Replacement Research Reactor Project

ULTIMATE DISPOSAL OR TRANSFER PLAN

Prepared By
Australian Nuclear Science and Technology Organisation

9 September 2004

ANSTO		Document N°: **RRRP-7200-EDEIN-005-REV0** Revision: **0**		
Replacement Reactor Project		Document Title: Ultimate Disposal or Transfer Plan		
REVISION SHEET		Ref No:		
		Print name, date and sign or initial		
Revision Letter	Description of Revision	Prepared	Checked/ Reviewed	Approved
0	Original issue to ARPANSA	ARR	KJH	GDW
Notes: 1. Revision must be verified in accordance with the Quality Plan for the job.				

TABLE OF CONTENTS

1 THE SCOPE AND PURPOSE OF THIS ULTIMATE DISPOSAL OR TRANSFER PLAN

This plan describes the arrangements for the ultimate disposal or transfer of all radioactive waste arising from the operation of the Reactor Facility. This includes the disposition of spent fuel and the decommissioning of the Reactor Facility.

2 REFERENCES

Regulatory Guideline on Review of Plans and Arrangements, ARPANSA, RB-STD-15-03, Version 0, August 2003

Code of Practice for the Disposal of Radioactive Wastes by the User (1985)

Code of Practice for the Near Surface Disposal of Radioactive Waste in Australia (1992)

Code of Practice for the Safe Transport of Radioactive Material (RPS2, 2001)

RRRP-7280-3BEIN-001 Preliminary Decommissioning Plan.

RRRP-7280-EBEIN-008 Decommissioning Safety Case

RRRP-7280-EDEIN-002 Organisation towards Decommissioning

RRRP-7280-EDEIN-005 Preliminary Decommissioning Cost Estimation

RRRP-7280-EDEIN-007 Risks Analysis for Decommissioning Options

RRRP-7280-EDEIN-009 Information on the Facility to Support Decommissioning

RRRP-7280-EDEIN-010 Preliminary Decommissioning Waste Management Plan

RRRP-7280-EDEIN-011 Decommissioning Activities

IAEA Safety Standard WS-G-2.1 Decommissioning of nuclear power plants and research reactors (1999)

3 DEFINITIONS

The following definitions have been used in this plan.

The reactor facility; or the Replacement Research Reactor	The reactor facility means the multipurpose research reactor that will replace HIFAR, and its associated buildings, physical plant, structures, components and systems including software and, where relevant, any management systems necessary to achieve the design, construction and operation of the facility.
The Project	The Project means all activities necessary to obtain the requisite approvals and procurement to achieve routine operation of the replacement reactor facility before 2006, as described in the project management plan.
The site of the reactor facility	An area of approximately four hectares situated at the western end of the Lucas Heights Science and Technology Centre.

The Lucas Heights Science and Technology Centre	An area of approximately 70 hectares, including a number of facilities immediately outside the perimeter security fence, such as the Lucas Heights Motel, canteen, Woods Centre, and other buildings in the ANSTO Technology Park
The buffer zone	A mostly circular area of radius 1.6 kilometres, centred on the existing HIFAR facility, within which land use restrictions apply and all residential development is excluded.

4 ROLES AND RESPONSIBILITIES

The roles and responsibilities associated with the implementation of this plan are as identified in this section.

4.1 MANAGER, REACTOR OPERATIONS

The Manager, Reactor Operations is the Nominee for the Reactor Facility and has overall responsibility for the safety and operation of the Reactor Facility at all times.

4.2 DIRECTOR, GOVERNMENT AND PUBLIC AFFAIRS

The Director, Government and Public Affairs, is responsible for the off-site spent fuel management strategy.

5 PLAN

5.1 SPENT FUEL

5.1.1 Research Reactor Fuel

About two decades ago, broad international agreement was reached that, for nuclear non-proliferation reasons (which Australia strongly supports), high enriched uranium (HEU) fuels would be phased out of use in research reactors and be replaced with low enriched uranium (LEU) fuels. ANSTO's HIFAR reactor originally used HEU fuel with very high enrichment, but the level of enrichment has been progressively reduced and conversion of HIFAR to LEU fuel will commence in 2004.

The first generation of LEU fuels, qualified for use since 1988, utilise uranium and silicon. This U-Si fuel remains the only type of LEU fuel currently available for research reactors. Spent U-Si fuel is not easily reprocessed, and has been managed to date by way of long-term storage arrangements. U-Si can be reprocessed in conjunction with larger volumes of other fuel.

A new generation of easily reprocessable LEU fuels, based on uranium-molybdenum (U-Mo), has been under development for some years. U-Mo fuel, which will provide better reactor performance than the U-Si fuels presently in use, is expected to enter into service around 2012. It is only the composition of the fuel "meat" that will be new in U-Mo fuel.

The fuel elements for the replacement research reactor consist of the standard dispersion fuel meat, aluminium clad, fuel plates assembled into standard materials test reactor box-type fuel.

This has been the most common fuel used in research reactors world-wide for many decades.

U-Si type fuel will be used for the initial operation of Reactor Facility. It is intended that the Reactor Facility will be converted to U-Mo when this type of fuel is qualified and available for commercial manufacture, and ARPANSA approval for the conversion has been obtained.

5.1.2 International Practice

The strategies that are planned for the management and transport of spent fuel and radioactive waste from the Reactor Facility are consistent with best international practice. Justification for this assertion is as follows:

Australia is a contracting party to the *Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management.* The Joint Convention contains a provision on the general requirements for spent fuel management[1], and further provisions concerning the siting, design, construction and operation of spent fuel management facilities[2]. Importantly, the Convention recognises that there is no single spent fuel management strategy that constitutes international best practice[3]. The first Joint Convention Review Meeting was held in November 2003. With regard to spent fuel management, contracting parties recognised that interim storage (in ponds or dry storage) or reprocessing is an acceptable international best practice. The important issue is that spent fuel has to be stored in safe and secure conditions so that it can be retrieved safely. Australian policies and practices were examined in detail by the other countries and found to be acceptable as international best practice. It was recognised that the Review Meeting, the peer review process, and the Convention in general, had contributed significantly to the safety of spent fuel and radioactive waste management[4].

The International Atomic Energy Agency has issued a technical report on the options in spent fuel management[5], which advises, *inter alia*, that "reprocessing is a mature and demonstrably safe technology that is available today for spent fuel management"[6].

As accepted by the CEO of ARPANSA in deciding to issue a licence for the construction of the replacement reactor, the reprocessing of spent fuel by COGEMA would result in a waste form suitable for long-term storage and disposal[7]. That observation was consistent with international best practice, as evidenced by the findings of the IAEA[8] and the NEA[9] .

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[1] Article 4.

[2] Articles 5-9.

[3] Preambular paragraph (vii) – "Recognizing that the definition of a fuel cycle policy rests with the State, some States considering spent fuel as a valuable resource that may be reprocessed, others electing to dispose of it".

[4] Joint Convention First Review Meeting Summary Report, paragraph 77.

[5] Options, Experience and Trends in Spent Nuclear Fuel Management, Technical Reports Series No. 378, 1995.

[6] At p 35.

[7] "The reprocessing process adopted by COGEMA La Hague produces a satisfactory vitrified waste form. The general waste form produced by La Hague is known to me and I regard it as likely to be able to be safely stored for a significant period of time in Australia." (page 47 of the Decision).

[8] "The waste fission products are immobilized in a stable form suitable for disposal …". Ref. footnote 12, at page 36.

The NEA has recently published a study comparing the radiological impacts of reprocessing with those of direct disposal of power reactor spent fuel[10]. The study concluded:

"The differences between the two fuel cycles examined in the report are small from the standpoint of radiological impact… Overall, the public exposures in both options are low compared to the pertinent regulatory limits, and also insignificantly low compared with exposures from natural background radiation."

The spent fuel management strategy proposed for the reactor facility necessitates the international transport of highly radioactive material. The IAEA has expressed the view that such transport may form part of an appropriate spent fuel management strategy[11]. In his decision to issue a construction licence for the replacement reactor, the CEO of ARPANSA considered this issue[12], concluding that "international transport of Reactor Facility spent fuel and resulting wastes could be conducted safely". This conclusion was confirmed by the International Conference on the Safe Transport of Radioactive Material held in Vienna in July 2003[13]. In that connection, we note that spent fuel is routinely transported without incident from a number of countries (including countries in our region such as Japan and the Republic of Korea) to France and the United Kingdom for reprocessing, the resulting waste products being returned to their country of origin. The Joint Convention sets conditions for such international transport[14], thereby demonstrating again that such transport is not inconsistent with international best practice.

5.1.3 Australian Spent Fuel Management Strategy

The strategy for the management of spent nuclear fuel from research reactor operations was determined by the then Government in 1995 in respect of the management of spent fuel from Australia's HIFAR reactor. The Government announced in October 1995 that it had decided "to make full use of international opportunities" by exporting the spent fuel and that Australia would

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[9] "Reprocessing, conditioning and recycle allow conversion of waste residues to specific requirements of society for disposal to permanent repositories. Vitrification processes in current facilities meet the challenge of providing a safe mechanism for immobilisation and indefinite storage of high level waste." Back-end of the Fuel Cycle in a 1000 GWe Nuclear Scenario, NEA Workshop Proceedings, October 1998.

[10] Radiological Impacts of Spent Nuclear Fuel Management Options: A Comparative Study, OECD 2000. The study compared the options with regard to spent power reactor fuel; however, its conclusions are also applicable to research reactor fuel. Similar conclusions would be expected with regard to the impacts of other non-reprocessing alternatives for research reactor spent fuel processing and waste conditioning.

[11] "Reprocessing is available to utilities from a few countries, e.g. France, Russia and the UK. For a country wishing to use this technology, it is necessary to have a well established industrial base, well trained personnel, a strongly developed safety culture and a long term commitment of financial resources. Thus utilising the services from experienced reprocessors may be favoured by countries that require reprocessing." "If the preferred option of a country is reprocessing by an international business company on a contract basis, then the country producing the spent fuel will have to make provision for taking back the reprocessing products." Ref. footnote 14, at pp 36 and 35 respectively.

[12] pp 50-51

[13] http://www-rasanet.iaea.org/meetings/transport_conf.htm.

[14] Article 27.

manage the long-lived intermediate level waste (LLILW) that would arise from reprocessing it. At that time, the Government authorised the negotiation of a contract to ship 114 spent fuel rods to the United Kingdom for reprocessing, and the return to Australia of the resulting waste, which must satisfy the definitional requirements of the International Atomic Energy Agency for LLILW.

This strategy was confirmed in 1997 by the Government for the management of spent fuel from both HIFAR and the replacement reactor. ANSTO has arrangements with the US Department of Energy for the repatriation of US-origin spent fuel (no waste will be returned to Australia), and a contract with the French company COGEMA for the reprocessing of the remainder of the spent HIFAR fuel. The contract with COGEMA also covers the reprocessing of spent fuel from the replacement reactor. It is a contractual requirement that waste arising from reprocessing by COGEMA will meet the international criteria for long-lived intermediate level waste. Spent Fuel Management Practice

5.1.4 Spent Fuel Management Practice

The spent fuel arisings from the normal full power operations of the reactor facility will be up to 37 fuel elements per year for U-Si fuel. INVAP estimate U-Mo fuel usage would be approximately 20 fuel elements per year.

Spent fuel discharged from the reactor core will be moved a short distance under water into storage racks in the reactor service pool, adjacent to and connected with the main pool. These racks will have the capacity to store, under water, up to 10 years' arisings of spent fuel discharged from the reactor, while retaining sufficient spare space to unload the complete operating reactor core at any time should this be required. This arrangement has the advantages of minimising handling of the spent fuel, with no movement required outside the immediate vicinity of the reactor for storage purposes and convenient, continuous monitoring of the spent fuel storage conditions. By this means, the spent fuel will be protected by the same structural features as the reactor itself. At all times, the spent fuel will be available for visual inspection of its condition.

The reactor service pool has a purpose-built stand to accommodate a spent fuel transport cask. Spent fuel elements will be moved underwater the short distance from the storage racks and loaded underwater into the transport cask for shipment.

Existing storage facilities for HIFAR spent fuel will not be used for storage of reactor facility spent fuel, and no other away-from-reactor storage will be required for the reactor facility spent fuel.

After a suitable period in storage, the spent fuel will be transported overseas for disposal or reprocessing. The timing of spent fuel shipments will be determined by a number of factors, including:

- time required to accumulate a practicable sized shipment;
- minimum cooling time required for the youngest elements in a shipment, to satisfy shipping cask regulatory criteria; and
- radiological safety benefit of minimising the number of shipment operations.

On the basis of up to 37 spent fuel elements arising per year, it is anticipated that there will be one overseas shipment of spent fuel every 5 or 6 years. The first such shipment would be around 8 or 9 years after commencement of reactor operation, given a cooling period of up to 3 years and the above-mentioned 5 or 6 years to accumulate a shipping quantity.

Fuel manufactured from US-origin enriched uranium arising from the operation of a research reactor can be returned to the US under the US DOE *Foreign Research Reactor Spent Nuclear Fuel Acceptance Program (FRR-SNF).* This program commenced in 1996 and was to accept spent fuel irradiated up to May 2006 and transported to the US before May 2009. In 2004, the United States Secretary of Energy announced that the timescale for this program is to be extended. To this end, the US Department of Energy is currently preparing a supplemental analysis required by the U.S. National Environmental Policy Act. The US Secretary of Energy has written to the Australian Minister for Science advising that he has instructed his Department to include the issue of management of spent fuel from the replacement reactor in this analysis.

The fuel for the initial operations of the reactor facility is of US-origin and is U-Si fuel, a type accepted under the FRR-SNF program. The preferred option for spent fuel from the initial reactor facility operations will be return to the US. In the case of spent fuel accepted by the US, there will be no return of waste to Australia.

The first alternative spent fuel disposition route is reprocessing by COGEMA. The ANSTO contract with COGEMA for spent fuel reprocessing includes U-Mo fuel but normally excludes U-Si fuel. However, ANSTO has made arrangements with COGEMA for the acceptance of U-Si spent fuel. This is additional to ANSTO's intention that the long-term disposition route for Reactor Facility spent fuel will be reprocessing by COGEMA. An agreement with France at inter-governmental level has been concluded to support these arrangements.

The solid waste prepared from reprocessing Australia’s research reactor spent fuels will, as guaranteed under the contract with COGEMA, meet the International Atomic Energy Agency’s criteria for classification as long-lived intermediate level waste. Further, the quality of the borosilicate glass in which the intermediate level waste will be encapsulated is equivalent to that accepted by Germany, Japan, Belgium and the UK for the storage and disposal of higher categories of radioactive waste.

ANSTO’s contract with COGEMA also includes provision of the multi-purpose transport and storage casks for return transport and long-term storage of the wastes. By providing the necessary packaging, shielding and containment of the wastes, these casks greatly simplify the design requirements for a storage facility. No additional shielding or remote-handling equipment, beyond that which would be required for the other long-lived intermediate level waste to be stored in the facility, will be necessary. The proposed national store for long-lived intermediate level wastes will be able to accept these casks as a small addition to the other quantities of waste in this category that will already be stored there.

As noted above, ANSTO’s existing contract with COGEMA for the reprocessing of spent fuel from HIFAR includes provision for the reprocessing of spent fuel from the replacement reactor. The same waste return provision will apply for replacement reactor fuel as has already been accepted by Government and regulatory authorities for HIFAR spent fuel. There is therefore every confidence that this same strategy will be acceptable for the replacement reactor fuel.

Also, as a further back-up option, INVAP has given a written guarantee to provide an alternative solution consistent with Australia’s requirements, as stipulated in the Request for Tender, using proven technologies. Argentina has already developed and demonstrated a novel technology for processing aluminium-clad research reactor spent fuel, and has plans to use that technology for managing its own research reactor spent fuel. This option has been made available for the reactor facility spent fuel. An agreement with Argentina at inter-governmental level to support these arrangements has been signed by both governments, but has not yet been ratified by

Argentina. However, INVAP is still contractually obligated to provide a disposal route for spent fuel (excluding the first 2 cores comprising 32 fuel elements).

The procedure for sending spent fuel abroad, whether for disposal or reprocessing, includes:

- site procedures for the loading of spent fuel into approved spent fuel transport casks. ARPANSA and AMSA validate the Certificates of Approval for the spent fuel transport casks.
- contractual agreements with the organisations transporting and accepting spent fuel, including transfers of responsibility. All transport is in accordance with the IAEA Regulations for the Safe Transport of Radioactive Material TS-R-1.
- preparation of a Transport Plan approved by ARPANSA.
- application for DITR and ASNO export licences.
- application for shipment approval from ARPANSA, ASNO and AMSA.
- consultation with relevant federal and state authorities, including NSW police.

In summary, ANSTO's preferred option is that the silicide-type spent fuel from the initial reactor facility operations will be returned to the US under the FRR-SNF program. After the initial operations, and probably after the reactor is converted to operate with U-Mo fuel, the spent fuel will be returned to COGEMA for reprocessing. Should the US FRR-SNF program not be extended, arrangements are in place with COGEMA to process the silicide-type spent fuel. The Argentine route is contractually available as a further fall-back option.

5.2 Long Term Management of Low level waste (LLW)

LLW from the operation of the facility will be handled in accordance with the existing Waste Operations licence. It is anticipated that LLW will be sent to the Commonwealth low level waste facility once that facility is licensed and in operation. When details of that facility are available, procedures will be produced to control the transfer of LLW from LHSTC to it. These procedures will include a provision for informing ARPANSA of any radioactive waste to be ultimately disposed of or transferred. There will also be a provision for consultation with local government and other relevant authorities for the transfer of LLW from the LHSTC site to the repository. Once LLW is transferred to the repository, the responsibility for the long-term management of the waste will transfer from ANSTO to the Commonwealth Department responsible for the facility.

Any disposal of LLW will be in accordance with:

- Code of Practice for the Disposal of Radioactive Wastes by the User (1985); and
- Code of Practice for the Near Surface Disposal of Radioactive Waste in Australia (1992).

Transport of LLW waste to the Commonwealth low level waste facility will be in accordance with the *Code of Practice for the Safe Transport of Radioactive Material (RPS2, 2001).*

The arrangements for the storage of LLW on site pending transport to the Commonwealth Repository are detailed in the Arrangements for the Management of Radioactive Waste. ANSTO has the technical and financial capability to continue to safely manage such waste during the lifetime of the reactor facility.

5.3 Long Term Management of Long lived intermediate level waste (LLILW)

Federal Government strategy is to establish a safe, purpose built facility on Commonwealth land for the storage of intermediate level radioactive waste produced by Commonwealth agencies, including ANSTO. That waste will include the small volumes of waste arising from the reprocessing of spent fuel from the replacement research reactor.

The proposal for a national store for the interim storage of long-lived intermediate level radioactive waste (LLILW) was supported by the Senate Select Committee on the Dangers of Radioactive Waste (November 1996), the Commonwealth/State Consultative Committee on Radioactive Waste Management (1997) and the Parliamentary Public Works Committee[15].

The Federal Department of Education, Science and Training (DEST) is responsible for managing the national store project. The Department of Education, Science and Training website www.radioactivewaste.gov.au is the source of the latest information on the national store project.

Information provided to ARPANSA for the *RRR Application to ARPANSA for a Facility Licence Construction Authorisation* demonstrated that such storage is consistent with international best practice[16].

The acceptance by the Department of Education, Science and Training (DEST) of LLILW from the operation and decommissioning of the reactor facility (including any waste returned from spent fuel processing) in this National Store is documented in DEST publications:

- Safe Storage of radioactive waste, the National Store Project, Methods for choosing the right site, public discussion paper, July 2001.
- Safe Storage of radioactive waste, the National Store Project, a report responding to public comment, April 2002.

The process announced by the Minister on 11 August 2000, and further detailed by Ministers in announcements of 8 February 2001 and 14 July 2004, for finding a site for the national store for long-lived intermediate level waste generated by Commonwealth agencies, including ANSTO, ensures that the necessary facilities will be available in ample time to accommodate the small volume of wastes from the reprocessing of research reactor spent fuel from the reactor facility to be returned to Australia. For the preferred option of return of spent fuel under the US FRR-SNF program, no waste would be returned to Australia. In this case, the national store would not be needed to accommodate the return of wastes from the processing of spent fuel from the reactor facility until after the longterm disposition route to COGEMA is adopted. Waste from this spent fuel processing would be expected to return to Australia after 2025.

In the case that the US option is not available and the alternative option of reprocessing by COGEMA is adopted for the initial spent fuel, the earliest date waste would be expected to be returned to Australia is 2018.

When details of the Commonwealth store are available, procedures will be produced to control the transfer of LLILW from overseas or LHSTC to the Commonwealth store. These procedures will include the provision for informing ARPANSA of any radioactive waste to be ultimately disposed of or transferred. There will also be a provision for consultation with local government and other relevant authorities for the transfer of LLILW from the LHSTC site to the store or the return of LLILW from spent fuel reprocessing overseas to the store.

Transport of LLILW waste to the Australian national store will be in accordance with the *Code of Practice for the Safe Transport of Radioactive Material (RPS2, 2001).*

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[15] Parliamentary Public Works Committee, “Report relating to the proposed Replacement Nuclear Research Reactor, Lucas Heights, NSW”, Canberra, 1999, paragraphs 4.82 and 4.145.

[16] Construction licence application, Appendix 3, page 6.

5.4

DECOMMISSIONING

5.4.1 Introduction

Decommissioning is the process which permanently removes the reactor facility from service and reduces radioactive material levels so that termination of some or all of the regulatory controls of the reactor may be permitted. It covers the staged process, following the final shutdown of the reactor facility, by which radioactive components and materials are removed. The process is to achieve a progressive and systematic reduction in radiological hazards and is carried out on the basis of pre-planning and assessment to ensure safety during decommissioning operations.

Issues relating to the plans and arrangements for managing safety during decommissioning have been considered throughout the design stage. The relevant design characteristics, hazards during the decommissioning process, the potential wastes that will be generated during operation and decommissioning, and the method to manage these wastes are identified and form some of the factors influencing the decommissioning strategy.

The SAR chapter 19 (Decommissioning) contains a description of:

- Hazards, including an estimate of radioactive inventory at the end of the facility life
- Decommissioning waste types and management
- Decommissioning strategies
- Activities during commissioning
- Design characteristics for facilitate decommissioning

The Preliminary Decommissioning Plan (RRRP-7280-3BEIN-001), prepared in accordance with the ARPANSA and IAEA guidelines, details the preliminary arrangements for decommissioning. This plan, and the related documents identified in the plan, address the requirements identified in the SAR and will be updated over the life of the reactor taking into account Reactor Facility operational experience and international decommissioning practices.

The Radioactive Waste Management Plan presents the plans and arrangements for the management of radioactive waste on site.

5.4.2 Decommissioning Objectives, Principles and Design Basis

The objectives of decommissioning the Reactor Facility are:

- To ensure the continued safety of the site personnel, the public and the environment;
- To keep radiation doses below prescribed limits and to reduce unavoidable exposure in accordance with the ALARA principle;
- To minimise the environmental impact;
- To minimise the production of radioactive waste as a result of decommissioning;
- To comply with the statutory requirements and regulations applicable to the decommissioning process; and
- Consistent with the above, to implement a cost-effective decommissioning process.

To achieve these objectives, the following principles and design bases related to decommissioning have been taken into consideration in the design of the Reactor Facility:

- Minimise the activation and contamination of components;
- Identify essential information required for decommissioning purposes to ensure that this information will be available at the end of the reactor's operational lifetime;

- During the reactor's operational lifetime, monitor those parameters that can potentially affect the radioactive inventory and the radiological factors necessary for estimating the potential radiation exposure during decommissioning;
- Facilitate its management during the safe-storage period after permanent shutdown and prior to dismantling; and
- Minimise the level of surveillance and maintenance required during the safe storage period.

5.4.3 Design Characteristics to Facilitate Decommissioning

The pool-type research reactor is inherently simple to dismantle compared to other reactor types. The design takes into consideration the decommissioning tasks from radiological safety, economic and operating perspectives.

The design characteristics considered to optimise these safety features include:

- Minimising the radiation fields at the end of the Reactor Facility life;
- Facilitating the dismantling and decontamination of equipment; and
- Facilitating supporting operations during decommissioning.

The construction of the facility has proceeded with the inclusion of these design characteristics.

5.4.3.1 Minimising Radiation Fields at the End of the Facility Life

Of paramount importance to the decommissioning operation will be the extent and intensity of the radiation fields throughout the Reactor Building and systems. Features and characteristics implemented to reduce the intensity and spread of the radiation fields are:

- Reduction of Activated Sources
- Reduction of Contamination
- Facility for dismantling and decontamination

5.4.3.2 Reactor Operation to Facilitate Decommissioning

During operation of the Reactor Facility, the Quality Management System which ensures best practice in operation shall be adhered to. Operational data and records will be maintained and stored appropriately in accordance with the Reactor Facility Quality Management System for Records Management. The records also include reports on abnormal occurrences, maintenance historical data, changes and modifications to structures, systems and components, wastes produced and their management. This information will facilitate the detailed preparation of the decommissioning plan.

5.4.4 Hazards

There are hazards associated with decommissioning activities. These include those from radiation sources, chemicals and physical conditions in the Reactor Facility, which may potentially be harmful to people and environment.

The radionuclides considered in estimating Reactor Facility inventory are detailed in RRRP-7280-3BEIN-001 *Preliminary Decommissioning Plan*. Of these, cobalt-60 and nickel-63 are seen as dominating.

5.4.4.1 Hazardous Substances

This category includes all substances that may cause disease or injuries either by ingestion, inhalation or assimilation. This is considered a low risk in the Reactor Facility as small quantities of these substances are used. Chemicals used in decontamination are examples of this type of hazardous substances.

5.4.4.2 Physical Hazards

These are the industrial hazards such as those related to electricity, mechanical dismantling, lifting and movement of equipment, material cutting, use of decontamination tools and noise. ANSTO industrial safety guidelines will be adhered to minimise risks from these hazards.

5.4.5 Decommissioning Waste Types and Management

The Reactor Facility is designed to minimise the generation of radioactive waste during operation and decommissioning. The reduction and minimisation of waste is a key principle in the *Radioactive Waste Management Plan.*

No high level waste will be generated during decommissioning.

The control, storage and transfer of radioactive waste generated from the Reactor Facility will be managed in accordance with established ANSTO procedures.

5.4.5.1 Decommissioning Plans

A Preliminary Decommissioning Plan is now available RRRP-7280-3BEIN-001 *Preliminary Decommissioning Plan*. This plan and other supporting documents include the information as listed in SAR 19.5.3.1. The plan has been prepared using ARPANSA and IAEA guidelines. It should be appreciated that the plans and arrangements relating to decommissioning the reactor can only be preliminary at this stage and that the plan should be flexible so as not to pre-empt future technological development in decommissioning techniques.

A final Decommissioning Plan will be prepared when the decision is made to permanently shut down the Reactor Facility.