Australian Government
Australian Submarine Agency

ASA

Safety Analysis Report

Controlled Industrial Facility (HMAS *Stirling*)
ARPANSA Construction Licence
Technical Overview

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List of Acronyms

ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
ASA	Australian Submarine Agency
AUKUS	The trilateral security partnership between Australia, United Kingdom and the United States of America
CIF	Controlled Industrial Facility
HMAS	His Majesty's Australian Ship
IAEA	International Atomic Energy Agency
µSv	microsievert
mSv	millisievert

Safety Analysis Report

Section 1 – Introduction

1.1 This Technical Overview provides general information on the safety analysis for construction of the Controlled Industrial Facility (CIF) at HMAS *Stirling*.

1.2 The content of this plan addresses ARPANSA requirements detailed in Section E to the Regulatory Services ARPANSA – Form -1797 v11.1 dated November 2022.

1.3 This Technical Overview contains information submitted to ARPANSA that was developed using the *Regulatory Guide - Plans and arrangements for managing safety* (ARPANSA-GDE-1735) and the ASA's internal guidance set out in *Best Practice Guidance for Managing Nuclear Safety and Radiation Protection*.

1.4 This Technical Overview is not a standalone document and should be read in conjunction with the other ASA technical overview documents.

Purpose

1.5 This Technical Overview should be read in conjunction with other ASA technical overview documents and:

a. Demonstrates that the ASA has considered plans for waste management, radiation protection, emergency preparedness and response, effective control and environmental protection as part of the CIF design

b. Provides sufficient information on the hazards associated with the facility, potential accidents and safety features that may need to be investigated as part of the detailed design process to prevent accidents or reduce their likelihood of occurrence

c. Demonstrates that plans have been made to construct the CIF and that these plans, and subsequent designs, will have safety incorporated into its future operations

d. Demonstrates that adequate planning, hazard identification and safety analysis has been completed such that the CIF can be safely constructed in a way that allows for safe operation and future decommissioning

e. Demonstrates that the design will meet safety requirements and confirm any operational limits and conditions attached to meeting those requirements

f. Equips the ASA with a top-level document which describes important facility details and features which have importance or relevance to safety and ensuring personnel, public and environment are not adversely impacted from its operations

g. Provides sufficient information on the planned facility operations to guide and inform compliance monitoring and safety oversight programs.

Scope

1.6 ARPANSA granted permission to the ASA to prepare a site for the CIF through the issuing of Facility Licence F0346 in July 2024.

1.7 This Technical Overview of the *Safety Analysis Report* provides an overview of the planning, hazard identification and safety analysis that has been completed as part of the ASA's ongoing design processes and preparations to commence construction of the CIF.

1.8 It provides a description of the general safety principles and criteria applied to the design of the CIF in order to protect the facility, the personnel, the public and the environment. It summarises the analyses of the potential hazards associated with the construction of the CIF. It outlines the safety features incorporated in the design to avoid or minimise the likelihood of operational accidents and to mitigate their consequences.

1.9 Hazards arising from activities conducted within the CIF as well as natural hazards including seismic and meteorological events have been considered based on a conceptual design.

1.10 Not all future operational matters are outlined in this Technical Overview, and will be further detailed in future regulatory submissions.

Section 2 – Facility description

Facility purpose

2.1 The purpose of the CIF is to support the maintenance, service and repair of nuclear-powered submarines from HMAS *Stirling* whilst protecting the public and the environment from radiation exposure. The facility shall allow for the safe maintenance of activated and/or contaminated components; processing of radioactive effluent from nuclear-power submarines; and characterisation and interim storage of low-level radioactive waste.

Facility safety objectives and principles

2.2 The safety objectives and principles for the CIF are as follows:

a. The design, construction and layout of structures, systems and components within the facility will reflect work health and safety legislation and codes of practice, and nuclear and radiological safety regulation

b. The dose limits for workers and members of the public under normal operation and accident conditions as set out in Schedule A and Schedule B of ARPANSA's *Code for Radiation Protection in Planned Exposure Situations* (Radiation Protection Series C1) will never be reached

c. Worker doses will be maintained as low as reasonably achievable, including intervention at or before an operational dose constraint for an adult worker

d. During normal operations, the facility's systems and design will minimise all releases of radioactive substances from the building as low as reasonably achievable, i.e. airborne discharge. All releases will be quantified, monitored and recorded through an environmental monitoring program

e. The facility will enable waste operations and storage to be conducted consistent with industry best practices, Australian standards and international and domestic guidance information.

Facility design

2.3 The ASA and its Design Services Consultant have developed the current working design for the CIF. This facility design has used a safety led systems engineering approach, and is based on the requirements that have been developed by ASA through consultation with US and UK partners.

2.4 The design detail is appropriate to begin construction, pending relevant regulatory approvals, with enough detail to demonstrate how hazards and risks are being appropriately managed. Future design development will consider any changes to functional or operational requirements and consider all completed and ongoing hazard and accident analysis, resulting in the development of a list of appropriate control measures. Any changes will be assessed and if found to have 'significant implications to safety', approval from the relevant regulator will be sought with the change not being finalised until approval is obtained.

Facility activities

2.5 Activities within the CIF will include the handling, processing, holding and packaging of solid, liquid and mixed (hazardous) radioactive waste[1] produced while operating and maintaining nuclear-powered submarines.

2.6 The key activities that will be conducted within the CIF, once operational, are:

a. Maintenance, servicing and repair of naval nuclear propulsion components and tools, including as needed:

   i. Decontamination of contaminated tools, equipment or items removed as part of maintenance or repair activities, and storage ready for reuse

b. Reception, management, treatment and decontamination of low-level, solid and liquid radioactive material generated from submarines during their operations in accordance with all applicable regulations and approved processes. This includes:

   i. Characterisation of radioactivity in solids and liquids, allowing for disposal of waste below radiological clearance limits as free issue/domestic waste

   ii. Processing of low-level radioactive liquid effluent, enabling discharge of treated effluent under appropriate environmental release limits

c. Temporary storage of low-level radioactive material before transport to an approved licenced disposal facility within Australia. This will involve:

   i. Providing safe custody and interim storage of waste packages classed as low-level waste and low-level hazardous waste.

[1] Low-level waste constitutes waste that is above exemption levels, but with limited amounts of long-lived radionuclides. Low-level hazardous waste contains both radioactive low-level waste and other non-radioactive materials. Further details can be found in Section 3 of the technical overview for *Radioactive Waste Management*.

2.7 The specialist work areas and laboratories are placed to enable ASA Stewardship and Technical Division personnel to undertake task specific activities. The spaces enable personnel to:

a. Support the compliant characterisation, triage, handling, treatment and packaging of radioactive waste

b. Deliver health physics, dosimetry & environmental monitoring services for onsite assurance.

Responsibilities of key facility personnel

2.8 Establishing and maintaining effective control over the facility requires the establishment of key responsibilities within the ASA. The technical overview for Effective Control Arrangements outlines those responsibilities.

Section 3 – Radioactive Waste Management

3.1 The proposed CIF will enable the radioactive waste management function to be conducted in a safe manner by incorporating a range of measures that help realise the relevant waste management objectives as specified in IAEA's *Radioactive Waste Management Objectives* (Nuclear Energy Series No. NW-0).

Radioactive waste classification

3.2 The radioactive waste classification criteria being used to inform planning of the CIF have been developed in line with the guidance provided in ARPANSA's *Guide for Classification of Radioactive Waste (*Radiation Protection Series G-4).

3.3 Low-level waste constitutes waste that is above exemption levels, but with limited amounts of long-lived radionuclides. The waste being managed at the CIF will be low-level waste and similar in levels to waste that is currently managed at more than 100 locations around Australia.

Radioactive waste streams

3.4 Maintenance and operational activities of submarines will generate three primary waste streams[2]:

a. Low-level solid waste (soft), for example, personal protective equipment

b. Low-level solid waste (hard), for example, plastic face shields, valve caps, mixed waste

c. Low-level radioactive liquid waste, for example, reactor primary effluent.

3.5 Low-level solid waste will be collected from a submarine crew and moved to the CIF in containers by a fit-for-purpose vehicle and by trained personnel. Arrangements for waste transfer to the CIF will be made in consultation with our trilateral partners as part of the preparations for the operating phase.

3.6 Low-level liquid radioactive waste will be moved by a fit-for-purpose vehicle for collection and movement to the CIF's low-level liquid radioactive waste storage and treatment system for processing and will then be held in processed liquid holding

[2] Further details can be found in Section 3 of the technical overview for *Radioactive Waste Management*.

tanks. It may be further processed via evaporation creating both concentrate and condensate.

Radioactive waste quantities

3.7 The ASA has estimated an upper limit for the anticipated total waste inventory, total facility activity, waste stream volume and generation rate, based on an ASA technical report that was prepared with relevant assumptions and quantities. This estimate informed the assessments for radiation hazards and the hazard identification studies undertaken to support the site preparation phase.

3.8 Further information is provided in the technical overview for *Radioactive Waste Management*.

Disposal of solid and liquid wastes

3.9 The Australian Radioactive Waste Management Framework will identify a disposal route for solid low-level radioactive waste. The ASA will work with the relevant government departments and agencies to ensure that wastes generated through CIF operations will meet waste acceptance criteria for disposal at a future national radioactive waste management facility, or other equivalent facility to be situated on the Defence estate.

3.10 Additional information on radioactive waste disposal options for the CIF-stored and generated wastes are outlined in the technical overview for *Radioactive Waste Management*.

Solid waste interim storage

3.11 Temporary waste storage is incorporated into the CIF design until it is transported to a permanent radioactive waste management facility.

Liquid waste disposal

3.12 The CIF incorporates a liquid effluent treatment plant that uses mechanical filters and ion exchange columns to reduce radioactivity.

3.13 Treated effluent is tested to confirm it is within the acceptable limits for discharge. If the treated effluent is not compliant with the acceptable limits, it is reprocessed through the treatment plant again until it is compliant.

3.14 The treated effluent is either transferred to a bulk evaporator and released to the environment via a stack above the roof line of the CIF, or reused to flush contaminated systems within the effluent treatment plant.

3.15 The treated effluent will be discharged to the environment via evaporation using thermal evaporators. The discharged effluent will be compliant with ARPANSA's *Code for Disposal of Radioactive Waste by the User* (Radiation Protection Series C-6).

Minimisation of radioactive waste

3.16 Minimisation of radioactive wastes generated through maintenance and operational activities can be best achieved through careful planning and optimisation of works. Considered planning of maintenance activities can help reduce overall volumes of waste that would need to be received and managed by the CIF.

Arrangements for managing radioactive waste

3.17 A list of key operating procedures will be in accordance with following:

a. IAEA, *Storage of Radioactive Waste*, Safety Guide No. WS-G-6.1

b. ARPANSA, *Code of Practice for the Security of Radioactive Sources*, Radiation Protection Series No. 11

c. ARPANSA, *Code for Radiation Protection in Planned Exposure Situations*, Radiation Protection Series C-1

d. ARPANSA, *Code for the Safe Transport of Radioactive Material*, Radiation Protection Series C-2.

Section 4 – Facility design requirements

Design for radiological protection and safety

4.1 The CIF is being designed such that:

a. Radiation exposure will not exceed regulatory limits for workers or the public

b. Exposure to workers will be reduced to the lowest value that can be reasonably achieved, taking into account economic and social factors.

4.2 Radiological safety design based on hazard identification and safety analysis has been completed as part of the detailed CIF design. The whole-body effective radiation exposure limit for workers is 20 mSv annually (averaged over five years) and 50 mSv in any one year as per the *Australian Radiation and Protection and Nuclear Safety Regulations 2018*. The regulations also prescribe limits on skin and extremity doses which have been considered in the design and operational procedures for the CIF.

4.3 The operational dose constraints for workers have been selected to ensure doses from operational activities are as low as reasonably achievable and will be significantly lower than the prescribed limits.

4.4 All staff who work within the CIF will be trained in work tasks and practices. CIF operational personnel will be tested for competency and currency of their skills before being allowed to conduct work unsupervised.

Design standards for radiological protection

4.5 The following standards are being considered to inform the CIF radiological design and safety analysis:

a. ARPANSA, *Code for Radiation Protection in Planned Exposure Situations*, Radiation Protection Series C-1 (Rev.1)

b. ARPANSA, *Code for Disposal of Radioactive Waste by the User*, Radiation Protection Series C-6

c. ARPANSA, *Code of Practice for the Security of Radioactive Sources*, Radiation Protection Series 11

d. ARPANSA, *Radiation Protection Standard for Occupational Exposure to Ultraviolet Radiation*, Radiation Protection Series 12

e. AS/NZS 2243.4 *Safety in laboratories*, Part 4: Ionizing radiations

f. ARPANSA, *Fundamentals for Protection Against Ionising Radiation*, Radiation Protection Series F-1

g. Various International Commission on Radiological Protection publications.

Design for industrial safety

4.6 Throughout the design process, industrial safety has been considered as per standard design processes and though 'Safety in Design' workshops. All mechanical and electrical equipment will be selected and installed to comply with the relevant Australian standards for industrial safety.

4.7 Where there are interfaces between radiological protection and industrial safety, the objective will be to reduce doses as low as reasonably achievable and industrial risks so far as is reasonably practicable. This will be managed under the ASA's Risk Management Framework.

Design for physical and environmental characteristics of the site and external events

4.8 Physical and environmental characteristics of the site and external events that are relevant to the CIF have been identified. Key characteristics and external events that have been considered in the CIF design to date, based on their potential impacts on safety include:

a. Seismic events—earthquake, surface rupture

b. Geotechnical—general ground conditions, liquefaction, karst

c. Flooding—tsunami

d. Extreme meteorological events—precipitation, winds

e. Climate change.

4.9 To date, design of the CIF has incorporated Australian and Defence standards, as well as ARPANSA regulatory codes and guides. International best practice will also be considered as the design progresses.

Design for fire protection

4.10 A fire detection and suppression system for the CIF will be in place to protect against the event of fire.

Design for decommissioning

4.11 The facility has been designed to minimise contamination of equipment, the facility and the environment, which will aid in the decommissioning of the facility when required. Further information can be found in the technical overview for *Decommissioning.*

Section 5 – Radiation protection

Radiation protection principles and their implementation within the ASA

5.1 The ASA will incorporate the radiation protection principles as set out in the *Fundamentals for Protection Against Ionising Radiation* (Radiation Protection Series F-1) and ARPANSA's *Code for Radiation Protection in Planned Exposure Situations* (Radiation Protection Series C-1) into its business practices.

ASA Radiological Control Principles

Dose limits and constraints

5.2 Individual and combination dose limits and constraints associated with activities and tasks undertaken in the CIF will comply with the IAEA guidelines, ARPANSA guidance and regulations, and International Commission on Radiological Protection recommendations.

5.3 The ASA is currently developing overarching dose constraints for the full life cycle of the CIF, from commissioning through operations and on to decommissioning. These are outlined in the technical overview for *Radiation Protection.*

5.4 The ASA will develop procedures for emergency exposure situations in accordance with ARPANSA's *Guide for Radiation Protection in Emergency Exposure Situations* (Radiation Protection Series G-3) in preparation for the operating phase. This work will consider the guidance values for restricting exposure of emergency workers as documented in Annex A of the Guide.

Optimisation of Radiation Protection

5.5 Where activity specific dose constraints are required, an assessment as to whether they are as low as reasonably achievable[3] will be conducted to determine the dose constraints by:

a. Defining the objective

b. Making a preliminary analysis of the type and level of doses

c. Defining the radiation protection options

d. Quantifying, where possible, the impact of these options in terms of cost, dose, time, operational impact etc. (where necessary a qualitative assessment may be used)

e. Comparing the options

f. Conducting a sensitivity analysis

g. Selecting and implementing the optimised solution.

5.6 The dose assessment will determine the dose constraint on which post activity doses are assessed, to provide a feedback mechanism for future assessments regarding whether the dose is as low as reasonably achievable.

[3] See: Commission of the European Communities (1991) *ALARA from theory to practice*, report EUR 13796.

Sources of radiation and contamination

5.7 All wastes received into the CIF will be low-level radioactive wastes meeting the classification contained within ARPANSA's *Guide for Classification of Radioactive Waste* (Radiation Protection Series G-4).

5.8 The principle source of radioactivity in the CIF is low-level solid and low-level liquid waste from nuclear-powered submarines, which includes trace amounts of activated corrosion and wear products generated from contact between the reactor plant metal surfaces and the cooling water. The predominant radionuclide is cobalt-60, which has a half-life of 5.27 years.

5.9 Further information on the relevant waste streams for operations at the CIF is outlined in the technical overview for *Radioactive Waste Management.*

CIF radiation safety design features

5.10 Design requirements are based on the types and quantities of radioactive materials managed. Requirements for dose rates in publicly accessible spaces, office spaces, supervised and controlled areas will be set.

Radiation protection design for accident scenarios

5.11 The CIF design has considered hazards that could lead to accidents and radiation exposure for workers or the public.

5.12 The facility design will incorporate fire protection to ensure a building fire will not result in releases to the environment. Similarly, the building structure will be designed to withstand external events, where appropriate.

5.13 Portable and fixed personnel decontamination showers have been incorporated into the facility design, and plans and arrangements.

5.14 Ventilation control systems will also be connected to radiation monitoring equipment.

Radiation shielding

5.15 Radiation shielding is an important aspect of the CIF's design to minimise the dose to workers.

5.16 The radiation shielding design was informed by the estimated waste inventory to ensure that during normal operations personnel will not receive doses above occupational dose constraints.

Process and component layout

5.17 The design of the plant layout will be optimised to minimise doses to workers. This includes consideration of access requirements during operation and maintenance.

Material characteristics

5.18 Material surfaces are designed to ensure they can be readily decontaminated.

5.19 Equipment/plant/building shape/layout are designed to reduce the likelihood of accumulation of contamination and to ensure they can be readily decontaminated.

Radiation and contamination monitoring

5.20 Fixed monitoring and mobile survey equipment will be used for personnel radiation monitoring. The locations and types of fixed radiation monitors will be finalised as a part of the detailed design for the CIF.

5.21 As a procedural control, treated liquid effluent will be sampled and analysed. This analysis will provide the necessary data to assess whether the treated effluence may be transferred to the thermal evaporator for discharge to the atmosphere.

Active ventilation systems

5.22 Active ventilation systems have been incorporated into the design to ensure that airborne contaminants are managed appropriately and do not result in contamination of personnel.

Designation of areas and access control

5.23 The objective of zoning/area control is to define the expected radiation or contamination levels that may be experienced within the facility to ensure radiological risks are managed appropriately.

5.24 Areas will be designated with respect to radiation and other hazards.

5.25 Each category of controlled area will have specific limits on radiation dose rates, contamination levels and personal protective equipment requirements.

Radiation protection in the CIF

Radiation detection instrumentation and equipment

5.26 The CIF will be fitted with contamination detection, radiation monitoring instrumentation and survey equipment.

5.27 All monitoring equipment will be in a calibrated and maintained state, in accordance with ISO 17025 – *Testing and Calibration Laboratories*, and as a part of the facility quality management program.

Section 6 – Radiation Safety Analysis

Dose modelling

6.1 The analysis of scenarios, outlined below, drew a number of conclusions including setting operational contact dose rate constraints for the liquid effluent treatment plant filters and recommending shielding/distancing provisions for handling and storage of certain waste items.

Modelling for Operational/Storage Considerations

6.2 Assessments were carried out for the liquid effluent treatment plant filter columns where radionuclides will accumulate. Shielding requirements to ensure annual worker doses are kept within selected dose constraints were derived and incorporated into the design as required.

Modelling for Effluent Spill

6.3 The consequence of a catastrophic primary effluent liquid spill was examined for both inside the CIF and outside the CIF.

6.4 The dose rates calculated were negligible for both of the above scenarios.

Maximum Credible On-Site Accident

6.5 An on-site accident during a maintenance activity at the CIF was the maximum credible on-site accident scenario. The bounding conservative dose consequence is a worker receiving a total dose exposure of 8.6 µSv, which is considered to be negligible.

Reference Accident Analysis

6.6 The CIF reference accident scenario was based on a fire which caused a release of a percentage of the radioactive waste inventory. The maximum total effective dose considered for a worker present for seven days post fire and located immediately adjacent to the CIF was predicted to be 0.3 µSv, which is considered to be negligible. All doses off site were calculated to be less than this value.

6.7 Comparing the reference accident values to the criteria set out in ARPANSA's *Guide for Radiation Protection in Emergency Exposure Situations*, Radiation Protection Series (RPS G-3), the criterion for requiring protective action is not exceeded and is more than a magnitude lower for all cases.

6.8 Ground contamination levels were also well below trigger levels for protective actions and operator intervention levels prescribed in ARPANSA's *Guide for Radiation Protection in Emergency Exposure Situations*, Radiation Protection Series (RPS G-3).

Section 7 – Operational limits and conditions

7.1 A definitive statement on the requirement, or otherwise, of operational limits and conditions will be made at the operating phase. General surveillance requirements will be explored to ensure the facility safety objectives are met. The ASA will implement a robust inspection, testing and maintenance regime for all relevant safety equipment.

Section 8 – Emergency Planning and Preparedness

8.1 Application of hazard assessment methodology set out in the *IAEA's Preparedness and Response for a Nuclear or Radiological Emergency, GSR Part 7* and ARPANSA's *Guide for Radiation Protection in Emergency Exposure Situations*, Radiation Protection Series (RPS G-3), shows that the CIF reference accidents would not exceed the thresholds to be classified as an Emergency Preparedness Category. This is a result of the low radionuclide inventory. However, normal emergency response actions to a building fire would satisfy the required Response Time Objectives for a Category III facility.

8.2 Further information is outlined in the technical overview for *Emergency Management.*

Section 9 – Decommissioning

9.1 A baseline radiological characterisation survey is being conducted for HMAS *Stirling* and will include the area of the proposed CIF footprint. This will provide data in support of remediation planning, if required, and release from regulatory control (clearance) once decommissioning has been completed.

Incorporating Decommissioning Planning into the CIF Design.

9.2 The initial decommissioning plan, developed in accordance with ARPANSA *Regulatory Guide – Decommissioning of a Controlled Facility,* will be updated appropriately throughout the life of the facility.

9.3 The CIF has been designed to facilitate maintenance, upgrades and disassembly during decommissioning. The facility has capacity for the temporary storage of both liquid and solid radioactive waste, liquid treatment and processing as well as decontamination capability. These radioactive waste management capabilities are suitable and provide ample support for decommissioning works. The CIF building's main engineering features are expected to be fully utilised during decommissioning and require minimal modification or upgrade.

9.4 The CIF design has incorporated engineering features that enable decommissioning activities to be completed in a manner that:

a. Minimises active waste volumes

b. Allows easy decontamination of wet or contamination prone areas

c. Minimises radiation doses to workers.

9.5 The design of the facility includes engineering features that reduce and eliminate accidental airborne or liquid discharges to the environment.

9.6 The main areas of possible contamination in the facility at its end of life are considered to be in the liquid effluent treatment plant. The following measures have been considered in the design to support decommissioning:

a. Minimisation of equipment in the design

b. Minimisation of crevices in joints/accumulation points and other areas where contamination can accumulate

c. Flow rates in the turbulent range throughout the system to minimise activity build up

d. Material selection and surface finish chosen to aid decontamination

e. Ability to flush the system with pure water to remove contaminants

f. Ability to utilise a dry air purge to remove contaminants from filters and the ion exchange

g. Skid mounted equipment where appropriate to support ease of disassembly.

9.7 The CIF has infrastructure for the management of effluent and an active ventilation system that could support decommissioning. In addition, various components shall be

designed to be deconstructed without invasive cutting and/or manual dismantling by workers.

9.8 Radiation monitors (including environmental monitoring, dose rate meters, contamination monitoring and atmospheric monitoring) will also be present to support decommissioning.

9.9 Further information can be found in the technical overview for *Decommissioning.*

Section 10 Conclusions

10.1 Despite the low hazard nature of the facility, the ASA has adopted a conservative approach to hazard identification and safety analysis. Consistent with this, a staged approach is being taken for applications for the relevant licences for a prescribed radiation facility. This demonstrates the ASA's commitment to complying with the highest standards of safety and security for our people, the public and the environment.

10.2 Hazard identification and safety analysis techniques (dose modelling and dispersion modelling) have been applied as part of the design in alignment with good engineering and nuclear stewardship practice. This report captures how ASA has incorporated safety into the design and future operations of the CIF through selection of appropriate design standards, good safety practices and industry experience.

10.3 The hazard identification and hazard and operability studies outlined as part of this Technical Overview align with the graded approach to safety assessment (considering the low levels of total activity to be managed within the facility), and were found to be appropriate given the level of maturity of the CIF design. They provide sufficient detail suited to the current stage of licensing, i.e. construction of a controlled facility.

10.4 Since the site preparation phase for the CIF, the ASA has obtained further information on the estimated source term for the facility from our trilateral partners. Updated modelling has been undertaken based on the new source term, which has provided even lower estimates of radiological doses for the Reference Accident.

10.5 Hazard identification studies were performed by experienced teams of designers, radiation safety experts, nuclear engineers and systems safety experts, which identified credible hazards, internal and external to CIF, originating from both manmade and natural events.

10.6 Engineering, administrative and personal protective equipment controls have been identified as part of the hazard identification studies with the outcomes generated providing a basis for identifying, evaluating, defining and justifying the selection (or rejection) of potential control measures.

10.7 Analysis is completed for external events that may impact the CIF, such as tsunami, flooding, seismic or other. Offsite radiation doses for a Reference Accident that may result from one of these external events has been found to be negligible.

10.8 Most of the significant external hazards, and some internal hazards, may result in a thermal event, for example, a building fire causing a partial release of the CIF waste

inventory to the atmosphere. A radiation hazard assessment was completed for this Reference Accident, with modelled potential onsite and offsite radiation doses for workers and the public not warranting any urgent or early protective response actions.

10.9 The ASA has used a building fire within the CIF as the Reference Accident. This accident has been modelled by the Defence Science and Technology Group. The maximum predicted and possible onsite dose for an adult present for seven days post- accident and located immediately adjacent to the CIF was predicted to be significantly less than the Australian annual background radiation dose.

10.10 The CIF will manage and treat low-level radioactive waste, which will be predominantly low-level liquid waste.

Suitability of the CIF design to proceed with construction of the Controlled Industrial Facility

10.11 On the basis of the updated facility design, source term, site characteristics and ASA/Defence processes, the ASA's conclusion is that construction of the CIF can commence, pending the ASA obtaining the relevant regulatory approvals.