Outline Operating Strategy

TELLUS

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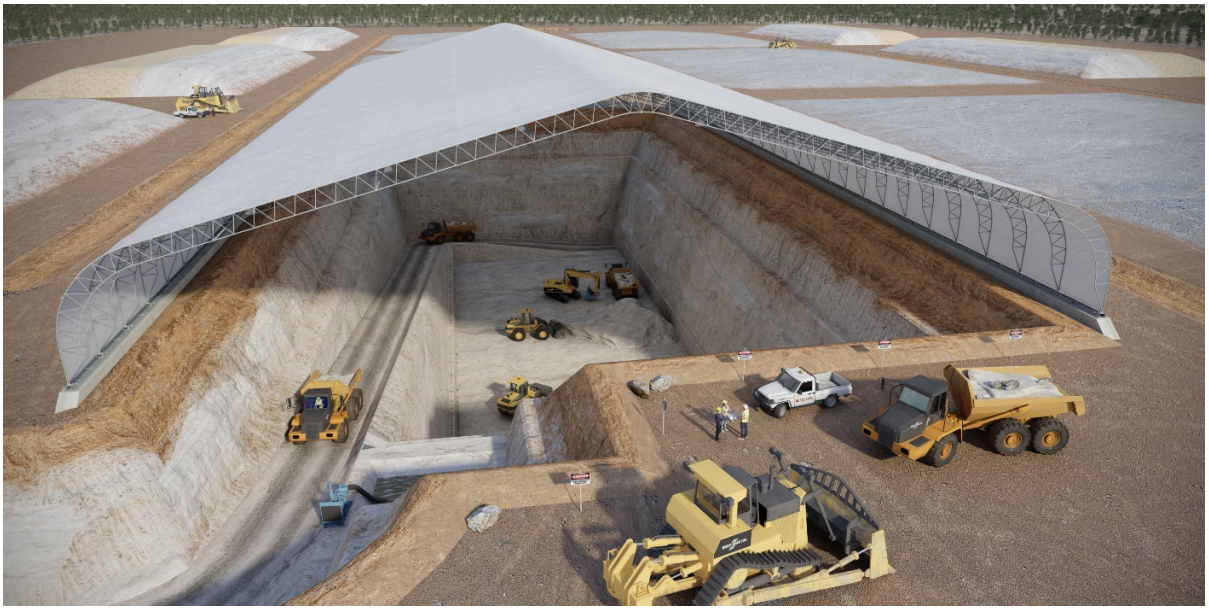
SANDY RIDGE FACILITY
OUTLINE OPERATING STRATEGY

Final Report | November 2016



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Disclaimer

This Outline Operating Strategy has been prepared as part of the Sandy Ridge Public Environmental Review (PER)which has been prepared for submission to the Western Australian Environmental Protection Authority for the purpose of the Minister for Environment making a determination regarding whether to approve Tellus Holding Limited's Proposal under the Western Australian Environmental Protection Act 1986. This PER has been developed for this purpose only, and no one other than the Environmental Protection Authority or the Minister should rely on the information contained in this PER to make any decision.

In preparing the draft Public Environmental Review (PER) Tellus has relied on information provided by specialists' consultants, government agencies and other third parties available during the preparation period. Tellus has not fully verified the accuracy or completeness except where expressly acknowledged in the draft PER.

The PER has been prepared for information purposes only; and, to the full extent permitted by law, Tellus, in respect of all persons other than the Environmental Protection Authority or the Minister, makes no representation and gives no warranty or undertaking, expressed or implied, in respect of the information contained in the PER and does not accept responsibility and is not liable for any loss or liability whatsoever arising as a result of any person acting or refraining from acting on any information contained in the PER.

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ABBREVIATIONS

ADG Code	Australian Dangerous Goods Code
ADT	Articulated dump truck
HLW	high level waste
ILW	Intermediate level waste
LLW	Low level waste
PER	Public Environmental Review
MCP	Mine Closure Plan
NATA	National Association of Testing Authorities
NEPM	National Environment Protection Measure
PPE	personal protective equipment
TETS	Tellus Electronic Tracking System
VLLW	very low level waste
VSLW	very short lived waste
WAC	waste acceptance criteria

GLOSSARY

Controlled waste	controlled waste means any matter that is — (a) within the definition of waste in the NEPM for the Movement of Controlled Waste between States and Territories; and *(b)* listed in Schedule 1 of the *Environmental Protection (Controlled Waste) Regulations 2004*
Customer	The owner of the waste. This may include a Waste Management Contractor company.
High level waste	HLW Has high levels of activity that generates significant quantities of heat by radioactive decay that needs to be considered in the design of a disposal facility.
Institutional Control Period	Following closure of the disposal facility, public access to, or alternative use of, the site shall be restricted for a predetermined period of time.
Intermediate level waste	Contains increased quantities of long-lived radionuclides and needs an increase in the containment and isolation barriers compared to LLW. ILW needs no provision for heat dissipation during storage and disposal. Long- lived radionuclides such as alpha emitters will not decay to a level of activity during the time for which institutional controls can be relied upon.
Intractable waste	Waste which is a management problem by virtue of its toxicity or chemical or physical characteristics which make it difficult to dispose of or treat safely, and is not suitable for disposal in Class I, II, III and IV landfill facilities.
Low level waste	LLW may include short lived radionuclides at higher levels of activity concentration, and also long-lived radionuclides, but only at relatively low levels of activity concentration. LLW covers a very wide range of radioactive waste, from waste that does not require any shielding for handling or transportation up to activity levels that require more robust containment and isolation periods of up to a few hundred years. LLW is generated in industry, hospitals and nuclear facilities and comprise of contaminated laboratory items such as paper, clothing, plastic and glassware, soil, smoke detectors, medicinal and industrial materials.

Register	Tellus' register of Transport Contractors who are approved for transport of hazardous wastes to the Sandy Ridge site.
Transport contractor	A Transport Contractor or commercial freight service. The Transport Contractor includes the principal company, all vehicles and operators and independent sub-contractors.
Very low level waste	VLLW does not need a high level of containment and isolation. Concentrations of longer-lived radionuclides in VLLW are generally very limited. Typical waste in this class includes soil and rubble with low activity concentration levels. Substantial amounts of waste arise from the operation of medical, industrial or research facilities with activity concentration levels in the region of or slightly above the levels specified for the exemption of material from regulatory control. Other such waste, containing naturally occurring radionuclides, may originate from the mining or processing of ores and minerals.
Very short lived waste	Waste with a very short half–life. This is mainly hospital waste, containing very-short-lived radionuclides (i.e. with half-lives that are less than 100 days), used for diagnostic or therapeutic purposes. Because of their very short half-lives, this waste is stored temporarily, for a period ranging from several days to several months and long enough for their radioactivity to decay. It is then disposed of as conventional waste.
Waste Management Contractor	A waste management services company, which may also include a Transport Contractor service.

1 INTRODUCTION

1.1 Background

This Operating Strategy has been prepared as an appendix to the Sandy Ridge Project Public Environmental Review (PER). The Sandy Ridge Project comprises two components; mining of kaolin clay for export and permanent storage of hazardous, intractable and low level radioactive waste in mine voids. Tellus will gain approval to mine kaolin under the *Mining Act 1978* and store hazardous and intractable waste under the *Environmental Protection Act 1986*.

The operational management of the kaolin clay mining will be documented in the Sandy Ridge Project Mining Proposal and the Mine Closure Plan required under the *Mining Act 1978*. The Mine Closure Plan is included as an appendix to the PER also.

Tellus recognise that the operational management of the waste aspect of the Sandy Ridge Project is likely to be of higher risk, and of greater regulator and community interest, hence this Operating Strategy was prepared to communicate Tellus' proposed strategies for handling and permanent isolation of hazardous, intractable and low level radioactive waste (LLW).

1.2 Objective

The objective of this Operating Strategy is to provide regulators and the community with an outline of the high–level operations management proposed for the Sandy Ridge Project.

2 OPERATIONAL LIFECYCLE

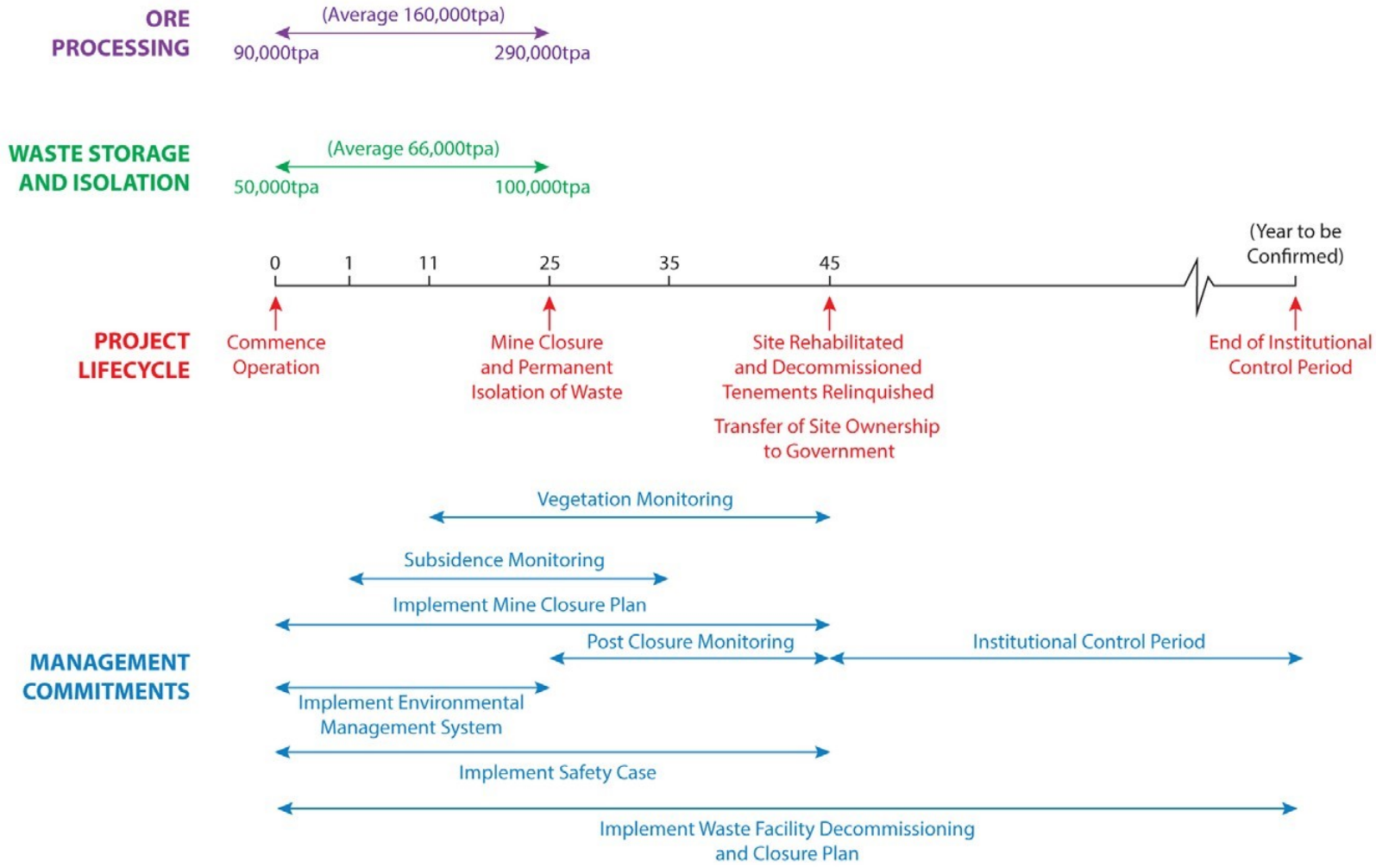
2.1 Lifecycle and milestones

Based on the currently proven kaolin clay resources estimates, enough kaolin is located within the exploration lease (E16/440) for the project to have a 52 year life. However for financial evaluation the Proposal assumes a project life of only 25 years.

Table 2–1 Project Milestones (25 Year Project Life)

Year	Milestone
1	At the completion of year one, the initial mine pit would have been excavated, with ore stockpiled ready for processing and up to 50,000 t of waste placed in the cell. How much waste is placed in the cell may vary due to the initial ramp-up of the business. Once the waste cell is full, the cap is completed and subsidence monitoring of the cell commences.
11	Subsidence monitoring finishes on the first cell. Topsoil is re-spread and seeded, and vegetation established. Vegetation monitoring commences. Other cells completed during the previous decade are continuing to be monitored for subsidence.
21	Vegetation monitoring finishes on the first cell, which is considered rehabilitated. Other cells completed during the previous two decades are continuing to be monitored for subsidence and vegetation growth.
25	At the completion of year 25, up to 7,250,000 t of ore would have been processed, and up to 2,500,000 t of hazardous, intractable and low–level radioactive waste would have been stored. Unless Tellus wishes to continue operations and an extension of the approval and licence is granted), mining and waste storage would cease. In accordance with the Waste Facility Decommissioning and Closure Plan (WFDCP), the cells would have been backfilled and capped, with various stages of rehabilitation and subsidence monitoring in progress.
35	Subsidence monitoring on all cells is completed.
37	Relinquishment of tenements under the *Mining Act 1978*. All mining related infrastructure has been decommissioned and surfaces revegetated in accordance with the Mine Closure Plan (MCP).
45	Vegetation monitoring on all cells is completed. Proposed development envelope is rehabilitated and infrastructure decommissioned. Transfer of Sandy Ridge to the state government along with financial provision for the management of the site during the institutional control period.
325	State of Western Australia controls Sandy Ridge for the institutional control period (as described in the PER).

Figure 2-1 The Sandy ridge Project life cycle



3 SANDY RIDGE GOVERNANCE HIERARCHY

The hierarchy of authority for implementation of the Sandy Ridge Project is illustrated in Figure 3–1 and described below. Each tier affects the way the next tier is implemented and thereby affects the running of the waste and mining aspects of the project.

Project Approvals – Five approvals outline conditions that affect the operational management of the Sandy Ridge Project. These include the Ministerial Statement (issued by the Minister for Environment; Heritage), Conditions of the Lease (issued by the Minister for Lands), Mining Lease and Miscellaneous Leases (issued by Department of Mines and Petroleum (DMP), Shire of Coolgardie planning approval and Commonwealth approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Licences, Registrations and Permits –Additional approvals to construct and operate the waste aspect of the Sandy Ridge Project will present a set of conditions to be considered and adhered to during construction and operations phases:

- a Works Approval and Licence under the *Environmental Protection Act 1986* – the facility will be a prescribed premise (category 66) under Schedule 1 of the *Environmental Protection Regulations*.
- A Registration / Licence under the *Radiation Safety Act 1975.*
- Permit to Possess Nuclear Material under the *Nuclear Non-Proliferation (Safeguards) Act 1987.*
- Radiation Management Plan approval under *Mines Safety and Inspection Regulations 1995*.
- Mining Proposal and Mine Closure Plan under the *Mining Act 1978*.
- Dangerous Goods Storage Licence issued under the *Mining Act 1978*.
- A Licence to Take Water issued under the *Rights in Water Irrigation Act 1914*.
- General Purpose Lease and easements issued under the *Lands Administration Act 1997*.
- Planning approval issued under the *Planning and Development Act 2005*

Note: Any licences, registrations, permits or approvals relating solely to the mining aspect have not been included in the list above given this list relates to the waste aspect of the project only.

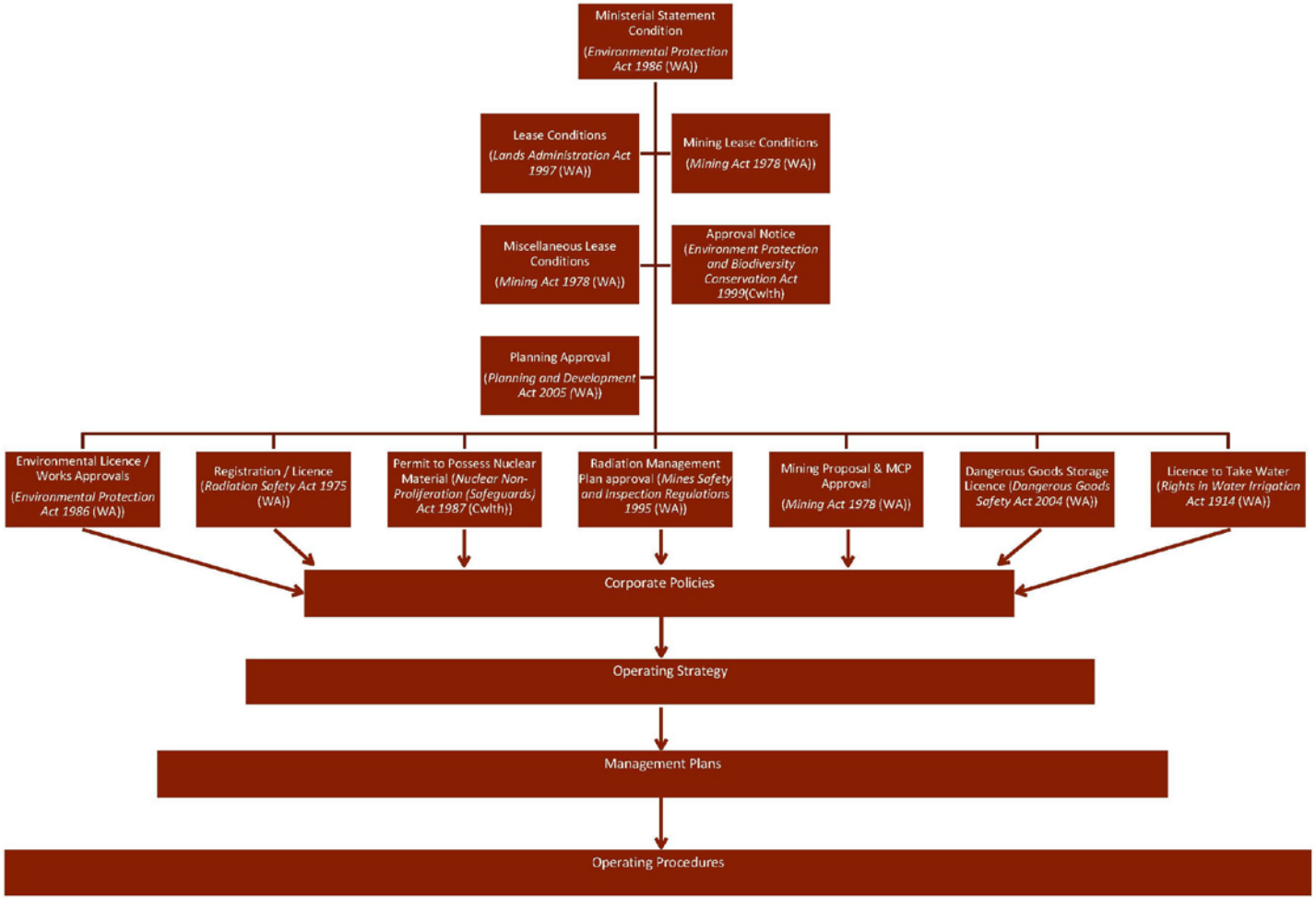
Tellus Corporate Policies – These policies are broad guidelines that detail how Tellus and its employees will act in implementing the Sandy Ridge Project.

Operating Strategy – This explains high–level management details on how the waste will be handled and disposed of in cells

Management Plans – These management plans will dictate how individual aspects of the waste disposal process will operate in order to reduce risks to the environment and people to as low as practicable.

Operating Procedures – The individual elements of the day to day operations will be set out in operating procedures to guide workers on performing the tasks required by management plans.

Figure 3-1 Governance Hierarchy



4 CUSTOMER REQUEST FOR DISPOSAL OF CHEMICAL AND RADIOACTIVE WASTE

Once a customer has requested and filled in the Chemical Waste Proforma (Appendix A.1) and/or the Radioactive Waste Proforma (Appendix A.2), Tellus administration will review the waste proforma in accordance with *SROP-01 Assessment of Waste Proforma Procedure*. The waste proforma will be examined to confirm it meets the acceptance criteria outlined below. If the waste is deemed acceptable it will be transported to Sandy Ridge by the customer's logistics company.

4.1 Acceptance criteria

Solid and liquid chemical waste which will not be accepted includes:

- No documentation – waste not accepted.
- Unexpected delivery with/without waste documentation – waste not accepted.
- Waste Proforma which lists NEPM codes E100, G100, K100, K110, K130, K140, K190, R100, R120, R140 or T200 – waste not accepted.
- Waste Proforma which lists WA Controlled Waste Categories E100, E120, E130, G100, K100, K110, K210, K230, K140, K190, K200, R100, R120 or R140 – waste not accepted.
- Waste Proforma which lists Explosive materials as a constituent of the waste — dangerous goods of **Class 1** (of ADG Code) – waste not accepted.
- Waste Proforma which lists Gases – dangerous goods of **Class 2** (of ADG Code) – waste not accepted.
- Waste Proforma which lists Flammable Liquids as a constituent of the waste – dangerous goods of **Class 3** (of ADG Code) – waste not accepted.
- Waste Proforma which lists Flammable Solids as a constituent of the waste – dangerous goods of **Class 4** (of ADG Code) – waste not accepted

Radioactive waste must meet the following criteria in order to be accepted at the facility:

- Only LLW and some ILW that meet the waste acceptance criteria will be accepted for disposal. Refer to Radioactive Waste Acceptance Guide (Hygiea Consulting, 2016) for waste acceptance criteria.

If wastes in the list above can be treated and conditioned to remove the characteristics which make them unacceptable for storage in the geological repository, then they may be considered for acceptance on a case by case basis.

5 TRANSPORT OF WASTE TO SANDY RIDGE

5.1 General principles of waste transport

Customers with small quantities of waste will be encouraged to use the services of Waste Management Contractors or Transport Contractors who have the ability to collect and consolidate waste packages, so as to minimise the number of vehicles travelling with hazardous wastes and to achieve economies of scale. The general principles of waste transport are:

- The Transport Contractor shall have in place procedures and equipment to respond to accidents, spills or fires that may occur during transport.
- Satellite tracking should be considered for consignments above a certain risk level.
- Rail transport should be used where feasible.
- A multi-barrier system of containment should be used for all waste packages, with the outer-most layer being an international standard shipping container (preferably 20 foot standard dimensions).
- When identifying wastes prior to transport, the Customer shall provide as a minimum a Materials Safety Data Sheet (MSDS) and a NEPM code identifier for the waste.
- Wastes shall be transported in accordance with all relevant codes, guidelines and Acts of any State or Territory through which the waste will travel.
- A 'disposal permit' is required for LLW from Radiation Health WA, and sealed source wastes would only be packaged suitable for transport, not final disposal which would be done at Sandy Ridge.

5.2 Register of transport contractors

Tellus will maintain a *Register of Transport Contractors* and their demonstrated capabilities for carrying various types of waste. A Transport Contractor will only remain on the Register for a limited period of time before being required to re-qualify and hence be re-instated onto the register.

Tellus, or an independent competent sub–consultant, will carry out an audit of a Transport Contractor's licences, systems and practices at any time in order for the contractor to remain on Tellus' Register. Failure to comply will result in that Transport Contractor being removed from the Register, but does not preclude the Transport Contractor from being re–instated to the Register upon passing future audits. Tellus reserves the right to remove a Transport Contractor from the Register at any time and for any reason.

The Transport Contractor will need to meet the following requirements to be listed on the *Register of Transport Contractors*:

- Be licensed to carry controlled waste in any State through which it transports the controlled waste.
- Pass regular compliance audits of management systems and operational practices. The systems and practices shall be appropriate for the type of waste being carried.

5.3 Roles and communication

The roles and communication between Tellus, the waste customer and the Transport Contractor is outlined in Table 5–1 below.

Table 5–1 Roles and communication

Step	Communication	Role
1	A **Customer** contacts **Tellus** to obtain a waste proforma (see appendices of Operating Strategy) and advises of the preferred time and date of delivery.	Customer
2	**Tellus** sends a copy of the waste proforma.	Tellus
3	**Customer** sends back the completed waste proforma.	Customer
4	**Tellus** reviews the waste proforma in accordance with *SROP-01 Assessment of Waste Proforma Procedure*. The waste proforma will be examined to confirm it meets the waste acceptance criteria (WAC). Tellus advises the customer on the price for accepting the waste, issues Tellus' required standards as prescribed in *SROP–05 Transport Standards*, and advises the Customer on other contractual issues pertaining to storage or permanent isolation certificates. If the waste proforma does not meet the WAC **Tellus** advises the Customer to pre-treat and / or package the waste so that it does meet the WAC. If the waste does require pre-treatment or packaging which the Customer cannot carry out themselves, they may be advised to use the services of an established and reputable Waste Management Contractor (e.g. Toxfree). If the waste proposed to be sent to Sandy Ridge is radioactive waste, the additional steps outlined in Table 2 will be undertaken.	Tellus
5	When the waste is in a suitable form and packaging for transport, the **Customer** then arranges freight of the waste using a Transport Contractor.	Customer
6	If the Customer does not already have established service contracts with a Transport Contractor, **Tellus** will recommend one.	Tellus
7	The **Customer** advises Tellus of the proposed Transport Contractor.	Customer
8	**Tellus** will confirm that the proposed Transport Contractor meets the requirements of *SROP–05 Transport Standards* and is listed on the *Register of Transport Contractors* who have been regularly audited by Tellus for compliance with various levels of hazardous waste transport licencing across all States and Territories of Australia.	Tellus

Step	Communication	Role
	If the Transport Contractor is not listed on the *Register of Transport Contractors* Tellus will advise the Customer, and waste will not be accepted if this Transport Contractor is used.	
9	The **Customer** (or their **Transport Contractor**) will obtain and complete forms and submit to government to meet state, territory and federal legislation requirements for transport of waste through each state and/or territory. A copy of the approval from each regulator will be sent electronically to Tellus before the agreed waste delivery date.	Customer / Transport Contractor
10	The **Customer** (or their **Transport Contractor**) shall complete and submit an Environmental Risk Assessment (ERA) for the transport of waste to Tellus. A copy of the ERA will be will be sent electronically to Tellus before the agreed waste delivery date.	Customer / Transport Contractor
11	A Customer Dispatch Notice will be issued by **Tellus** to the Customer once the above documentation is provided and considered satisfactory, to allow delivery of the waste to Sandy Ridge. The date and time of delivery to Sandy Ridge will be mutually agreed at this point.	Tellus
12	Once the **Customer** (or their **Transport Contractor**) is in possession of the Customer Dispatch Notice the waste can be transported to Sandy Ridge.	Customer / Transport Contractor
13	The **Transport Contractor** advises Tellus of when the consignment has departed the Customer's premises, and confirms the expected delivery date and time.	Transport Contractor
14	The truck transporting shipping containers will enter the facility and be weighed on the weighbridge and the driver will proceed to the front gate office. Documentation will be checked in accordance with *SROP-02 Review of Waste Documentation Procedure*. The following actions will occur: • If the documentation is not provided or is incomplete, Tellus will be unable to confirm that its packaging and transport standards have been met, and the truck will either be turned away from the site or directed to the hardstand while any uncertainties or discrepancies are resolved. • If the documentation meets Tellus' packaging and transport standards the waste carrier will be externally audited.	Tellus

5.4 Indicative transport routes

The primary modes of transport for waste transfer to Sandy Ridge will be trucks carrying shipping containers by road. The preferred transport routes for Transport Contractors from each capital city would follow the National Land Transport Network (Department of Infrastructure and Regional Development, 2014) determined under the *National Land Transport Act 2014*. Maps of the network are available at http://investment.infrastructure.gov.au/whatis/network/.

6 WASTE HANDLING AND DISPOSAL PROCESS

6.1 Front gate and weighbridge – external audit

The truck transporting shipping containers will enter the facility and be weighed on the weighbridge and the driver will proceed to the front gate office. Documentation will be checked in accordance with *SROP-02 Review of Waste Documentation Procedure*. The following actions will occur:

- If the documentation is not provided or is incomplete, Tellus will be unable to confirm that its packaging and transport standards have been met, and the truck will either be turned away from the site or directed to the hardstand while any uncertainties or discrepancies are resolved.
- If the documentation meets Tellus' packaging and transport standards the waste carrier will be externally audited.

Scenario 1 External audit

A logistics company (ACME Solutions) arrives with complete documentation but a shipping container containing arsenic trioxide has been hit by a kangaroo and the container has a large dent in the side, but nothing is leaking from the container. The delivery is considered accepted and is sent to the hardstand.

Scenario 2 No documentation and external audit

Using the *SROP-03 External Shipping Container Audit Procedure*, the operator at the front gate will confirm:

- No visible damage to the shipping container(s).
- No evidence of material leaking from the shipping container(s).
- Gamma radiation levels on the surface of the shipping container(s) will be measured in accordance with procedure *SROP-04 Gamma Radiation Monitoring*.
- Various points of the truck will be inspected.

If the truck does not meet Tellus' required standards as prescribed in *SROP–05 Transport Standards*, it will be quarantined in a holding bay, away from areas in which people are working, and Tellus will liaise with the waste customer regarding the discrepancy.

Once confirmed that the shipping container meets Tellus' transport standards, it will be moved to the hardstand.

6.2 Hardstand – external audit

Trucks will park temporarily on the hardstand whilst the shipping container is transferred to the hardstand. The shipping container remains closed. An external audit is undertaken in accordance with *SROP-03 External Shipping Container Audit* as soon as practical.

If the shipping container is confirmed to be damaged or leaking Tellus will move it directly into the Waste Inspection Area to conduct an internal audit (see Section 4.1.4) and remove the leaking/damaged waste packages. Clean-up of leaked material on the hardstand will be in accordance with *SROP-06 Spill Cleanup Procedure*.

Otherwise the shipping container will remain on the hardstand until the operators of the Waste Inspection Area are ready to receive it.

6.3 Waste inspection area audit

The shipping container will be lifted onto the Waste Inspection Area dock and one end of the container opened to allow access for the internal audit. The audit will be conducted in accordance with *SROP-07 Internal Shipping Container Audit*.

A number of waste packages will be removed from the shipping container and placed on the floor of the Waste Inspection Area. Radiation of the waste packages will be checked in accordance with *SROP–04 Gamma Radiation Monitoring* and will confirm if the emissions match those expected based on the customer's waste proforma. If the radioactivity recorded is higher than expected based on the information provided by the waste customer, the following actions will occur:

1. The radiation meter will be re-calibrated in accordance with manufacturer's specifications.
2. The radioactivity of the waste package(s) will be recorded again.
3. If the recording is still higher than expected, but below the acceptance criteria limits (see Radioactive Waste Acceptance Guide (Hygiea Consulting, 2016)) then the waste packages will be moved to the Radioactive Waste Warehouse. Tellus will liaise with the waste customer to confirm the reason for the discrepancy and if satisfactory, an Acceptance Certificate will be issued.
4. If the recording is still higher than expected, and above the acceptance criteria limits, treatment options and cost involved will be discussed with the waste customer. If unable to treat and reduce the radioactivity to within acceptable levels, Tellus will be unable to place the waste package in the cell (as this will contravene approvals issued for the site) and the waste customer will be contacted to organise removal of the waste package from the site. The waste packages may be temporarily stored in the Radioactive Waste Warehouse until this is organised.

Following checking of the packages for radioactivity, sampling of these waste packages will occur in accordance with *SROP-08 Sampling of Wastes*, and each sample will undergo checks against the customer's documentation and laboratory testing.

The waste package will be audited against the customer's waste proforma to confirm the volume and type of waste delivered is as described in the customer's documentation. The outcome of the review of documentation will be:

- If the documentation is incomplete or does not match the waste that has arrived, the package is replaced into the shipping container, the container is closed, and is moved back to a section of the hardstand pending liaison with the waste customer.
- If documentation is complete, the waste packages will be inspected for damage and leaks. If the packaging is damaged significantly the pallet will be held in a safe and secure manner (in accordance with *SROP–09 Damaged or Leaking Waste Package Procedure*) whilst a solution is agreed to with the waste customer.

Tellus will make safe any damaged or leaking waste package as soon as possible to minimise worker exposure to the waste.

Make Safe

The off-specification waste management section of the Waste Inspection Area will be fully enclosed with controlled ventilation to allow materials in leaking or unsuitable packaging to be re-packaged or wastes to be treated to ensure they are suitable for placement in a cell. Pre–treatment options are described in Section 6.5.

Following internal audit of the shipping container, all waste packages examined will be repacked into the container. The shipping container will either be:

- Transferred directly to the cell for disposal.
- Sent to the hardstand to await placement as per the Cell Schedule (described further below).
- Sent to the Radioactive Waste Warehouse for temporary storage.

6.4 Laboratory testing

Composite and random samples of the newly arrived waste packages will be collected and tested in the onsite laboratory. Testing will ensure the chemicals sent are as per the waste customer's documentation.

The onsite laboratory will be accredited by the National Association of Testing Authorities (NATA) for the analysis to be performed. Chemical analysis will be performed in accordance with the laboratory methods accredited by NATA. The laboratory will produce sample results which will be stored in the Tellus Electronic Tracking System (TETS) alongside the waste customer's proforma and NEPM documentation.

Once the sample results match the customer's documentation, the remnants of the sample, the previously removed waste packages, equipment contaminated by the sample and the lab analyst's personal protective equipment (PPE) will be repacked into the shipping container and the container closed. The shipping container is transferred back to the hardstand. The shipping container remains on the hardstand until it is scheduled to be moved into the waste cell.

Scenario 4: Analysis of Arsenic Trioxide Waste Packages

Waste packages that the waste customer claims contain arsenic trioxide are sampled. These samples are analysed using the Tellus laboratory method THLM-01 Metals in Soils by ICPOES. This method has been accredited by NATA. The results of the analysis indicate the samples contain between 5% and 60% arsenic. This matches:

a) The description of the waste provided on the waste proforma
b) The customer supplied laboratory certificate, which indicates similar concentrations.

The testing confirms that the waste that arrived matches the customer's documentation and can processed to the next step in the waste disposal process.

6.5 Pre – treatment of wastes

Tellus may accept some wastes at the facility which are flammable, explosive, corrosive, biodegradable or reactive which will require pre-treatment or conditioning before being placed in the disposal cell to ensure that they do not compromise cell integrity. Possible pre-treatment processes may include one or more of the following:

- Crushing and/or screening to ensure that the particle sizes of materials would not result in excessive voids being created (e.g. for pot liner materials).
- Solidification and stabilisation using pozzolanic cement, fly-ash or kaolinitic materials.
- Centrifugation or filtering to remove excess moisture.
- Evaporation and biological conditioning

Scenario 5: Pre–treatment of pipework containing scale

ACME Solutions delivers a 200L drum containing multiple pieces of pipe from an oil platform located on the North West Shelf. The pipes contain a build-up of scale on their inner surfaces. The scale is radioactive due to the presence of small amounts of naturally occurring uranium and thorium (i.e. NORMs). As the pipes are open at each end, there is potential for air voids to be created if they were placed directly in the radioactive shaft. Therefore the pipework would be pre–treated by filling each pipe with pozzolanic cement and then cementing the pipes within the 200L drum. The drum is then considered a solid radioactive waste and is acceptable to be disposed of in the radioactive shaft.

6.6 Acceptance certificate

Once the waste load has been audited, tested and verified, an Acceptance Certificate will be issued to the customer (in accordance with *SROP–10 Issuing Waste Acceptance Certificate*). At this point the ownership of the waste is still with the customer, but the Acceptance Certificate will provide the customer with confidence that the waste has been accepted at the facility for storage and isolation in the geological repository.

6.7 Transfer of shipping container into cell

Tellus will program the placement of waste into the disposal cell in based on the nature of the waste and planning of the cell layout to store waste of similar characteristics in designated areas of the cell. This further reduces the possibility of interactions between wastes of different types. The order of placement will be programed and documented in the Cell Scheduler.

When the Cell Scheduler indicates that a particular container is scheduled for placement, it will be loaded onto a Waste Haul Articulated dump truck (ADT) and driven into the cell. The shipping container will be removed from the Waste Haul ADT and placed on the floor of the cell adjacent to the designated disposal area. The shipping container will be opened and the pallets of waste packages removed in accordance with *SROP-11 Unpacking of Shipping Container and Placement of Waste Package in Cell.*

Waste packages will be placed into the allocated section and tightly packed together to minimise void space between containers. Backfilling of void spaces will be undertaken in a manner that ensures that all voids are completely filled. Refer to *SROP-12 Backfilling Procedure*.

6.8 Monitoring

Subsidence monitoring of each backfilled and capped cell is undertaken in accordance with *SROP–13 Subsidence Monitoring*. Radon monitoring of the surface of each cell is undertaken in accordance with *SROP–14 Radon Monitoring*.

7 OCCUPATIONAL EXPOSURE MONITORING

Exposure of workers to the various occupational health hazards on site will be monitored and controlled in accordance with a risk based occupational hygiene program. This monitoring program will include radiation monitoring in accordance to the SROP15–Occupational radiation monitoring to ensure no employee is exposed above the annual exposure limit and that exposure levels are kept as low as reasonably achievable.

8 MANAGEMENT PLANS AND OPERATING PROCEDURES

The Management Plans and Operating Procedures that will guide the operations are listed in Table 8–1.

Table 8–1 Management Plans and Operating Procedures

Management Plans	
SRMP-01	Radiation Waste Management Plan
SRMP-02	Mine Closure Plan
SRMP-03	Waste Facility Decommissioning and Closure Plan
SRMP-04	Emergency Management and Response Plan
SRMP-05	Project Management Plan
SRMP-06	Class II Landfill Post Closure Management Plan
SRMP-07	Drinking Water Quality Management Plan
SRMP-08	Radioactive Waste Acceptance Guide
SRMP-09	Construction Environmental Management Plan
SRMP-10	Operation Environmental Management Plan
Operating Procedures	
SROP-01	Assessment of Waste Proforma
SROP-02	Review of Waste Documentation
SROP-03	External Shipping Container Audit
SROP-04	Gamma Radiation Monitoring
SROP-05	Transport Risk Assessment
SROP-06	Spill Clean-up
SROP-07	Internal Shipping Container Audit
SROP-08	Sampling of Wastes
SROP-09	Damaged and Leaking Waste Package
SROP-10	Issuing Waste Acceptance Certificate
SROP-11	Unpacking of Shipping Container and Placement of Waste Package in Cell
SROP-12	Backfilling
SROP-13	Subsidence Monitoring
SROP-14	Radon Monitoring
SROP-15	Occupational Radiation Monitoring

9 ROLES AND RESPONSBILITIES

Table 9–1 lists the roles and responsibilities of the Tellus Sandy Ridge (SR) team.

Table 9–1 Roles and Responsibilities

Role	Responsibility
SR Waste Acceptance Manager	• Initial point of contact with waste customer. • Issues waste proforma. • Reviews all requests for waste disposal in accordance with *SROP-01 Assessment of Waste Proforma Procedure.* • Issues certificates in accordance with *SROP-10 Issuing Waste Acceptance Certificate.*
SR Site Supervisor	• Responsible for meeting the requirements of the governance hierarchy (Section 3). • Supervision of all personnel onsite, to ensure their roles are undertaken correctly. • Responsible for implementing *SROP–15 Occupational Radiation Monitoring*. • Training of all personnel onsite. • Liaise with Tellus Corporate.
SR Front Gate and Weighbridge Operators	• Initial point of contact with waste carrier on arrival at site. • Checks documentation in accordance with *SROP-02 Review of Waste Documentation Procedure* and *SROP–05 Transport Standards*. • Undertakes external audits in accordance with *SROP-03 External Shipping Container Audit Procedure.*
SR Waste Inspectors and Disposal Operators	• Directs waste carrier on hardstand or to Waste Inspection Area. • Conduct audits in accordance with *SROP-03 External Shipping Container Audit* and *SROP-07 Internal Shipping Container Audit.* • Cleanup spills in accordance with *SROP-06 Spill Cleanup Procedure.* • Checks documentation in accordance with *SROP-02 Review of Waste Documentation Procedure*. • Implements *SROP–09 Damaged and Leaking Waste Package Procedure* as required. • Unpacks shipping container in cells as per *SROP-11 Unpacking of Shipping Container and Placement of Waste Package in Cell.*

Role	Responsibility
	• Places waste in cell section or dedicated shaft (radioactive waste) in accordance with *SROP-11 Unpacking of Shipping Container and Placement of Waste Package in Cell.* • Backfills and compacts each placed section in accordance with *SROP-12 Backfilling Procedure*.
SR Laboratory Technicians	• Sample waste packages in accordance with *SROP-08 Sampling of Wastes*. • Complete laboratory analysis as per NATA accredited methods. • Provide results to SR Waste Acceptance Manager.
SR Radiation Safety Officer	• First check of waste carrier at front gate in accordance with *SROP–04 Gamma Radiation Monitoring.* • Implementation of the *SRMP-01 Radiation Waste Management Plan.*
Earthmoving Contractor	• Excavation of mine pits. • Capping of cell.
SR Environmental Manager	• Complete subsidence monitoring in accordance with *SROP–13 Subsidence Monitoring.* • Complete radon monitoring in accordance with *SROP-14Surface radon monitoring*. • Reporting to regulator on non-compliances with approval conditions.

10 REFERENCES

Department of Infrastructure and Regional Development, 2014, *National Land Transport Network 2014–Road*, available at: http://investment.infrastructure.gov.au/whatis/network/images/National_Land_Transport_Network_2014_-_Road.pdf

Hygiea Consulting, 2016, *Radioactive Waste Acceptance Guide*

11 APPENDICES

A.1 Chemical Waste Proforma

CHEMICAL WASTE PROFORMA

All sections of this waste proforma must be filled in by the applicant prior to lodgement.

Application (TETS) Number: (Tellus Use Only)	
APPLICANT INFORMATION	
Applicant Name and ABN / ACN:	
Applicant Address:	
Applicant Contact Person and Contact Details:	
Requested date for delivery (if approved by Tellus):	
WASTE INFORMATION	
Origin of waste (indicate name of waste-producing facility):	
Volume:	kL
Weight:	tonnes
Waste Form (circle one):	Solid Liquid[1] Gas
Description of previous treatment/conditioning of waste:	
Is a copy of a NATA accredited laboratory certificate attached that contains a comprehensive analysis of the waste?:	Yes No
Identify/describe waste constituents:	
TRANSPORT INFORMATION	
***National Environment Protection (Movement of Controlled Waste between States and Territories) Measure 1998 (as amended)* Code:**	
WA Controlled Waste Category:	
Australian Dangerous Good Class:	
Transport Mode:	
Transport Provider:	
Does the Truck meet Tellus Standards?[2]:	
Describe the waste package and container:	
Any specific additional information advice, especially procedures and warnings related to accidental damage to the container;	
ENDORSEMENT	
Signature of Applicant:	
Date:	

[1] including sludge and pastes

[2] Refer to *SROP–05 Transport Standards*

A.2 Radioactive Waste Proforma

RADIOACTIVE WASTE PROFORMA

All sections of this waste proforma must be filled in by the applicant prior to lodgement.

Application (TETS) Number: (Tellus Use Only)	
APPLICANT INFORMATION	
Applicant Name and ABN / ACN:	
Applicant Address:	
Applicant Contact Person and Contact Details:	
Requested date for delivery (if approved by Tellus):	
WASTE INFORMATION	
Origin of waste:	
Present location of waste:	
Source/material description:	
Radioisotope(s):	
Half-life:	
Type of radiation emitted (circle one):	Alpha beta gamma neutron
Current date:	
Current activity:	
Waste Form (circle one):	Solid Liquid[3] Gas
Source type (circle one):	Sealed Unsealed
Is it a special form of radioactive material (circle one):	Yes No
If yes to the above question, provide further information:	Expiry date of special form certificate: Special form certificate number:
Volume of source/material for disposal: (may need to include container and/or shielding volume)	
Length of time source/material used/registered:	
Purpose/use of source/material:	
Is a chemical analysis of the waste attached?:	Yes No
Has a Disposal Permit been issued by the Western Australian Radiological Council: (if yes, please attach)	Yes No
If relevant provide details on the source:	Manufacturer: Manufactured date: Serial number: Initial activity: Radiological Council Registration No:

[3] including sludge and pastes

Application (TETS) Number: (Tellus Use Only)			
RADIOLOGICAL ASSESSMENT			
Radioisotope	**Activity (GBq)**	**Volume (L)**	**Activity fraction of 200L drum**
TRANSPORT INFORMATION			
***National Environment Protection (Movement of Controlled Waste between States and Territories) Measure 1998 (as amended)* Code:**			
WA Controlled Waste Category:			
Australian Dangerous Good Class:			
Transport Mode:			
Transport Provider:			
Does the Truck meet Tellus Standards?[4]:			
Describe the waste package and container:			
Any specific additional information advice, especially procedures and warnings related to accidental damage to the container;			
ENDORSEMENT			
Signature of Applicant:			
Date:			