should be referred to the Commonwealth Environment Minister for a decision on whether approval is required. In order to decide whether an action is likely to have a significant impact, it is necessary to take into account the nature and magnitude of potential impacts.

An action does not require approval from the Commonwealth Environment Minister under the Act if:

- the action is approved under, and taken in accordance with, a State management plan that is accredited by the Commonwealth for the purposes of a bilateral agreement (see section 46 of the Act), or
- the action has been authorised by a Government decision on which the Minister's advice has been sought (see section 160 of the Act).

If the Minister decides that an action requires approval, then the proposed action is called a “controlled action” and an environmental assessment must be carried out. The Minister decides whether to approve the action, and what conditions to impose, after considering the environmental assessment.

A referral should contain information about the proposed action, including a description of the proposal, its location and potential impacts. The referral must also state whether the proposed action is considered to be a controlled action.

Referrals are submitted to the EPBC Act Referrals Section of the Department of the Environment and Heritage, and the referral process takes 20 business days from when the Department receives a referral. During this time, the referral will be posted on the Department's website for public comment for 10 days.

6.1.3 Controlling provisions and assessment process

If the referred action is determined to be a controlled action, then the decision-maker will identify the controlling provisions (or EPBC triggers) for the proposal. In some cases, an action may not require approval if it is taken in accordance with a manner specified in the referral.

For nuclear actions, the matter protected by the Act is the whole environment (not just matters of national environmental significance) and information must be included about the nature and extent of the likely impacts on the environment. The environment includes:

- ecosystems and their constituent parts, including people and communities;
- natural and physical resources;
- the qualities and characteristics of locations, places and areas; and
- the social, economic and cultural aspects of these things.

Having determined the controlling provisions, the Commonwealth Environment Minister will select one of the five options:

1. preliminary documentation – likely when:
   - the number and complexity of relative impacts is low and locally confined; or
   - the relevant impacts of the controlled action can be predicted with a high degree of confidence; or
   - the relevant impacts are being adequately assessed under State legislation.
2. public environment report (PER) – required when:
   - an assessment of the relevant impacts is expected to focus on a relatively small number of key issues; and
   - an adequate assessment of these issues will require the collection of new information and/or further analysis of existing information.
3. environmental impact statement (EIS) – required when:
   - an assessment of the relevant impacts is expected to raise complex issues, or a large number of issues; and
   - an adequate assessment of these issues will require the collection of new information and/or further analysis of existing information.
4. public inquiry – may be required when:
   - the relevant impacts are likely to be relatively high; or
   - the relevant impacts, or the management of those impacts, are outside the control of a single proponent; or
   - a public inquiry is necessary or desirable to ensure effective and efficient public involvement in the assessment process.
5. an accredited assessment process – may be accepted where it is agreed that a State will manage the assessment, or the Commonwealth will do so under other legislation. This assessment approach allows appropriate case-by-case accreditation of State assessment processes in situations where bilateral agreements and declarations do not apply. The Commonwealth Environment Minister must be satisfied that certain standards will be met, that the process will ensure the relevant impacts of the action will be fully addressed and that he or she will receive an adequate report on those impacts.

   Alternatively, if a 'bilateral agreement' is in place that accredits the SA assessment process, the SA Minister will assess the action under the terms of that agreement. This means that a single assessment

process can be carried out to satisfy both State and Commonwealth requirements.

At the present time there is no bilateral agreement in place between South Australia and the Commonwealth. Thus, the State assessment process could be used if it were accredited for use by the Commonwealth Environment Minister for the Interim Store project.

If the Commonwealth Environment Minister decides on assessment by preliminary documentation, PER or EIS, the following steps need to be taken:

1. the person proposing to take the action prepares and publishes draft assessment documentation, in accordance with regulations and published guidelines;
2. a public comment period;
3. the person proposing to take the action finalises the assessment documentation, taking public comments into account; and
4. the Secretary of the Department of the Environment and Heritage (DEH)prepares an assessment report for the Commonwealth Environment Minister.

After the proponent has prepared and submitted the necessary report and associated documents to the Commonwealth Environment Minister, and the DEH assesses that documentation, the Minister must make a decision on whether to approve the taking of the action within 30 business days of receiving an assessment report, or within 40 business days of receiving a report from a commission of inquiry.

6.1.4 EPBC Approval Process Timeline

The flowchart below (from the DEH website) shows the various steps to be taken and the possible outcomes.

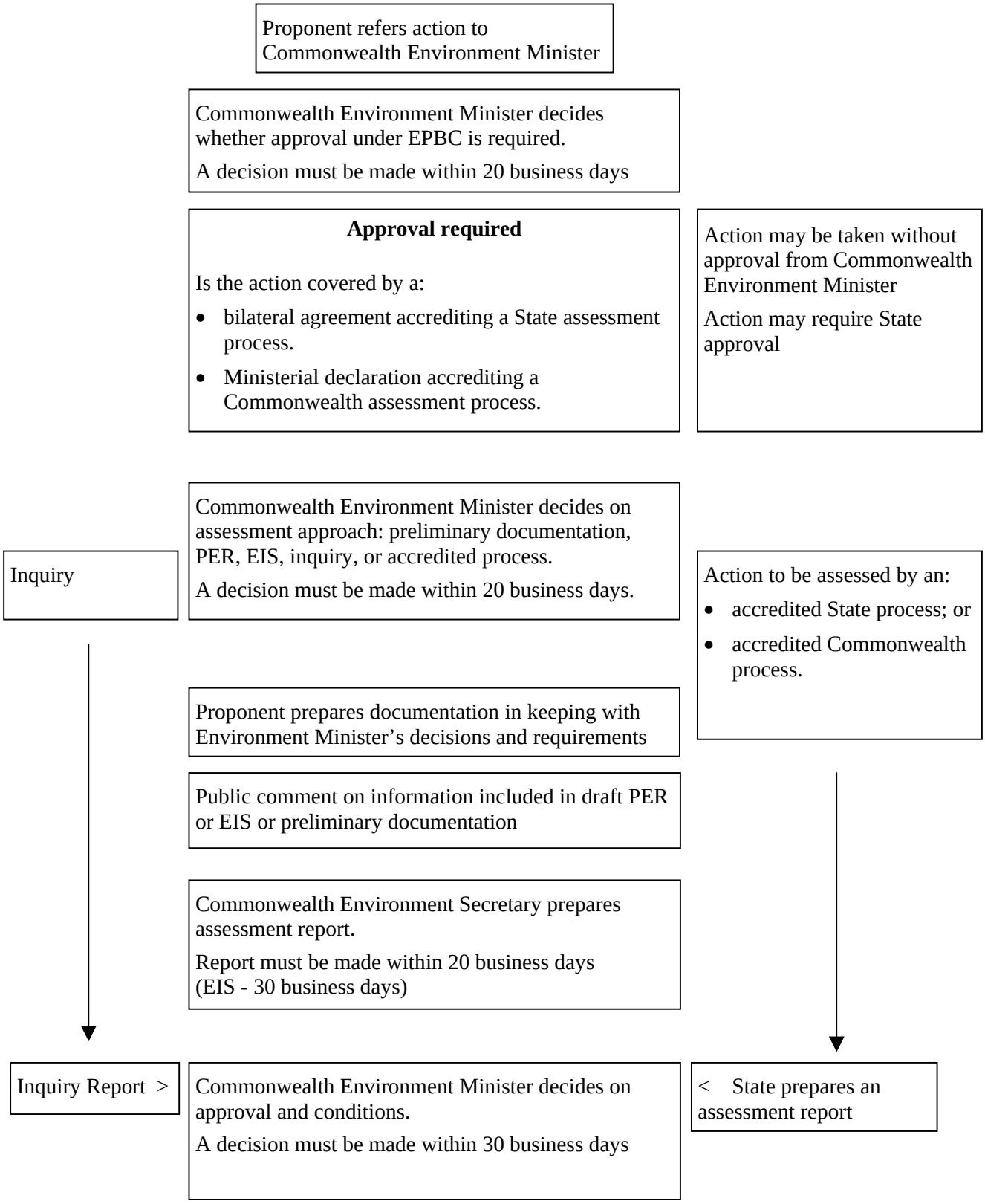

Figure 6.1 - EPBC Approval Process

If in this process the PER or EIS routes are chosen, it is necessary to add:

- 20 business days for draft guidelines plus 20 business days after comment period (typically 10 business days but could be more)
- at least several months for the draft report
- at least 20 business days for public comment on the draft (determined by the Commonwealth Minister - no upper limit)
- at least 10 business days (could be several months, depending on the complexity of the issues raised) for responses to the public comment.

6.2 SA Approval Process

6.2.1 Development Approvals

Approval Requirement

Developments within South Australia are governed by the provisions of the Development Act, 1993. Development is defined as:

- building work; or
- a change in the use of land; or
- the division of an allotment; or
- the construction or alteration of a road, street or thoroughfare on land; or
- in relation to a State heritage place - the demolition, removal, conversion, alteration or painting of, or addition to, the place, or any other work that could materially affect the heritage value of the place; or
- in relation to a local heritage place - the demolition, removal, conversion, alteration of, or addition to, the place, or any other work (not including painting but including, in the case of a tree, any tree-damaging activity) that could materially affect the heritage value of the place; or
- in relation to a significant tree - any tree-damaging activity; or
- prescribed mining operations on land; or
- an act or activity in relation to land (other than an act or activity that constitutes the continuation of an existing use of land) declared by regulation to constitute development, (including development on or under water) but does not include an act or activity that is excluded by regulation from the ambit of this definition.

It is likely that the nature of the project is such that it will constitute development on and at most sites in SA.

Pursuant to Section 32 of the Development Act, no development may be undertaken in SA without approval from the Relevant Authority after having been assessed against (either as an integrated application or separately as a provisional application):

- the provisions of the appropriate Development Plan; and
- the provisions of the Building Rules.

Relevant Authority

The Relevant Authority is a body prescribed by Section 34 of the Development Act, and can be:

- the Local Council; or
- the Development Assessment Commission (DAC) where the Regulations prescribe, based on the class of development, or if required by the Minister, or if not within a Council area; or
- the Minister for Planning subject to the significance of the development proposed.

The Relevant Authority can only be defined for the project once the full details of the project and the location of the site are established, as both these aspects may affect the outcome of the determination. It is however suggested that the nature of activity is such that we would expect that the Relevant Authority would be either the DAC (pursuant to Schedule 10 of the Regulations, the development of land for the purpose of the reception, storage, treatment or disposal of waste), or the Minister for Planning.

Schedule 21 and 22 of the Development Act Regulations indicate activities that are considered to be activities of environmental significance, and can trigger differing processes for development approval determination.

6.2.2 Process for Approvals

The process for seeking Development Approvals can be achieved using either:

- a Section 39 standard Application for Development Approval process, or
- a Section 49 Crown Development process, or
- a Section 46 Major Developments Declaration process; or
- Creative Processing including use of Section 24 to Amend the Development Plan.

There are varying pros and cons for each option and these will vary depending on the exact site selected, the nature of possible issues, and the ultimate form of the development and it is premature to make such a recommendation at this stage. Nevertheless, it is useful to discuss the validity of each of these to the project generally.

Section 39 Process

As a Section 39 process, an application is lodged by the proponent to the Relevant Authority (and in this case likely to be the DAC) in a prescribed form and with any information reasonably required by the relevant authority and accompanied by such plans, drawings, specifications or other documents as may be prescribed; and a lodgement fee.

On receipt of an application, a relevant authority:

- May request an applicant to provide additional documents or information (including calculations and technical details) as the relevant authority may "reasonably require" to assess the application; seek the remedy of any defect or deficiency in any application or accompanying document or information required; consult with an authority or body prescribed by the regulations; request the preparation of a Statement of Effect in accordance with the regulations in relation to a development of a kind that is expressed to be a non-complying development under the relevant Development Plan.
- Categorise the nature of the development and the category of development against which it will assess the application. This will essentially be to categorise the development and use against statutory terms, then to categorise such as Complying, Merit, or Non-Complying within the zone of the land, and to categorise the application as either Category 1, 2 or 3, which refers to the extent of public notification that is required prior to the Relevant Authority making its decision.
- Will seek "Referrals and Concurrences" with public authorities and the level of importance that these referrals have are prescribed under the Regulations (and include Transport SA, Coast Protection Board, EPA, Minister for Heritage, Primary Industries and Resources South Australia (PIRSA), Department of Environment and Heritage, Native Vegetation Council, State Aboriginal Affairs, and Planning SA) as:
    - Regard - the relevant authority cannot consent to or approve the development without having regard to the response of the prescribed body;
    - Concurrence - the relevant authority cannot consent or approve the development without the concurrence of the prescribed body (which concurrence may be given by the prescribed body on such conditions as it thinks fit);
    - Direction - the prescribed body may direct the relevant authority to refuse the relevant application; or if the relevant authority decides to consent to or approve the development (subject to any other Act) to impose such conditions as the prescribed body thinks fit (and that the relevant authority must comply with any such direction).
- May require public notification if necessary (Category 2 and Category 3).
- Will issue a Notice of Determination.

It is possible that the nature of this project is such that the zoning of sites where such a facility might be located will be such that this development could be categorised as either of Merit or Non-complying, as

there are only a small number of zones in SA in which such an activity would be listed as Complying. A categorisation of Non-complying essentially removes any right of appeal by the proponent.

Section 49 Process

Crown Development Applications are decided by the Minister for Planning but are lodged with the DAC for assessment "advice", with notification required to be issued to the local Council.

DAC is required to consider the application and the comments of the local Council and report to the Minister of Planning who can then approve or reject the application. The report will determine whether or not the project will be "seriously at variance" with relevant Development Plans, and any code or standard prescribed by Regulations. DAC may require the Development Application to be publicly notified.

Section 46 Process

The Minister of Planning may, if of the opinion that a declaration under Section 46 is appropriate or necessary for the proper assessment of development or a project of major environmental, social or economic importance, by notice in the Gazette, declare that this section applies and consider the application.

In such a case, a Major Developments Panel (panel of experts) is appointed by the Minister of Planning to consider the matter, and this could require the proponent to prepare either:

- an EIS;
- a PER; or
- a Development Report (DR).

Each of the above have differing (reducing) degrees of assessment rigour. The Panel will formulate guidelines for the preparation of the report. A public meeting is required during the public exhibition period for an EIS or PER but not for a DR.

Section 24 Alternative Process

As an alternative process where situations require, an amendment to a Development Plan could be prepared to facilitate the nature of development envisaged where such would otherwise be difficult to achieve. The amendment can only be prepared by the relevant Council for the area or by the Minister of Planning.

6.3 Environmental Authorisations

Activities which are likely to be of environmental significance are also governed by the Environment Protection Act, 1993 (EP Act). Clause 36 requires that a person must not undertake a prescribed activity of environmental significance except as authorised by an environmental authorisation in the form of a licence.

Part A of Schedule 1 of the EP Act lists the activities that are considered to be prescribed activities of environmental significance. Item 3 is Waste or Recycling Depots, which is defined as the conduct of a depot for the reception, storage, treatment or disposal of waste. In addition, a waste transport business (category B) is included on the list and is defined as the collection or transport for fee or reward of …. *solid waste from any commercial or industrial premises or from any teaching or research institution (other than building or demolition waste).*

Accordingly, a licence will be required under the EP Act for both the operation of the Interim Store and the transport of waste to the store. This can only be granted after the Development Approval is issued, but prior to works and operations commencing.

Notwithstanding the above approvals, there are general environmental duties under the EP Act (Section 25) that require that a person may not undertake an activity that pollutes or might pollute the environment unless the person has taken all reasonable and practicable measures to prevent or minimise any resulting environmental harm.

Environmental harm is defined by Section 5 of the EP Act and a series of Environmental Protection Policies under the Act. This while not an approval *per se*, is a very powerful statutory tool that needs to be considered in defining the project. Measures to comply with the provisions of Section 25 will depend on:

- The nature of pollution or potential pollution and the sensitivity of the receiving environment
- The financial implications of the various measures that might be taken as those implications relate to the class of persons undertaking activities of the same kind or similar kind
- The current state of technological knowledge and likelihood of successful applications of various measures that might be taken.

6.4 Radiation Protection Authorisations

Licence to use or handle radioactive substances

Clause 28 of the Radiation Protection and Control Act 1982 (RPC Act) requires that "A natural person shall not use or handle a radioactive substance unless that use or handling is authorised by a licence or temporary licence under this section."

Thus a licence will be required for each person involved in the handling of radioactive waste, i.e., conditioning operations, transfers within the storage facility etc. Such people will need to demonstrate that they are fit and proper people to hold a licence, and that they have appropriate knowledge of the principles and practices of radiation protection to carry on the activities required.

Registration of premises in which unsealed radioactive substances are handled or kept

Clause 29 of RPC Act requires that "Any premises in which an unsealed radioactive substance is kept or handled must be registered under this section in the name of the occupier of the premises". Note that it is not intended that unsealed sources in liquid form will be accepted for storage in the Interim Store.

Thus the Interim Store will need to be registered in the name of the occupier of the premises.

Registration of sealed radioactive source

Clause 30 of the RPC Act requires that a sealed radioactive source must be registered in the name of the owner of the source. Registration is achieved by application in the prescribed form and the payment of a fee.

Arrangements will need to be made to clarify the ownership of the sealed sources once physically transferred to the store. Transfers of ownership are also controlled under the regulations under the Act. Registration requirements will also need to be clarified, along with the $20 per year per source registration fee.

Regulations under the Radiation Protection and Control Act 1982

Division 3 of the Regulations, Accounting for and Storage and Labelling of Radioactive Substances, places many requirements on the registered occupier of premises in which radioactive substances are kept or handled, including:

- maintain a detailed register of unsealed radioactive substances; and
- maintain a detailed register of sealed radioactive sources (whether or not registered under section 30 of the Act);

As long-term interim storage was probably not foreseen by the writers of the regulations, arrangements will need to be made to ensure that these administrative requirements are sufficiently comprehensive without being unnecessarily complex, to achieve the aims of the Act.

6.5 Other State Approvals

Dependant on the site selected, there could be other State approvals required including but not limited to:

- Permits under the Native Vegetation Act for vegetation clearance; and
- Approvals under the Heritage and Aboriginal Heritage Acts.

6.6 Public Consultation

There are minimum periods for public consultation specified in both Commonwealth and South Australian planning laws. Public consultation requirements under the Commonwealth PER or EIS routes include:

- 20 business days for public comments on draft guidelines; and
- at least 20 business days for public comment on the draft report.

There is some discretion allowed for the Commonwealth Minister and the period for public comment on the draft report can be extended. Similar arrangements are in place for South Australian planning processes.

Given that an Interim Store Project is likely to be seen as a sensitive issue, it would be prudent to plan for a more extensive public consultation process than is required by the various planning laws. Public consultation should be conducted at each stage of the process, and the type of consultation should be appropriate to allow public education and acceptance. Table 6.1 below outlines a consultation process that would be suitable for an Interim Store project.

Table 6.1 Public Consultation

Stage	Type of Public Consultation
Feasibility and site selection	Half-day workshop of invited community, industry and government representatives. Final Feasibility Report presentations to the general public followed by questions and answers. Web site containing all relevant information.
Planning approvals	Invite public comments on environmental assessment guidelines. Presentations of the environmental assessment report to the general public followed by questions and answers. Invite written comments on the environmental assessment report. Updated web site.
Construction and operation	Pre-construction consultation with local community - presentations followed by questions and answers. Annual or biannual community consultation during the operational phase. Updated web site.

Most of the consultation described in Table 6.1 would be conducted after suitable advertising, allowing sufficient time for the public to plan and respond. The advertising should reference previous advertising to highlight the efforts to be transparent and consultative.

Limitations

URS Australia Pty Ltd has prepared this report for the use of the EPA in accordance with the usual care and thoroughness of the consulting profession. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated 13 October 2004.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared between November 2004and January 2005, and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by a qualified legal practitioner.

i EPA 2003 - Audit of Radioactive Material in South Australia, Radiation Protection Division, South Australian Environment Protection Authority, September 2003.

ii IAEA Safety Series 111-F- The Principles of Radioactive Waste Management, International Atomic Energy Agency, Vienna, 1995.

iii IAEA Safety Series 111-G-3.1- Siting of Near Surface Disposal Facilities, International Atomic Energy Agency, Vienna, 1994.

iv NRC-1986 US Nuclear Regulatory Commission, "Standard Format and content for the health and Safety Sections of License Renewal Applications for Uranium processing and Fuel Fabrication," Regulatory Guide 3.52, November 1986.

v NRC-2002 US Nuclear Regulatory Commission, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility," NUREG-1520, March 2002.

vi NRC-2001 US Nuclear Regulatory Commission, "Integrated Safety Analysis Guidance Document," NUREG-1513, March 2001.

vii DOE-1998 US Department of Energy, "Licensing an Assured Isolation Facility for Low-Level Radioactive Waste," Low-Level Waste Management Program, DOE/LLW-250, July 1998.

viii TNRCC-2000 Texas Natural Resource Conservation Commission, "Texas Compact Low-Level Radioactive Waste Generation Trends and Management Alternatives Study," RAE-42774-019-5407-2, August 2000.

ix NHMRC 1992 - Code of practice for the near-surface disposal of radioactive waste in Australia (1992), Radiation Health Series No. 35, National Health and Medical Research Council, Canberra, November 1992