Naturally occurring radioactive material (NORM) is the term used to describe materials containing radionuclides that occur naturally in the environment.

Although the radionuclide content is low in most environments, the processing of materials extracted from the earth (e.g. mineral sands or hydrocarbons) can concentrate the NORM. Typical waste streams may be contaminated soils, sludges and scales deposited in processing equipment (e.g. pipes, see Fig. 1).

NORM does not pose the same level of external radiation risk as sealed sources, but does pose a significant internal hazard both from inhalation of dust as well as potential for exposure to radon gas due to radium decay. Therefore, NORM has the potential to harm humans and the environment and must be managed appropriately.

Additionally, NORM wastes may possess other hazardous characteristics that are not related to radioactivity (e.g. flammability, toxicity) and treatment may be required to eliminate these characteristics prior to disposal.

NORM wastes are often placed in temporary storage facilities for extended periods of time, sometimes years. This increases the risk of unacceptable radiological exposure and/or radionuclide release, as security is difficult to maintain over extended periods as packaging materials and label markings degrade.

Extended storage can also result in loss of records and knowledge regarding the radionuclide content and activity concentration.

The availability of NORM disposal methods depends on the form, activity and hazardous properties of the waste.

Current methods of managing NORMs include:

- Store for extended periods until a suitable cost-effective disposal technique becomes available in Australia.
- Export for disposal at an international facility. The international transport of radioactive materials is heavily regulated, risky and often cost prohibitive.
- Disposal at Mt Walton East IWDF which operates on a campaign basis and only accepts Western Australian waste.
- Addition as part of the cementitious backfill in underground mines.
- Injection into oil wells to be plugged and abandoned.
KEY POINTS

• NORM’s occur naturally in low volumes but may be concentrated during processing of materials.
• Danger is dependent on radionuclide release, exposure method and radiation exposure, Tellus is able to dispose of NORM solids, liquids, sludges and surface contaminated objects.

TYPICAL DG CLASS AND UN CODE

Radioactive materials for dangerous goods transportation are generally Class 7. Specific classification depends on waste composition, properties and hazard characteristics.

Typical classifications expected at Sandy Ridge include:

• UN 2912 – RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-I), non-fissile or fissile excepted.
• UN 2913 – RADIOACTIVE MATERIAL, SURFACE CONTAMINATED OBJECTS (SCO-I, SCO-II or SCO-III), non-fissile or fissile excepted.

IMMOBILISATION AND DISPOSAL OF NORM CONTAMINATED WASTES

Tellus’ Sandy Ridge Facility will accept NORM contaminated waste classified as low level waste, including surface contaminated objects and material in solid, liquid or sludge form.

Permanent isolation (disposal) will be completed in accordance with best practices described by the International Atomic Energy Agency, particularly Safety Requirements for the Disposal of Radioactive Waste (SSR-5.) Additionally, due to the co-disposal of hazardous chemical wastes, disposal will also be in accordance with the Basel Convention.

Requirements 8 and 9 of SSR-5 involve ensuring the facility design includes barriers to prevent or minimise the release of radionuclides and prevent the migration of radionuclides from the disposal area.

In order to meet these requirements and Tellus’ Waste Acceptance Criteria (WAC), Tellus must immobilise some wastes prior to disposal in a bed of low-permeability clay.

Immobilisation treatment involves locking the waste into a cementitious matrix and/or adsorbing it onto a suitable material (Fig. 2 and 3). The process involves mixing the waste with appropriate ratios of binders and kaolin, according to one of several formulations that Tellus has developed, to produce a solid, cementitious block. The appropriate formulation will be selected based on the characteristics of the waste and the required outcome of immobilisation treatment.

NORM wastes will be subjected to immobilisation and other treatments under the following conditions:

• Waste is in a liquid or sludge form.
• Waste possesses hazardous properties that are not compatible with the Sandy Ridge disposal system.

NORM wastes that do not require immobilisation, such as surface contaminated objects, will be disposed of using an appropriate method. Objects such as decommissioned equipment pieces may be oddly shaped with significant void spaces (e.g. pipes), therefore, Tellus has developed techniques to grout oddly shaped items, prior to disposal.

Fig. 2: A sample block of immobilised waste (with NORM)

Fig. 3: Processing equipment contaminated with NORMs requires grouting to fill all void spaces
THE TELLUS SOLUTION

Tellus is currently developing storage, recovery, and permanent isolation infrastructure in the form of geological repository facilities supported by a “hub and spoke” logistics solution across Australia.

KEY CLIENT BENEFITS

Tellus offers simple, safe and cost-effective storage, treatment and permanent isolation (disposal) solutions for hazardous wastes.

Features and benefits include:

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<thead>
<tr>
<th>Quality</th>
<th>Functionality</th>
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<tr>
<td>• Australia’s first best practice permanent solution for legacy, production and emerging waste streams across all sectors.</td>
<td>• Broad range of waste acceptance (hazardous waste and low level radioactive waste (LLW)).</td>
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<td>• Due to Sandy Ridge’s superior site selection and multi-barrier safety case, waste is permanently isolated from the biosphere over geological time (millions of years).</td>
<td>• Can accept liquid, sludge and solid waste.</td>
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<td>• International Organization for Standardization (ISO) accreditation and compliance; ISO 14001 (environment), ISO 9001 (quality), AS 4801 (health and safety).</td>
<td>• Can provide one-stop-shop solution (facilitate pre-gate services with approved waste characterisation, packaging and transport providers).</td>
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<th>Commercial &amp; risk transfer</th>
<th>Sandy Ridge availability and innovation</th>
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<td>• Tellus is the only company that can issue a valuable Permanent Isolation Certificate (Tellus PICTM).</td>
<td>• Licenced capacity of 100 ktpa for 25 years.</td>
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<td>• A Tellus PICTM certifies critical facts that provides a basis for derecognising a liability provision on financial statements under Australian Accounting Standard Board (AASB) accounting standard AASB 137.</td>
<td>• Facility is operationally available throughout the year.</td>
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<td>• Adequate assurance and insurance (agreed with the regulators and international peer reviewed).</td>
<td>• Innovative cell airdome improves overall safety, productivity and allows all-weather use.</td>
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<td>• Risk and title transfer to Tellus on the issue of a waste acceptance notice.</td>
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<td>• When waste is removed from a client’s site, benefits are also recognised in a reduction to health, safety, environmental, community and compliance risk.</td>
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<th>Regulatory approvals and licensing</th>
<th>Price</th>
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<td>• Commonwealth, state and local government approvals and licensing for Sandy Ridge facility that support a near surface clay geological repository with unique site characteristics and a robust safety case.</td>
<td>• Tellus’ waste services are cost effective and provide long-term-cost certainty.</td>
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<td>• Tellus’ Sandy Ridge and Chandler geological repositories are the only waste facilities in Australia that have been awarded Major Project Facilitation (MPF) status by the Australian Government.</td>
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