Amendment Report

Application for Licence Amendment

Part V Division 3 of the *Environmental Protection Act 1986*

Licence Number	L9240/2020/1
Licence Holder	Tellus Holdings Ltd
ACN	138 119 829
File Number	DER2020/000039~25
Premises	Sandy Ridge Facility Crown lease O289974 granted by the State of Western Australia to Tellus Holdings Ltd in respect of Lot 510 on Deposited Plan 413497, Whole Volume 3169 Folio 365 Mining lease M16/574 held by Tellus Holdings Ltd 102.5 km north of Great Eastern Highway, via Access Reserve 44102, Boorabbin WA 6429
Date of Report	25 January 2023
Decision	Revised licence granted

Abbie Crawford

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Abbie Crawford
A/Manager, Waste Industries

an officer delegated under section 20 of the *Environmental Protection Act 1986* (WA)

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1. Decision summary

Licence L9240/2020/1 is held by Tellus Holdings Ltd (Licence Holder) for the Sandy Ridge facility (the Premises), located approximately 75 kilometres (km) north-east of Koolyanobbing in the Shire of Coolgardie, within the Goldfields Region of Western Australia.

This Amendment Report documents the assessment of potential risks to the environment and public health from proposed changes to the emissions and discharges during the operation of the Premises. As a result of this assessment, Revised Licence L9240/2020/1 has been granted.

2. Scope of assessment

2.1 Regulatory framework

In completing the assessment documented in this Amendment Report, the department has considered and given due regard to its Regulatory Framework and relevant policy documents which are available at https://dwer.wa.gov.au/regulatory-documents.

2.2 Application summary

On 20 September 2022, the Licence Holder submitted an application to the department to amend L9240/2022/1 under section 59 and 59B of the *Environmental Protection Act 1986* (EP Act). The following amendments are being sought:

- To authorise the permanent isolation/disposal of low-level radiological waste in the waste cells; and
- To change condition 5 of the licence to refer to the revised radiological and chemical waste acceptance criteria and procedures, in place of the 2016 criteria and procedure.

Currently, the only operational waste cell is Waste Cell 1. However, DWER recently granted a works approval (W6700/2022/1) for the construction of three new waste cells (Cells 2, 3 and 4) at the Premises. The new cells are to be constructed in a similar manner to Waste Cell 1, and are also subject to conditions under Part IV of the EP Act (section 2.5) and under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (section 2.7.1).

Table 1 lists the documents submitted during the assessment process.

Table 1: Documents and information submitted during the assessment process

Document/information description	Date received
Licence Amendment Application and supporting documentation	20 September 2022
Confirmation that Tellus had applied for a 3-year renewal of site registration (RS 210/2018 30289) under the *Radiation Safety Act 1975* (RS Act). The previous registration had an expiry date of 17 October 2022. Under section 37 of the RS Act, it is legal to continue operating and working while a renewal application is being reviewed and assessed.	24 October 2022

Document/information description	Date received
Clarification of items in the licence amendment application, including that “add use of portable waste treatment equipment” was mistakenly included in the application form; and that the Radiological Waste Acceptance Procedure (Tellus, 2022) and the Radiological Waste Acceptance Criteria (Tellus, 2022) were the same documents submitted to the Radiological Council.	28 October 2022
Information regarding the updated Flora and Vegetation Management Plan required under Part IV of the EP Act.	7 November 2022
Advice that Tellus removes the request for in-cell horizontal vault disposal of disused sealed radioactive sources (DSRS). DSRS will be disposed in shafts as described in the application, and as described in the Public Environmental Review assessed under Part IV of the EP Act in 2016.	30 November 2022
A copy of the updated site registration under the RS Act, issued by the Radiological Council.	1 December 2022
Confirmation that Tellus is not requesting changes to the waste types listed under condition 3 (Table 2) of the Existing Licence.	21 December 2022
Clarification of radiological waste disposal methods.	10 January 2023

2.3 Permanent disposal/isolation of radiological waste

The Licence Holder has approval under Part V of the EP Act, and as per the Site Registration under the *Radiation Safety Act 1975* (RS Act), to accept low level radioactive waste (LLW) for temporary storage (up to 12 months).

Under this application, the Licence Holder is seeking approval for the permanent isolation of low-level radiological waste into waste cells at the Premises. The Licence Holder recently applied to the WA Radiological Council to allow for long-term isolation of radiological substances in the waste cells at the Premises.

2.3.1 Radioactive waste types and forms accepted

The Existing Licence already authorises the acceptance of low-level radioactive waste and naturally occurring radioactive material (NORM), prior to temporary storage. Waste acceptance criteria and procedures were updated in 2022, as described section 2.4.

Radioactive waste may arrive at the gate of the Premises in a solid, liquid or sludge form. The types or sources of radioactive waste proposed for disposal at the Premises include:

- Mineral ores or other material containing NORM, such as phosphate minerals, mineral sands, coal, some gold bearing rocks and hydrocarbons (such as scales arising in the oil and gas industry);
- Intervention actions, meaning actions to clean up after accidents or to remediate areas

affected by past practices;

- Medicine, research and industry (e.g. radioisotopes and sealed radioactive sources); and
- Any other materials categorised as either Low Specific Activity (LSA) material or Surface Contaminated Objects (SCO) in the *Code for the Safe Transport of Radioactive Material*, Radiation Protection Series (RPS) C-2 (Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), 2019).

Key Finding:

Nuclear waste is excluded from acceptance or disposal at the Premises, in accordance with the WA *Nuclear Waste Storage and Transportation (Prohibition) Act 1999*. "Nuclear waste" is defined as waste that is of a nuclear plant, or that results from the testing, use or decommissioning of nuclear weapons, whether or not that material has been conditioned or reprocessed.

Certain other types of wastes are also excluded from acceptance and/or disposal at the Premises by the waste acceptance criteria (section 2.4). This includes wastes that are liquid, explosive, flammable, highly reactive, gases, infectious, biodegradable or (as above) nuclear waste. Materials which fit this description can only be accepted if they can be modified to make them suitable for permanent isolation – such as via the solidification/immobilisation of liquid or sludge waste.

Activity limits for specific radionuclides apply, broken down by per source (for DSRS), package limits (for disposal of DSRS) and activity concentration limits. Overall activity limits also apply for disposal at the Premises.

2.3.2 Handling and storage

The Licence Holder authorises the shipment of each package to the Premises prior to departure, via an authorised Request to Ship Notice (RTSN). The RTSN includes details of the waste, packaging and transport. No shipment may access the Premises without a RTSN. The waste acceptance procedure (section 2.4) contains a three-part process used to characterise the waste material to ensure that it is suitable storage or permanent isolation.

Following arrival at the gate, trucks drive to a hardstand unloading area. At this point the waste is considered delivered, but not yet accepted. Shipping containers or packages are removed from the truck, externally inspected and weighed. If cleared of any contamination, the truck may pick up empty shipping containers and leave the Premises.

Radioactive wastes are placed in the radioactive waste storage area (Radioactive Waste Warehouse and Radioactive Waste Storage Yard). If necessary, the East Yard may be converted to a temporary radiation supervised area to provide additional storage space, in accordance with the Radiation Management Plan (RMP). The Radioactive Waste Storage Yard includes dedicated storage locations for containerised DSRS and containerised safeguards materials, which allows permanent monitoring and exclusion zone is to be set up if needed for security reasons.

The Licence Holder reports that surface water contamination is a very low risk due to the strict nature of transport and storage package requirements (section 2.7.2). Sludge and liquid wastes will be stored in tanks or intermediate bulk containers, packaged within sealed outer containers. The construction of storage areas at the Premises also includes stormwater collection for the management of any spills. The Radioactive Waste Warehouse floor drains into two blind concrete sumps, one within an inspection bay within the bunded Radioactive Waste Warehouse area and one within the Waste Immobilisation Plant bund area. The Radioactive Waste Storage Yard also drains to the sump within the Waste Immobilisation Plant bund area.

Radioactive wastes may remain in storage (for up to 12 months, as per the conditions of the Existing Licence) to suit current activities at the site or may be immediately moved for disposal to the waste cell.

Key finding:

The Existing Licence allows for temporary above-ground storage of waste for a maximum of 15,000 tonnes (for radioactive and chemical wastes combined) for a maximum period of 12 months. The risks and controls have been considered in previous assessments. Changes to storage conditions on the Existing Licence have not been requested as part of this amendment application.

2.3.3 Treatment on site

Liquid or sludge radioactive waste is required to be immobilised (treated to create a solid form) prior to disposal. The Existing Licence authorises the immobilisation or solidification of liquid and sludge radioactive waste, prior to temporary storage. That process occurs in the Waste Immobilisation Plant at the Premises. Other pre-disposal management requirements will be based on the physical form of the material, as shown in Table 2.

Table 2: Radioactive waste types, physical form and pre-disposal management proposed at Sandy Ridge. Information provided by Licence Holder.

Waste Type	Physical Form	Pre-disposal management requirements
Unsealed radioactive material	Solid	None
	Liquid or sludge	Immobilisation treatment
Contaminated objects	Solid	Void filling prior or during disposal operations
DSRS	Solid (or contained)	Additional security and dose management controls
Safeguards materials	Solid	Additional security controls
	Liquid or sludge	Additional security controls Immobilisation treatment

In Table 2, “safeguards materials” means any radioactive material for which technical measures or “safeguards” apply (for example permits, transport requirements, accounting, reporting and surveillance) under the Commonwealth *Nuclear Non-Proliferation (Safeguards) Act 1987.* The *Nuclear Non-Proliferation (Safeguards) Act 1987* gives effect to Australia’s obligations under the international Treaty on the Non-Proliferation of Nuclear Weapons (NPT), to which Australia has been a signatory since 1968. It also reflects agreements between Australia and various countries concerning transfers of nuclear items and cooperation in peaceful uses of nuclear energy (Australian Safeguards and Non-Proliferation Office, 2019).

2.3.4 Transport within the Premises including to the waste cell

Containers and waste packages that are stored in the radioactive waste storage area, ready to be placed in the waste cell, are loaded by mobile plant (such as a reach stacker or forklift) onto a truck for transport to the waste cell. Radioactive waste packages are typically moved inside a shipping container. Bulky materials may require the use of flat-bed trucks, low-loaders and/or a crane.

The Licence Holder has implemented Traffic Management Plans for the Premises and access roads, which are monitored and improved over time.

The movements and location of waste are tracked by Tellus on the way to the site and within the Premises. The Licence Holder advises that its system records the movement of each container between storage locations.

Condition 7.3(4) of Ministerial Statement 1078 requires Tellus to record the "specific coordinates" (northing, easting and elevation) of each waste placed within waste cells, including both chemical and radioactive wastes. The tracking system currently used by Tellus uses high accuracy surveys of cell floors using survey equipment at the end of each month, and daily photographic records of waste placement.

2.3.5 Immobilisation prior to disposal

Radioactive materials in liquid or sludge form will be subjected to immobilisation treatment in the waste immobilisation plant. The Licence Holder proposes that the treated material will arrive in the cell as a cementitious slurry and be tipped into the disposal area and left to solidify. If the waste characteristics are compatible, the cementitious slurry may also be used as backfill to eliminate void space in other radioactive items.

Key Findings:

Conditions 15 and 19 of the Existing Licence (which applies to radioactive liquid waste) requires liquid waste to be stabilised and solidified (and meet certain specifications) prior to disposal in the waste cell. These conditions are intended to ensure the geotechnical stability of the final landform and prevent the generation of leachate within the waste cell. The Delegated Officer will retain conditions 15 and 19 as part of the Amended Licence.

2.3.6 Disposal methods

The Licence Holder proposes the following methods for disposal of radioactive waste:

- Solid radioactive material, items and packages will be unloaded and put into position into the final disposal location.
- Any unpackaged bulk naturally occurring radioactive materials (NORM), such as NORM-contaminated soils or pipework contaminated with NORM scale, will be tipped into the final disposal location and dust control measures will be implemented.
- The Licence Holder proposes to dispose of disused sealed radioactive sources (DSRS) by in-cell vertical shaft disposal (Figure 1). The vertical shaft is constructed within the cell from prefabricated concrete interlocking rings, surrounded by natural materials and backfilled with a concrete slurry.
- Other Class IV and V wastes, including packaged and unpackaged NORM, will be disposed of separately within the cell, as shown in Figure 5.

Each waste cell is filled in layers, with multiple sections in each layer containing wastes of similar characteristics. Compacted granular material is placed over each waste layer to fill voids, and each layer is compacted. Once filling reaches 7 metres below ground level (m bgl), a thick sealing layer of low permeability clay is installed to start cell capping and closure.

Figure 1: Artist impression of waste disposal within the cell (Tellus, 2022)

2.4 Waste acceptance criteria and procedures

Condition 5 of the Existing Licence L9240/2020/1 requires the Licence Holder to manage waste acceptance on the premises in accordance with the waste acceptance procedures (WAP) and the waste acceptance criteria (WAC) documents, both dated August 2016. The Licence Holder has split the 2016 WAC and WAP documents into a chemical and a radiological version, creating four 2022 documents (Figure 2).

The Licence Holder advises that this change is to provide additional clarity on radiological waste acceptance, and to incorporate the findings of the Operational Radiological Safety Assessment and the Post-Closure Radiological Safety Assessment – which have both been reviewed by the WA Department of Health. The Licence Holder has applied to change condition 5 of licence L9240/2020/1 to refer to the four 2022 waste acceptance criteria and procedures.

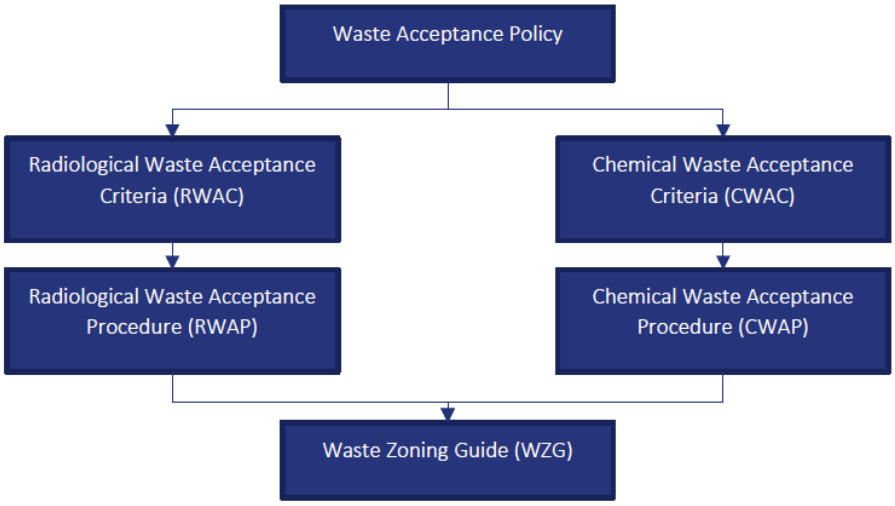

Figure 2: The Licence Holder's updated Waste Acceptance Criteria document hierarchy

2.4.1 Radiological waste acceptance criteria and procedures

The types of radiological waste that can be accepted at the Premises are described above, in section 2.3.

The RWAC contains criteria for radionuclide activity and activity concentration limits suitable for acceptance at the Premises. The criteria are based on the siting, design and planning of the Premises to ensure that no person is exposed above the dose limits or dose constraints determined by the approved Safety Case. The criteria also based on the outcomes of radiation safety assessment modelling, with the most conservative limit being implemented for each radionuclide.

The specific radionuclide activity and activity concentration limits included in the RWAC have not been reproduced in this Amendment Report due to a confidentiality request by the Licence Holder. However, the RWAC has been reviewed and approved by the WA Department of Health via the Radiological Council, as discussed in section 2.7.2 of this Amendment Report.

The RWAC contains a three-part process used to characterise the waste material to ensure that it is suitable for storage or permanent isolation. The process includes:

1. Detailed characterisation of the waste properties: a thorough analysis using standardised analysis and behaviour testing methods
2. Compliance testing: some regularly arising wastes are subject to simpler standardised analysis methods to determine ongoing compliance with licence conditions
3. On-site verification: simple checks to confirm that waste is the same as the one subject to detailed characterisation and/or compliance testing, and that it is as described by the waste generator (client).

The on-site verification for radioactive waste includes:

- A visual check to confirm the integrity of the container and/or package, and to audit it against the client's documentation;
- A contamination wipe test to confirm that the container or package has not leaked during transport; and
- A dose rate check at the surface and at 1 metre away.

The Registration Certificate for the Premises requires the Licence Holder to obtain a disposal permit from the Radiological Council prior to radioactive waste being accepted for final disposal, in accordance with section 34 of the *Radiation Safety Act 1975*. Approvals under that legislation are discussed in section 2.7.2.

2.4.2 Chemical waste acceptance criteria and procedures

The Licence Holder has advised that the revised 2022 CWAP and CWAC have not substantially changed from the 2016 WAC and WAP documents.

DWER notes that as a result, the waste types listed in Table A.1 "Potential waste category list" of the 2022 Sandy Ridge CWAP do not exactly match the waste codes in the Existing Licence. For example, the Existing Licence does not permit the acceptance of grease trap waste (K110); clinical and related wastes (R100); waste of an explosive nature not subject to other legislation (E120); or tyres (T140). The Licence Holder has confirmed (see Table 1) that an amendment to condition 3, Table 2 of the Existing Licence is not being sought as part of this application.

Key finding:

Waste types listed in the updated CWAP do not exactly match the waste codes in the Existing Licence. However, the Delegated Officer will not assess changes to chemical waste codes as part of this Amendment. Condition 3 (Table 2) of the Existing Licence describes the waste types that can be accepted at the Premises, which includes LLW.

2.5 Exemptions

The Existing Licence already includes conditions allowing the acceptance, temporary storage and treatment (immobilisation or stabilisation) of low-level radioactive wastes. Those activities will not be assessed again (and changes will not be made to the relevant conditions of the Existing Licence) as part of this Amendment application.

2.6 Part IV of the EP Act

In June 2015, the Sandy Ridge Facility proposal was first referred to the Environmental Protection Authority (EPA) under Part IV of the EP Act. The EPA determined to assess the proposal under a Public Environmental Review (PER) in August 2015.

A PER was prepared by Tellus in December 2016. The PER proposed mining kaolin, followed by the permanent isolation of hazardous, intractable and low level radioactive wastes (LLW) within the void spaces left from mining operations. Attached to the PER were waste acceptance criteria and supporting documents dated August 2016, which proposed that non-nuclear LLW such as sealed sources would be accepted at the Premises. The PER proposed the permanent storage of sealed sources in vertical storage shafts.

A base layer of waste is placed on one side of the floor of the mine void. Wastes of different types are segregated by internal compacted kaolin walls which are 5 m wide. The height of each waste layer and barrier wall is the equivalent of the height of a waste package, typically 0.9 m. Waste packages are placed tightly next to each other in a row. Granular material is backfilled between and around the waste packages to fill any air spaces.
The shafts for radioactive waste are constructed approximately 3 m apart from each other and with a 5 m barrier between the shafts and the chemical waste layer.

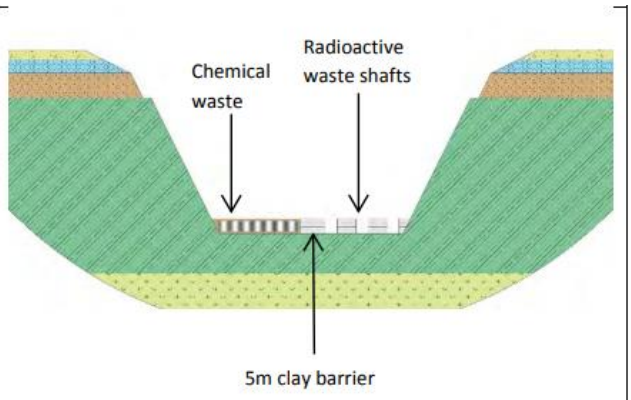

Figure 3: Radioactive waste placement in cell; excerpt from the PER (Tellus, 2016).

The EPA published a report on assessment in December 2017. Report 1611 concluded that the relevant EP Act principles and environmental objectives could be met (subject to conditions) and that the application was environmentally acceptable.

Ministerial Statement 1078 (MS 1078) was then issued for the proposal on 27 June 2018. MS 1078 authorises a number of activities, including:

- Class IV and V waste acceptance (up to 100,000 tonnes per annum (tpa) at the gate);
- Temporary waste storage (up to 15,000 tonnes, for up to 12 months);
- Disposal of waste and treated waste to waste cells (up to 280,000 tpa); and

- Vegetation clearing, access roads and stormwater management infrastructure.

There are a number of conditions listed under MS 1078, including requirements to develop and implement a leachate monitoring and management plan; avoid and manage impacts from flora and fauna; and implement post-closure monitoring and management.

Post-assessment changes were made to Ministerial Statement 1078 under section 45C of the EP Act on 5 February 2019.

Tellus are currently proposing to increase the tonnage of waste accepted at the Sandy Ridge Facility from 100,000 tpa up to 280,000 tpa for permanent isolation in waste disposal cells, via a proposal under section 38 of the EP Act. The proposal also describes two methods of disposal, including in-cell vertical shaft disposal and in-cell horizontal vault disposal. The EPA determined in September 2021 to assess the proposal under a Public Environmental Review (now described as an Environmental Review Document).

The EPA's assessment of the Environmental Review Document will also consider updated flora and vegetation and terrestrial fauna surveys, and an updated Flora and Vegetation Management Plan provided to the EPA in November 2022. The most up to date information is included in DWER's summary of environmental receptors in Table 4.

Key Findings:

The Delegated Officer has determined that the following environmental aspects are managed through Ministerial Statement 1078, under Part IV of the EP Act and are therefore not assessed further in this Amendment Report:

- The proponent is required to submit a Leachate Monitoring and Management Plan which will include six monthly groundwater monitoring.
- The proponent is required to submit a Waste Facility Decommissioning and Closure Plan to the EPA demonstrating how the site will be rehabilitated, remediated and decommissioned to ensure it is physically safe, geotechnically and geomorphically stable, and chemically and radiologically non-polluting, in the long-term.

The Delegated Officer notes that the following environmental aspects are also managed through Ministerial Statement 1078, under Part IV of the EP Act:

- The proponent is required to manage implementation of the proposal to avoid direct or indirect impacts to certain significant flora species, including by implementing a Flora and Vegetation Management Plan.
- The proponent is required to manage implementation of the proposal to avoid direct or indirect impacts to terrestrial fauna.

Given that updated flora and vegetation and terrestrial fauna surveys have not yet been considered by the EPA, the Delegated Officer has chosen to assess the potential impacts of the proposal on flora, vegetation and fauna in this Amendment Report (see section 3.3).

2.7 Other approvals

2.7.1 Environment Protection and Biodiversity Conservation Act 1999

On 23 September 2015, the Department of Environment determined under section 75 of the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) the construction of the Sandy Ridge Facility to be a controlled action to be assessed under the Bilateral Agreement with Western Australia (Agreement between the Commonwealth of Australia and Western Australia under section 45 of the EPBC Act relating to Environmental Impact). The relevant matters of national environmental significance considered for the Sandy Ridge Facility included s21 and 22A – Nuclear action.

In January 2019, the Department of Environment and Energy granted approval for the Premises (EPBC Reference No. 2015/7478) under section 133 of the EPBC Act. The action description of the approval notice refers to "*permanent isolation (disposal) of hazardous and intractable wastes (including low level radioactive wastes)*".

Key conditions within EPBC 2015/7478 include:

- Implementation of a deep groundwater monitoring and management plan;
- Surface and floodwater management; and
- Waste placement within cells to be as described in the action description of the approval notice, and not to include disposal by the borehole method (BOSS method).

Key Finding: The Delegated Officer will give consideration to the conditions of the Commonwealth approval when assessing the risk of this Application and the need for additional controls. In particular, the Commonwealth approval includes a deep groundwater monitoring and management plan, a requirement for surface and floodwater management, and implementation of the PFAS NEMP.

2.7.2 Radiation Safety Act 1975

The *Radiation Safety Act 1975* (RS Act) regulates the keeping and use of radioactive substances in Western Australia. Registration and licensing are the principal means by which the use of radiation is regulated. The Radiological Council is an independent statutory authority appointed under the RS Act to assist the Minister for Health to protect public health and to maintain safe practices in the use of radiation.

Safety Case and associated documents

The Radiological Council recently considered a proposal by Tellus for the permanent isolation (disposal) of LLW in waste cells at Sandy Ridge. The proposal, which was submitted in April 2022, included an operational Radiological Safety Case (Safety Case) for the Sandy Ridge Facility, dated April 2022. In November 2022, the WA Department of Health advised DWER that the Radiological Council had approved the Safety Case for Sandy Ridge.

The Safety Case was required under the *Australian Code for Disposal Facilities for Solid Radioactive Waste* (RPS C-3) published by ARPANSA. The Code sets out the principles and regulatory requirements for the safety and security of disposal of solid radioactive waste. The Code aims to ensure that people and the environment are protected against radiation risks.

A Safety Case includes the following elements to demonstrate that the Premises will achieve the required level of protection for people and the environment (ARPANSA, 2018):

- The organisational and technical arrangements at the Premises;
- The nature of the waste to be accepted;
- The design of the Premises, and the arrangements for its construction, operation, decommissioning or closure and post-closure stages;
- The assessment of radiation risks, including modelling; and
- Assurance of the adequacy and quality of all of the safety-related work associated with the disposal facility.

The Licence Holder advises that the Safety Case is supported by safety assessments for the operational and post-closure periods, to demonstrate safety to personnel and protection of the environment. These assessments are titled Operational Radiological Safety Assessment (ORSA) and Post-Closure Radiological Safety Assessment (PCRSA). The Radiological Council also required a Radiation Management Plan (RMP) and supporting procedures for

use during operation. At the time of assessment, the RMP was also being reviewed by the Department of Mines, Industry Regulation and Safety (DMIRS) as discussed in section 2.7.3.

The Radiological Waste Acceptance Criteria (RWAC) are then derived from the Safety Case. As part of the approval process, the Radiological Council also reviewed the RWAC (Tellus, 2022) and Radiological Waste Acceptance Procedure (RWAP) (Tellus, 2022).

The RWAC and RWAP reviewed by the Radiological Council were the same documents provided to DWER as part of this application.

Registration

The Radiological Council issued an updated "*Certificate of Registration of Premises in which Radioactive Substances are to be used, stored or manufactured*" under the *Radiation Safety Act 1975* (RS Act) on 8 November 2022 for the Sandy Ridge Facility (RS 210/2018 30289), with an expiry date of 17 October 2025.

The conditions of the Certificate of Registration under the RS Act include:

- Prior to radioactive waste being accepted for final disposal, a disposal permit must be granted by the Radiological Council in accordance with section 34 of the RS Act;
- The Licence Holder's radiation management and safety must be in accordance with RPS C-3, as well as the *Radiation Safety (General) Regulations 1983*, and the *Australian Code for Radiation Protection in Planned Exposure Situations* (RPS C-1) published by ARPANSA;
- The packaging of radioactive waste must comply with the approved RMP with reference to the *Australian Safety Guide for the Predisposal Management of Radioactive Waste* (RPS-16) published by ARPANSA;
- The transport of radioactive substances must comply with the Australian *Code for the Safe Transport of Radioactive Material* (RPS C-2) published by ARPANSA and with the *Radiation Safety (Transport of Radioactive Substances) Regulations 2002*;
- The Licence Holder is still testing and trialling immobilisation methods for radioactive material in the waste immobilisation plant. After 12 months of trials, the Licence Holder must report on the results of the procedures trialled and on gamma and contamination monitoring to the Radiological Council; and
- After 18 months of disposal operations, a revised Operational Radiological Safety Assessment and Post Closure Radiological Safety Assessment are to be submitted to the Radiological Council.

Key Findings:

The Delegated Officer will give consideration to the conditions of the Registration under the RS Act when assessing the risk of this Application and the need for additional controls.

The Radiological Council approved the Safety Case prepared by Tellus in April 2022 for long-term isolation of radiological substances in the waste cells. The Radiological Council also reviewed the updated 2022 radiological waste acceptance criteria and procedures, provided as part of this amendment application. An updated Registration has been issued, which allows radioactive waste to be accepted for disposal with conditions.

The updated Registration includes a special condition for testing and trialling immobilisation methods for radioactive material in the waste immobilisation plant.

The Delegated Officer has determined that the following environmental aspects are managed through the RS Act and are therefore not assessed further in this Amendment Report:

- Conditions on disposal permits under the RS Act, radiation management and safety, the packaging and transport of radioactive waste.
- Specific acceptance criteria and procedures for radioactive waste, as described in the RWAC and RWAP.
- Environmental monitoring (gamma, dust and air quality) to ensure that radiological risks to humans and the environment remain low.
- The assessment of radiological risk associated with the Premises post-closure.

2.7.3 Work Health and Safety (Mines) Regulations 2022

Radiation safety on certain mine sites in Western Australia is also subject to the *Work Health and Safety (Mines) Regulations 2022* (the WHS Mines Regulations), which are administered by Department of Mines, Industry Regulation and Safety (DMIRS).

Tellus is required to prepare a Radiation Management Plan (RMP) to the satisfaction of DMIRS under the WHS Mines Regulations. The RMP is intended to address health and safety matters falling under the remit of the WHS Mines Regulations. Tellus submitted a revised RMP to DMIRS at the end of November 2022.

The RMP submitted to DMIRS has already been reviewed by the Radiological Council as part of the Safety Case (see section 2.7.2).

Key Finding:

Radiation safety in the context of the employees, visitors and contractors has been assessed by the Radiological Council as part of the Safety Case. As at December 2022, safety was also being reviewed by DMIRS. In accordance with the *Guideline: Risk assessments* (DWER 2020), the Delegated Officer has excluded risk to employees, visitors and contractors of the Licence Holder from its assessment.

3. Risk assessment

The department assesses the risks of emissions from prescribed premises and identifies the potential source, pathway and impact to receptors in accordance with the *Guideline: Risk assessments* (DWER 2020).

To establish a Risk Event there must be an emission, a receptor which may be exposed to that emission through an identified actual or likely pathway, and a potential adverse effect to the receptor from exposure to that emission.

3.1 Source-pathways and receptors

3.1.1 Emissions and controls

The key emissions and associated actual or likely pathway during premises operation which have been considered in this Amendment Report are detailed in Table 3 below. This section also details the proposed control measures the Licence Holder has proposed to assist in controlling these emissions, where necessary.

The overarching organisational arrangements at the Premises for managing and controlling potential exposure to ionising radiation are shown in Figure 4. These include the “waste acceptance suite” (RWAC and RWAP) and the Radiation Management Plan (RMP).

The Radiological Waste Acceptance Criteria (RWAC) sets limits for the radionuclide activity and activity concentration limits that can be accepted at the Premises. These limits are based on dose limits or dose constraints as determined by the Safety Case (section 2.4.2). The limits

take into account the siting, design and planning of the Premises. This includes the unique geology, arid climate, remoteness, engineered multi layered shielding and barriers, duration of institutional control, site specific management plans and operating procedures.

Tellus is required to prepare a Radiation Management Plan (RMP) to the satisfaction of DMIRS under the WHS Mines Regulations (section 2.7.3). Tellus submitted a revised RMP to DMIRS at the end of November 2022. The RMP has already been reviewed by the Radiological Council as part of the Safety Case (see section 2.7.2).

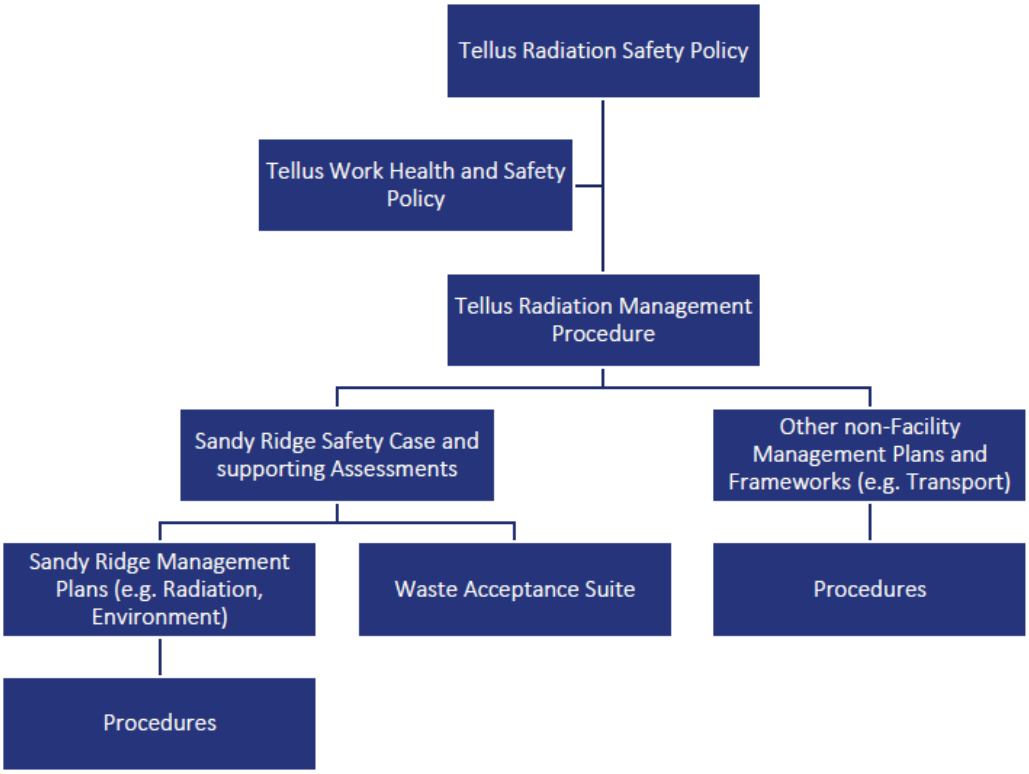

Figure 4: Organisational hierarchy for managing potential exposure to radiation.

Figure 5 shows a visual depiction of some of the controls proposed by the Licence Holder.

Table 3: Emissions and Licence Holder controls

Emission	Sources	Potential pathways	Proposed controls
Dust	Vehicle movements within the site during disposal to waste cell	Air / wind dispersion	Location of the premises remote from sensitive human receptors. The Flora and Vegetation Management Plan required under MS 1078 will be implemented. Under MS 1078, the proponent is also required to manage implementation of the proposal to avoid direct or indirect impacts to terrestrial fauna.
Noise	Vehicle movements within the site during disposal to waste cell	Air / wind dispersion	Location of the premises remote from sensitive human receptors. Plant and equipment to meet Australian Standards for noise.
Radiation, including radioactive dust and particles; and radon gas (and radon decay products/daughters)	Transport of radioactive materials within the Premises e.g. to the waste cell Permanent isolation of radioactive waste within waste cells	Direct exposure Inhalation or ingestion by humans or fauna Air / wind dispersion	Location of the premises remote from sensitive (human) receptors. Organisational hierarchy for managing potential exposure to radiation shown in Figure 4. Includes the RMP, RWAC and RWAP. The waste cell area is fully fenced, staffed daily, and is covered by CCTV. The Air Dome will also exclude fauna during operation until the capping layer is established. The Licence Holder has a procedure for the safe removal and relocation of any fauna from the waste cell area. Strict transport and storage package requirements apply and the site's RS Act registration includes conditions (section 2.7.2) including: • All radioactive waste is double contained in (generally bulk bags or drums inside shipping containers) whilst in temporary storage. • DSRS will be placed in vertical shafts within the cell for additional radiation shielding (section 2.3.6). Environmental monitoring on a monthly, quarterly or annual basis as per the RMP, which includes monitoring stations in the area surrounding the waste cell and outside the perimeter fence: • Gamma surveys and surface contamination measurements of radiation classified areas and any public areas where radioactive materials may transit; • Airborne activity, and Radon/Thoron, measurements in the waste cell

Emission	Sources	Potential pathways	Proposed controls
			and around the site to compare with baseline records. Under MS 1078, the proponent is also required to manage implementation of the proposal to avoid direct or indirect impacts to terrestrial fauna.
Leachate from encapsulated/solidified liquid and sludge wastes	Permanent isolation of radioactive waste within waste cells	Discharge to land and waters	The geology, hydrogeology and meteorology at this location make it suitable for the disposal of Part IV and V wastes, as assessed under Part IV of the EP Act. Construction of waste cells includes a 5 m buffer between the base of the cell and either groundwater or the underlying unweathered granite, whichever is shallower. Cell closure includes compacted clay domed cap to shed water. Post-closure monitoring and management requirements apply under MS 1078. Organisational hierarchy for managing potential exposure to radiation shown in Figure 4. Includes the RMP, RWAC and RWAP. Implementation of the Leachate Monitoring and Management Plan required under MS 1078, and the Deep Groundwater Monitoring and Management Plan required under EPBC 2015/7478. Immobilisation of liquid and sludge wastes, as described in section 2.3.3. Packaging requirements apply under the RS Act (section 2.7.2).
Radiation-contaminated stormwater	Permanent isolation of radioactive waste within waste cells Breach of containment of waste containers during transport within the Premises e.g. to the waste cell	Direct discharge of contaminated stormwater to land and waters Ingestion of contaminated surface water by fauna	Organisational hierarchy for managing potential exposure to radiation shown in Figure 4. Includes the RMP, RWAC and RWAP. The use of an air dome over the active cell to prevent rainfall infiltration, and the diversion of uncontaminated stormwater away from the waste cells. The Air Dome will also exclude fauna during operation. After closure, the cell will be closed and capped (section 2.3.6). Strict transport and storage package requirements apply under the site's RS Act registration (section 2.7.2). The Flora and Vegetation Management Plan required under MS 1078 will be implemented. Under MS 1078, the proponent is also required to manage implementation of the proposal to avoid direct or indirect impacts to terrestrial fauna.

Figure 5: Conceptual site model for radioactive waste disposal. Note that the Licence Holder is not proposing to use the horizontal "vault" method as part of this application (refer to Table 1).

3.1.2 Receptors

In accordance with the *Guideline: Risk assessments* (DWER 2020), the Delegated Officer has excluded employees, visitors and contractors of the Licence Holder from its assessment. Protection of these parties often involves different exposure risks and prevention strategies, and is provided for under other state legislation. For this Amendment Application, radiation safety has been assessed by the Radiological Council as part of the Safety Case. As at December 2022, it was also being reviewed by DMIRS.

A native title claim, which was registered by the Marlinyu Ghoorlie under the National Native Title Register on 28 March 2019, includes the Premises boundary. In future if the claim is determined, the native title holders may visit the area near the Premises. However, a cultural heritage assessment that was undertaken in June 2015 indicated no known record of heritage items within the site. There are no known Aboriginal sites or heritage places within the Project footprint or within 10 km. As such the Marlinyu Ghoorlie have not been considered as a receptor for the purposes of the risk assessment, given visits are only likely on an occasional and short duration basis.

Table 4 below provides a summary of potential human and environmental receptors that may be impacted as a result of activities upon or emission and discharges from the prescribed premises *(Guideline: Environmental siting* (DWER 2020)).

Table 4: Sensitive human and environmental receptors and distance from prescribed activity

Human receptors	**Distance from prescribed activity**
Workers at the Mount Walton Intractable Waste Disposal Facility (IWDF)	Approximately 5 km east of the Premises. An area immediately east of the Premises has also been set aside for potential future expansion of the IWDF.
Workers at Department of Biodiversity Conservation and Attractions (DBCA)-managed lands and waters	The former Jaurdi Pastoral Lease (a proposed conservation reserve) is located 4km south-west. The Mount Manning Range Nature Reserve is located approximately 10 km north-west of the Premises. The Mount Manning – Helena and Aurora Ranges Conservation Park is located approximately 20 km west of the Premises. The Boorabbin National Park is located approximately 100 km south of the Premises.
Ex-Juardi pastoral station homestead	Approximately 50 km south of the Premises
Carina Iron Ore Village / Mine Camp	Approximately 52 km south of the Premises
Town of Koolyanobbing	Approximately 75 km south-west of the Premises
Environmental receptors	**Distance from prescribed activity**
Underlying groundwater (non-potable purposes)	A Proclaimed Groundwater Area (Goldfields Groundwater Area) intersects with the premises boundary. An updated hydrogeological model was

	developed by the Licence Holder in 2022. It found the absence of a groundwater aquifer in the weathered granite profile. Any water stored in the very low permeability fresh granite is likely to form localised fractured rock aquifers only. There was no evidence of a shallow groundwater table, due to annual evaporation rates (2400 mm) exceeding the average annual rainfall (250 mm). EPA Report 1611 considered potential impacts from waste leachate to groundwater from the storage of intractable waste and found that there is unlikely to be any residual impact.
Non-perennial surface water bodies	DWER GIS data indicate two minor non-perennial waterbodies associated with Lake Raeside, one approximately 50 m south of the proposed premises boundary and one approximately 450 m west of the proposed premises boundary (based on available GIS dataset – Hydrography WA 250K – Surface Waterbodies). These waterbodies are located approximately 2.5 km and 1.4 km respectively from the proposed infrastructure area and temporary waste storage area. EPA Report 1611 considered potential impacts from waste leachate to inland surface water receptors from the storage of intractable waste and found that there is unlikely to be any residual impact.
DBCA-Managed Lands and Waters	The Mount Manning Range Nature Reserve is located approximately 9.8 km north-west of the Premises. The Mount Manning – Helena and Aurora Ranges Conservation Park is located approximately 19.8 km west of the Premises. The Boorabbin National Park is located approximately 100 km south of the Premises. The former Jaurdi Pastoral Lease, which is a proposed conservation reserve, is located approximately 4 km south-west of the Premises.
Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs)	The Finnerty Range/Mt Dimer/Yendilberin Hills Vegetation Complexes (Banded Ironstone Formation) (Priority 1 PEC) are located approximately 12.5 km to the south-west of the Premises. Recent flora surveys have found that a vegetation association in the water infrastructure area has affinity to that PEC. That information will be reviewed by the EPA as part of the Environmental Scoping Document (ESD) (see section 2.6).

Threatened/Priority Flora	MS 1078 included conditions on the management of flora and vegetation. Recent flora surveys have found that 10 priority flora species occur within the Premises or immediate surrounds, including within the indicative disturbance footprint. Three species of interest were also identified, and an undescribed species resolved. That information will be reviewed by the EPA as part of the ESD.
Threatened/Priority Fauna	MS 1078 included conditions on the management of fauna. A recent fauna survey found that vulnerable fauna (*Leipoa ocellata*) is mapped within the premises boundary. Malleefowl, Central Long-eared bat, Western Rosella, Fork-tailed Swift, Peregrine Falcon are noted to possibly occur within the prescribed premises boundary. Four fauna habitats were also recorded within the development envelope. Five significant fauna are considered to potentially occur within the development envelope. The above information will be reviewed by the EPA as part of the ESD.

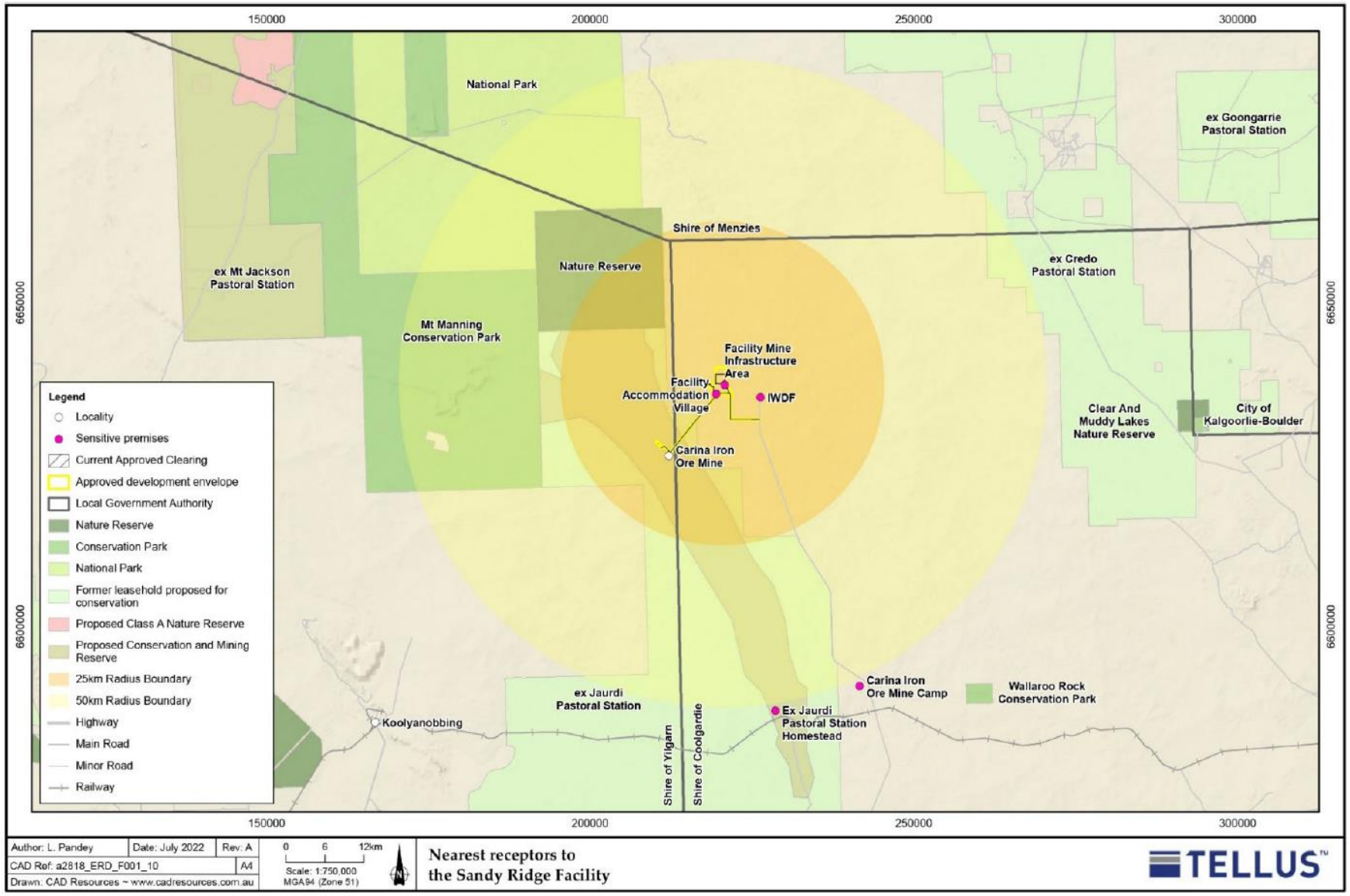

Figure 6: Distance to sensitive receptors

3.2 Risk ratings

Risk ratings have been assessed in accordance with the *Guideline: Risk Assessments* (DWER 2020) for those emission sources which are proposed to change and takes into account potential source-pathway and receptor linkages as identified in Section 3.1. Where linkages are in-complete they have not been considered further in the risk assessment.

Where the Licence Holder has proposed mitigation measures/controls (as detailed in Section 3.1), these have been considered when determining the final risk rating. Where the Delegated Officer considers the Licence Holder's proposed controls to be critical to maintaining an acceptable level of risk, these will be incorporated into the licence as regulatory controls.

Additional regulatory controls may be imposed where the Licence Holder's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in Table 5.

The Revised Licence L9240/2020/1 that accompanies this Amendment Report authorises emissions associated with the operation of the Premises i.e. the permanent isolation of radiological wastes within waste cells and the use of the revised radiological and chemical waste acceptance criteria and procedures.

The conditions in the Revised Licence have been determined in accordance with *Guidance Statement: Setting Conditions* (DER 2015).

Table 5. Risk assessment of potential emissions and discharges from the Premises during operation

Risk Events					Licence Holder controls	Risk rating C = consequence L = likelihood [1]	Applicant controls sufficient?	Conditions of Revised Licence [2]	Justification for additional regulatory controls
Sources/ Activities	**Potential emissions**	**Potential pathway**	**Potential receptors**	**Potential adverse impacts**					
Vehicle movements within the Premises to deliver waste to the waste cell, including on unsealed access roads and reversing beepers Breach of containment of waste containers during transport	Dust	Air / wind dispersion	Temporary workers of Mount Walton IWDF 5 km away.	Impacts to health and amenity	See section 3.1.1	C = Minor L = Rare **Low Risk**	Y	N/A	The nearest sensitive receptor is a significant distance (5km) away. The Delegated Officer considers it unlikely a Risk Event from dust emissions will occur given that distance. As such, the Delegated Officer considers that the Applicant's proposed controls are acceptable for the mitigation of dust emissions.
			Surrounding ecosystems, native vegetation and communities	Potential suppression of photosynthetic and respiratory functions		C = Minor L = Rare **Low Risk**	Y	N/A	The Delegated Officer notes that the management of impacts to adjacent vegetation communities is managed under requirements of the Part IV Ministerial Statement (MS 1078) and does not require further assessment under Part V of the EP Act.
	Noise	Air / wind dispersion	Temporary workers of Mount Walton IWDF 5 km away.	Amenity impacts	See section 3.1.1	C = Minor L = Rare **Low Risk**	Y	N/A	The nearest sensitive receptor is a significant distance (5km) away. The Delegated Officer considers it unlikely a Risk Event from noise emissions will occur given that distance. As such, the Delegated Officer considers that the Applicant's proposed controls are acceptable for the mitigation of noise. Noise can be effectively managed by the provisions of the *Environmental Protection (Noise) Regulations 1997.*
	Radiation, including radioactive dust and particles; and radon gas (and radon decay products/daughters)	Direct exposure Air / wind dispersion Inhalation or ingestion	Temporary workers of Mount Walton IWDF 5 km away.	Impacts to health and amenity	See section 3.1.1	C = Major L = Rare **Medium Risk**	Y	2-6 (waste acceptance), 9 (containers to remain closed), 11-14 (spill response)	The Delegated Officer has determined that the risk of this activity to human and environmental receptors is likely to be similar to the risk of transporting radioactive waste containers within the site for other reasons, such as transport to the temporary storage area, which was assessed as part of previous licence applications. The risk can be effectively managed by conditions already present on the licence, and by the provisions of the RS Act.
			Native vegetation communities, flora and fauna.	Impacts to ecosystem function, vegetation growth and fauna health	See section 3.1.1	C = Major L = Unlikely **Medium Risk**	Y		

Risk Events					Licence Holder controls	Risk rating C = consequence L = likelihood [1]	Applicant controls sufficient?	Conditions of Revised Licence [2]	Justification for additional regulatory controls
Sources/ Activities	**Potential emissions**	**Potential pathway**	**Potential receptors**	**Potential adverse impacts**					
	Radiation-contaminated stormwater	Direct discharge to land and waters Ingestion of contaminated surface water by fauna	Native vegetation communities, flora and fauna.	Impacts to ecosystem function, vegetation growth and fauna health	See section 3.1.1 for the Licence Holder's proposed controls, and other requirements under Part IV of the EP Act and the RS Act.	C = Moderate L = Unlikely **Medium Risk**	Y	1 (infrastructure), 2-6 (waste acceptance), 9 (containers to remain closed), 11-14 (spill response), 22-27 (stormwater)	N/A
Placement of solid and encapsulated/ solidified radiological wastes within waste cells	Radiation, including radioactive dust and particles; radon gas; radon decay products/daughters	Direct exposure Air / wind dispersion Inhalation or ingestion	Temporary workers of Mount Walton IWDF 5 km away	Impacts to health and amenity	See section 3.1.1 for the Licence Holder's proposed controls, and other requirements under Part IV of the EP Act and the RS Act.	See detailed risk assessment in section 3.3			
		Direct exposure Air / wind dispersion Inhalation or ingestion	Surrounding ecosystems, native vegetation communities and fauna.	Impacts to ecosystem function, vegetation growth and fauna health		See detailed risk assessment in section 3.3			
	Leachate from radioactive wastes	Direct discharge to land and waters	Surrounding ecosystems, native vegetation communities and fauna.	Soil contamination causing impacts to vegetation growth and fauna health	See section 3.1.1 for the Licence Holder's proposed controls, and other requirements under Part IV of the EP Act, the RS Act and the EPBC Act.	See detailed risk assessment in section 3.3			
	Radiation-contaminated stormwater	Direct discharge to land and waters Ingestion of contaminated surface water by fauna	Surrounding ecosystems, native vegetation communities and fauna.	Impacts to ecosystem function, vegetation growth and fauna health	See section 3.1.1. Proposed controls include the use of an air dome over the active cell to prevent rainfall infiltration, and the diversion of uncontaminated stormwater away from the landfill cells.	C = Moderate L = Rare **Medium Risk**	Y	1 (infrastructure), 21-26 (stormwater)	N/A

Well Note 1: Consequence ratings, likelihood ratings and risk descriptions are detailed in the *Guideline: Risk assessments* (DWER 2020).

Note 2: Proposed Licence Holder's controls are depicted by standard text. **Bold and underline text** depicts additional regulatory controls imposed by department.

3.3 Detailed risk assessment for radioactive emissions from the permanent isolation of radioactive wastes

3.3.1 Description of risk event

The emission of ionising radiation during the permanent isolation of radioactive wastes as a result of placing the waste within waste cells has the potential to cause an adverse impact to people outside the Premises (temporary workers of Mount Walton IWDF 5 km away) and/or the environment. Relevant environmental receptors include native vegetation communities, flora and fauna, and non-perennial surface water bodies within and adjacent to the premises.

3.3.2 Description of potential adverse impact from the emission

Ionising radiation has the potential to damage cells in living organisms, including humans and the environment (including flora and fauna) (ARPANSA, 2014). Potential impacts of exposure to ionising radiation include acute or delayed tissue damage, cancer and heritable effects in humans and the environment. Other potential environmental effects could include increased morbidity and/or mortality; and/or reduced reproductive success. There may also be more subtle effects such as mutations and effects on ecosystem functions (ARPANSA, 2014).

Sources

Potential primary sources of radiation at Premises include sealed sources, bulk unsealed material, and surface contaminated objects. These sources could generate gamma radiation and beta particles.

Unsealed material and surface contaminated objects could also create radioactive dust and particles (with the potential to be inhaled). Radioactive gases and airborne particles could be generated due to leaking packages. Finally, water could also become contaminated via spills or contamination.

Pathways

Exposure to radiation can occur through external exposure (from outside the body), or through inhalation, ingestion or absorption through the skin (ARPANSA, 2014). Potential pathways of radiological exposure to relevant receptors (human or environmental) at or near Sandy Ridge as identified by the Licence Holder include:

- Direct exposure from sealed sources or unsealed materials handled e.g. during transport within the cell, or isolation operations.
- Inhalation of radioactive dust and particles from unsealed material and surface contaminated objects;
- Inhalation of radioactive gases and airborne particles due to leaking packages;
- Inhalation of radon gas (and radon decay products/daughters) released from the decay of radon and thorium in bulk material and surface contaminated objects;
- Ingestion of radioisotopes transferred from objects to hands, mouth, or food;
- Ingestion of radioisotopes from contaminated water (including groundwater) due to spills or contamination; and
- Absorption of radioactive substances through wounds on exposed skin areas.

Receptors

The nearest human receptors being considered as part of this risk assessment are the

temporary workers of Mount Walton IWDF 5 km away. Workers at the Premises, and visitors and contractors of the Licence Holder, are excluded from DWER's risk assessment in accordance with the *Guideline: Risk assessments* (DWER 2020). Protection of these parties often involves different exposure risks and prevention strategies, and is provided for under other state legislation.

Threatened and priority flora and fauna occur within the Premises or immediate surrounds, as described in Table 4. Recent flora surveys have also found that a vegetation association in the water infrastructure area has an affinity to a Priority Ecological Community recorded nearby.

3.3.3 Criteria for assessment

Human

Radiation dose limits and maximum permissible exposure levels for the protection of health are specified in regulation 24 and Schedule I of the *Radiation Safety (General) Regulations 1983*. The dose limits for persons other than occupationally exposed persons are as follows:

- An effective dose of 1 mSv annually, averaged over 5 years.
- An effective dose of 5 mSv in any year.
- An effective dose of 250 µSv in any period of 7 days for areas that might be continuously occupied.
- An effective dose of 20 µSv in any 1 hour for areas that might be continuously occupied.

Environment

The screening criteria for protection of the environment was a dose rate of 10 µGy/hr for incremental exposures to native plants and animals near the Premises, as required by the Safety Case. Exceeding the criteria is a trigger for more detailed assessment.

3.3.4 Applicant/Licence Holder controls

This risk assessment has considered the controls described above in section 3.1.1.

3.3.5 Predicted emissions

Human

A detailed Operational Radiological Safety Assessment (ORSA) was developed by the Licence Holder as part of the Safety Case (see section 2.7.2). The ORSA identified 24 risk scenarios, which included normal operations, incidents and accidents. Computer models of the scenarios were built to calculate radiological exposures to workers, visitors and contractors at the Premises and to the natural environment.

Workers, visitors and contractors at the Premises are excluded from DWER's risk assessment in accordance with the *Guideline: Risk assessments* (DWER 2020). Protection of these parties often involves different exposure risks and prevention strategies, and is provided for under other state legislation.

The nearest human receptors being considered as part of this risk assessment are the temporary workers of Mount Walton IWDF 5 km away. For the purposes of this risk assessment, DWER is considering those workers "persons other than occupationally exposed persons" (see section 3.3.3 for assessment criteria).

During operations at Sandy Ridge, the effective dose to visitors and contractors at the Premises was predicted to be less than 0.1 mSv per year. This is less than the assessment criteria for "persons other than occupationally exposed persons". Workers at the Premises

(who may enter the waste cell inside the Air Dome) were predicted to receive an annual effective dose of less than 5 mSv/year for normal operations and “anticipated operational occurrences” combined. This is also less than the assessment criteria for “persons other than occupationally exposed persons”, except one (effective dose of 1 mSv annually, averaged over five years).

At the IWDF, facilities are present to cater for five permanent personnel. However, workers at the IWDF are 5 km from the Premises. The Licence Holder has advised that during operation, based on the modelling and controls in the Radiation Management Plan, radiological exposures at the surface outside the Air Dome (>7m away) will be insignificant.

IWDF workers are also not likely to have a permanent presence at the IWDF, given that since July 2008, only one delivery of waste was made (DWER, 2022). Workers will still be required at the IWDF for care and maintenance (for example, ongoing environmental monitoring) or for future waste deliveries.

Environment

The Licence Holder commissioned a radiological risk assessment for fauna and flora in 2016, as part of the PER under Part IV of the EP Act (Hygiea Consulting, 2016).

The Licence Holder has advised that the risk assessment was updated in 2022, and included in the PCRSA approved by the Radiological Council (section 2.7.2).

The radiological risk assessment was carried out using the ERICA tool, which is a software system maintained by a consortium (including ARPANSA) that is led by the Norwegian Radiation and Nuclear Safety Authority. The ERICA model contains a tiered approach to assessment, whereby exceeding the screening criteria is a trigger for more detailed assessment. As more assessment is carried out, more site-specific data is included. If, after including more site-specific data, the dose rate is above the screening criteria, then further assessment or management (controls) would be considered as needed to reduce the risk.

The terrestrial fauna and flora species selected for the risk assessment included general categories such as soil invertebrates, grasses and herbs, tree, mammal, bird and reptile; as well as specific fauna and flora species native to the area as described in the PER. General Australian species like the kangaroo, emu, cockatoo and echidna. The assessment considered whether each species lived within soil, on soil or in the air.

More recent flora and fauna surveys have been carried out by the Licence Holder and some changes were identified, including:

- The vegetation association *Banksia arborea* shrubland (Ba-S) that forms part of a Priority Ecological Community (PEC) occurred in the borefield location (not within the prescribed Premises);
- 10 priority flora species occur within the Premises or immediate surrounds. Species identified that were not listed in the 2016 assessment include *Cryptandra exserta* (P1), *Hyalosperma stoveae* (P2), *Acacia crenulate* (P3), *Cryptandra crispula* (P3), *Drosera eremaea* (P3), *Labichea eremaea* (P3), *Melichrus* sp. Bungalbin Hill (F.H. & M.P. Mollemans 3069) (P3), *Banksia arborea* (P4) and *Eucalyptus formanii* subsp. *Circulate* (P4). Three species of interest were also identified; and
- The Central Long-eared bat, Western Rosella and Peregrine Falcon were noted to possibly occur within the prescribed premises boundary.

The results of recently updated surveys have not yet been reviewed by the EPA and were not included in the PCRSA. However, the new species identified are likely to have similar assessment outcomes to the species already included. For example, fauna included in the 2016 assessment included birds in a range of sizes (e.g. rainbow bee-eater, fork-tailed swift, cockatoo, cattle egret, great egret); and four separate local plant species as well as general

categories for tree, shrub, grasses and herbs, lichen and bryophytes.

Four exposure scenarios were modelled using the ERICA tool:

1. exposure of fauna and flora present in the area surrounding the radioactive waste warehouse, and (as per the 2022 update) a waste cell during waste operations;
2. exposure to windblown material originating from operational stockpiles e.g. ore, sand, laterite and silcrete during the mining phase. Since the 2016 report, the Licence Holder has characterised native soil materials at the site and confirmed that NORM levels are an order of magnitude below threshold radiological doses;
3. exposure to windblown material originating from adhoc stockpiles e.g. radioactive materials received as bulk or from emergency clean-up operations; and
4. exposure post-closure, with 7 metres of capping material and rehabilitation established.

Separate models were developed for unsealed material (i.e. NORM) containment and isolation, and DSRS containment and isolation via the vertical shaft.

During operations, the 7 metres of capping material will not yet be in place but an enclosed Air Dome will be present to prevent air emissions and exclude fauna (section 3.1.1). Additional controls (set out in the Radiation Management Plan) will also be in place to protect the Licence Holder's workers, who may enter the waste cell inside the Air Dome. The Licence Holder has advised that during operation, radiological exposures at the surface outside the Air Dome (>7m away) are expected to be insignificant. Gamma, dust and air monitoring will be regularly carried out as described in section 3.1.1.

Modelling for Scenario 3 (windblown material from bulk radioactive material stockpiles) found that radiological impacts were too high for adequate protection of flora and fauna. The assessment found that it was imperative to ensure that bulk materials were contained to prevent windblown dispersal to the surrounding environment. It was also recommended that fauna species be excluded from bulk materials and pits during operations. Conditions have been applied accordingly, as set out in section 3.1.1. Current controls include double containing all radioactive waste, and regular environmental monitoring.

The Licence Holder proposes to tip bulk NORM materials directly into the waste cell. However, this will be occurring below ground, with dust suppression, inside the enclosed Air Dome.

The Licence Holder has advised that during operation, based on the controls in the Radiation Management Plan (which are designed to protect workers inside the cell), radiological exposures at the surface outside the Air Dome (>7m away) will be insignificant.

Leachate

The updated ERICA tool modelling carried out in 2022 found that radiological exposures to the environment were slightly above the screening dose from exposure to unsealed material, via the contaminated water pathway, in the "defect scenario". The "defect scenario" refers to a failure of infrastructure performance, such as the post-closure capping not performing as expected and allowing infiltration into the waste cell. The Delegated Officer considers that a similar scenario could occur during operations if the Air Dome were to not perform as expected and/or if the immobilisation process is inadequate. Treatment procedures for radioactive liquid wastes remain under development (section 2.7.2).

The PCRSA found that direct exposure to contaminated water by biota was unlikely. The Delegated Officer notes that a contiguous groundwater aquifer has not been identified beneath the site (see Table 4), and subterranean fauna were not identified as a key environmental aspect during assessment under Part IV of the EP Act. Radiological waste acceptance criteria were derived based on the activity and activity concentration limits calculated through the risk assessment. This included the groundwater pathway.

3.3.6 Key findings

The Delegated Officer has reviewed the information regarding the permanent isolation of radioactive wastes and has found:

1. The Radiological Council has approved the Licence Holder's Safety Case and associated documentation, finding that the Licence Holder's controls are acceptable for mitigating impacts associated with radiation emissions during operations and post-closure.
2. More recent flora and fauna surveys have been carried out by the Licence Holder and some changes were identified. The results of these surveys have not yet been reviewed by the EPA. However, the new species identified are likely to have similar assessment outcomes to the species already included.
3. The controls in the Radiation Management Plan, which are designed to protect workers inside the cell, are likely to also reduce risk to sensitive human receptors (workers at the IDWF, 5km away) and environmental receptors.
4. Radiological waste acceptance criteria (RWAC) were calculated based on the outcomes of the risk assessment, including potential exposure to biota via contaminated groundwater. Those criteria have been reviewed by the Radiological Council and are a condition of the site's registration under the *Radiation Safety Act 1975*.
5. Leachate could occur during operations if the Air Dome were to not perform as expected and/or if the immobilisation process is inadequate. Conditions are present on the Existing Licence in relation to operational requirements of the Air Dome. However, in order to ensure the adequacy of the immobilisation process, the Delegated Officer considers that liquid and slurry wastes should be stabilised and solidified prior to disposal in the waste cell, rather than be tipped into the disposal area and left to solidify.

3.3.7 Consequence

If radioactive emission occurs and reaches sensitive receptors from the permanent isolation of radioactive wastes in waste cells, then the Delegated Officer has determined that the impact of that emission will be low-level adverse health effects or occasional medical treatment for human receptors 5km away; and/or mid-level onsite impacts or low-level off-site impacts for environmental receptors. Therefore, the Delegated Officer considers the consequence of radioactive emission from permanent isolation of radioactive wastes to be **Moderate**.

3.3.8 Likelihood of Risk Event

The Delegated Officer has determined that the likelihood of radioactive emission from permanent isolation of radioactive wastes occurring will be **Unlikely**.

3.3.9 Overall rating of radioactive emission from permanent isolation of radioactive wastes

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix and determined that the overall rating for the risk of radioactive emission from permanent isolation of radioactive wastes is **Medium**.

3.3.10 Justification for additional controls

The Delegated Officer has assessed the risk associated with radioactive emission from permanent isolation of radioactive wastes, and has determined that the Revised Licence should include the following conditions:

- The Licence Holder is required to meet the specifications of the RWAC for any radiological waste accepted at the site (condition 5);
- Conditions that relate to waste processing (condition 15) and disposal (condition 19) will be amended to clarify that solidification and immobilisation specifications for liquid waste also relate to liquid radioactive wastes;
- The Licence Holder is required to seek approval from the Radiological Council prior to disposing of radiological waste in the waste cell (condition 20 will be added, similar to existing condition 6 that requires the Radiological Council's approval for accepting radioactive wastes); and
- Condition 21 will be added to clarify that DSRS are required to be placed within dedicated vertical concrete shafts constructed as described in the PER approved under Part IV of the EP Act.

4. Consultation

Table 6 provides a summary of the consultation undertaken by the department.

Table 6: Consultation

Consultation method	Comments received	Department response
Application advertised on the department's website (8/11/2022) and in the West Australian newspaper (14/11/2022)	None received	N/A
Shire of Yilgarn advised of proposal (8/11/2022)	None received	N/A
Shire of Coolgardie advised of proposal (8/11/2022)	None received	N/A
Dimer Heritage Pty Ltd advised of proposal (8/11/2022)	An informal response was received on 13 January 2023, after the consultation period had closed. The matters raised did not relate directly to this Amendment application.	Noted. The Department has responded separately to the matters raised.
Koora Retreat advised of proposal (8/11/2022)	None received	N/A
Department of Mines, Industry Regulation and Safety (DMIRS) advised of proposal (8/11/2022)	DMIRS provided advice between 11 November 2022 and 15 December 2022. The Sandy Ridge facility is considered a kaolin mining operation. The health and safety of employees, visitors and contractors of the Licence Holder and associated matters therefore fall under the remit	The Delegated Officer notes DMIRS' advice that works can commence during review of the RMP, as long as any required improvements to the RMP to suit WHS (Mines) Regulations are implemented accordingly. As stated in section 0, the health and safety of employees, visitors and contractors of the Licence

	of the *Work Health and Safety (Mines) Regulations 2022*. The WHS (Mines) Regulations includes obligations for the control of exposure to radioactive materials, including the appointment of a suitably qualified person to the role of Radiation Safety Officer. Tellus is also required to prepare a Radiation Management Plan (RMP) and a Radioactive Waste Management Plan (RWMP). The Safety Case is considered as meeting the requirements of the RWMP. As the Safety Case has been approved by the Radiological Council, DMIRS will defer to that decision. The RMP was submitted to DMIRS for review by the end of November 2022. Works can commence, as long as any required improvements to the RMP to suit WHS (Mines) Regulations are implemented accordingly.	Holder is excluded from DWER's risk assessment.
Department of Planning, Lands and Heritage (DPLH) advised of proposal (8/11/2022)	DPLH responded on 29 November 2022 to advise that the disposal of LLW is permitted under the Lease. DPLH has no objection to the proposed amendment, subject to Tellus obtaining all necessary approvals and consents required.	Noted.
Marlinyu Ghoorlie c/o Native Title Services Goldfields advised of proposal (8/11/2022)	None received	N/A
Licence Holder was provided with draft amendment on 23/01/2023	The Licence Holder responded to clarification requests made by DWER in the draft amendment and noted a typographical error. No comments were made on the risk assessment or licence conditions.	The Licence Holder's clarifications have been incorporated into the final amendment document. No changes were made to the draft licence conditions.

5. Conclusion

Based on the assessment in this Amendment Report, the Delegated Officer has determined that a Revised Licence will be granted, subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

5.1 Summary of amendments

Table 7 provides a summary of the proposed amendments and will act as record of implemented changes. All proposed changes have been incorporated into the Revised Licence as part of the amendment process.

Table 7: Summary of licence amendments

Condition no.	Proposed amendments
5	Amended refer to updated waste acceptance criteria and procedures.
15	Amended to clarify that solidification and immobilisation specifications also relate to liquid radioactive wastes.
20	Condition added to require the Licence Holder to seek approval from the Radiological Council prior to disposing of radiological waste in the waste cell.
21	Condition added to require that DSRS are placed within dedicated vertical concrete shafts constructed as described in the PER approved under Part IV of the EP Act.
29, 30, 33	Condition number references amended.
N/A	Definitions added for DSRS and NORM.

References

1. Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) 2014, *Fundamentals: Protection against Ionising Radiation*, Radiation Protection Series (RPS) F-1, Commonwealth of Australia, Victoria.
2. ARPANSA 2018, *Australian Code for Disposal Facilities for Solid Radioactive Waste* (RPS C-3), Commonwealth of Australia, Victoria.
3. Australian Safeguards and Non-Proliferation Office (ASNO) 2019, *Australian Safeguards and Non-Proliferation Office Annual Report 2018–2019*, Barton, Australian Capital Territory. Available from: https://www.dfat.gov.au/publications/corporate/asno-annual-report-2018-19/site/section-3/functions.html Accessed 25 January 2023.
4. Department of Environment Regulation (DER) 2015, *Guidance Statement: Setting Conditions*, Perth, Western Australia.
5. Department of Water and Environmental Regulation (DWER) 2020a, *Guideline: Environmental Siting*, Perth, Western Australia.
6. DWER 2020b, *Guideline: Risk Assessments*, Perth, Western Australia.
7. DWER 2022, *Decision Report: Application for Licence, Part V Division 3 of the Environmental Protection Act 1986. Licence Number: L8190/2007/2.* Perth, Western Australia. Available from: https://der.wa.gov.au/component/k2/item/17146-l8190-2007-2 Accessed 6 January 2023.

Appendix 1: Application validation summary

SECTION 1: APPLICATION SUMMARY					
Application type					
Works approval	☐				
Licence	☐	Relevant works approval number:		None	☐
		Has the works approval been complied with?		Yes ☐ No ☐	
		Has time limited operations under the works approval demonstrated acceptable operations?		Yes ☐ No ☐ N/A ☐	
		Environmental Compliance Report / Critical Containment Infrastructure Report submitted?		Yes ☐ No ☐	
		Date Report received:			
Renewal	☐	Current licence number:			
Amendment to works approval	☐	Current works approval number:			
Amendment to licence	☒	Current licence number:	L9240/2020/1		
		Relevant works approval number:		N/A	☒
Registration	☐	Current works approval number:		None	☐
Date application received		20 September 2022			
Applicant and Premises details					
Applicant name/s (full legal name/s)		Tellus Holdings Ltd			
Premises name		Sandy Ridge Facility			
Premises location		O289974 granted by the State of Western Australia to Tellus Holdings Ltd in respect of Lot 510 on Deposited Plan 413497, volume/Folio 3169/365. 102.5 km north of Great Eastern Highway, along access reserve 44201, Boorabbin WA 6429			
Local Government Authority		Shire of Coolgardie			
Application documents					
HPCM file reference number:		DWERDT661313			
Key application documents (additional to application form):		Sandy Ridge Facility L9240/2020/1 Licence Amendment Application Supporting Document – Disposal of Radioactive			

	Material Attachment 9 - IR-F27_Category_checklist_landfills_cat.63_to_66
Scope of application/assessment	
Summary of proposed activities or changes to existing operations.	Licence amendment application: 1. Authorise the permanent isolation of low-level radiological waste in the waste cells, and 2. Change condition 5 of the licence to refer to the revised radiological and chemical waste acceptance criteria and procedures, in place of the 2016 criteria and procedure. The waste acceptance criteria (WAC) and waste acceptance procedure (WAP), dated 2016, have been split into a chemical and a radiological version, all dated 2022.

Category number/s (activities that cause the premises to become prescribed premises)

Table 1: Prescribed premises categories

Prescribed premises category and description	Assessed production or design capacity	Proposed changes to the production or design capacity (amendments only)
61	100,000 tonnes (combined) per annual period	No change
61A		No change
65	280,000 tonnes (combined) per annual period	No change
66		No change

Legislative context and other approvals

Has the applicant referred, or do they intend to refer, their proposal to the EPA under Part IV of the EP Act as a significant proposal?	Yes ☐ No ☒	Referral decision No: Managed under Part V ☐ Assessed under Part IV ☒
Does the applicant hold any existing Part IV Ministerial Statements relevant to the application?	Yes ☒ No ☐	Ministerial statement No: MS1078 EPA Report No: 1611
Has the proposal been referred and/or assessed under the EPBC Act?	Yes ☒ No ☐	Reference No: EPBC 2015/7478
Has the applicant demonstrated occupancy (proof of occupier status)?	Yes ☒ No ☐	Certificate of title ☐ General lease ☒ Expiry: 99 years from 26 Nov 2019 Mining lease / tenement ☒ Expiry: M16/547, commencing

		13/3/2020 for 21 years Other evidence ☐ Expiry:
Has the applicant obtained all relevant planning approvals?	Yes ☒ No ☐ N/A ☐	Approval: DAP/17/01318 Expiry date: Granted 3 April 2019, works to be substantially commenced by 2 April 2024
Has the applicant applied for, or have an existing EP Act clearing permit in relation to this proposal?	Yes ☐ No ☒	CPS No: N/A No clearing is proposed as part of this amendment application.
Has the applicant applied for, or have an existing CAWS Act clearing licence in relation to this proposal?	Yes ☐ No ☒	Application reference No: N/A Licence/permit No: N/A No clearing is proposed.
Has the applicant applied for, or have an existing RIWI Act licence or permit in relation to this proposal?	Yes ☐ No ☒	Application reference No: Licence/permit No: GWL202536(1)
Does the proposal involve a discharge of waste into a designated area (as defined in section 57 of the EP Act)?	Yes ☐ No ☒	Name: N/A Type: Has Regulatory Services (Water) been consulted? Yes ☐ No ☐ N/A ☒ Regional office: N/A
Is the Premises situated in a Public Drinking Water Source Area (PDWSA)?	Yes ☐ No ☒	Name: N/A Priority: N/A Are the proposed activities/ landuse compatible with the PDWSA (refer to WQPN 25)? Yes ☐ No ☐ N/A ☒
Radiological substances – does the Applicant have approval under the *Radiation Safety Act 1975*?	Yes ☒ No ☐	Site Registration: RS 210/2018 30289 with expiry 17 October 2025
Is the Premises subject to any other Acts or subsidiary regulations (e.g. *Dangerous Goods Safety Act 2004, Environmental Protection (Controlled Waste) Regulations 2004, State Agreement Act xxxx*)	Yes ☒ No ☐	*Mining Act 1978*; M16/547 *Mines Safety Inspections and Regulations 1995*; Project Management Plan PM-666-293959 *Land Administration Act 1997*;

		Crown Lease includes conditions relating to a Financial Assurance Deed
Is the Premises within an Environmental Protection Policy (EPP) Area?	Yes ☐ No ☒	N/A
Is the Premises subject to any EPP requirements?	Yes ☐ No ☒	N/A
Is the Premises a known or suspected contaminated site under the *Contaminated Sites Act 2003*?	Yes ☒ No ☐	Classification: contaminated – restricted use (C–RU) Date of classification: 30 March 2022