TELLUS

Benefits of a Geological Repository

Governments globally are increasingly seeking alternative options to surface landfill of hazardous waste as they move away from the linear economy of "Take, Make and Dispose" and seek long term environmental performance. Geological repositories are generally considered by government to have the ability to contain hazardous waste over the long term and consider the material as a future valuable resource where we create the opportunity for it to re-enter the circular economy or be stored safely until it can.

The Issue

Australia produces approximately 6 million tonnes of hazardous waste each year and we have approximately 900 million tonnes of legacy hazardous waste sitting in temporary landfill, short term storage facilities and other temporary locations. Australians also continue to be one of the largest emitters of haz. waste per capita.

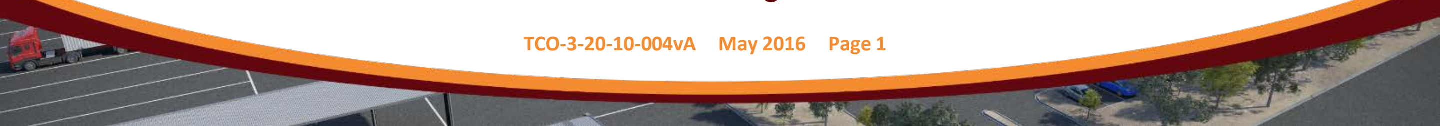
In Australia, ever increasing legislation and regulation driven by the requirement for continual environmental improvement and sustainability is creating a position whereby the available infrastructure for recovery of valuable materials or the permanent solution for difficult to manage haz. wastes are limited. The result is that haz. waste often remains on site in temporary storage, is treated with relatively expensive processes and then landfilled, incinerated, illegally dumped or gets exported overseas.

The Solution

Geological repositories provide the highest levels of containment through the use of carefully selected natural geological barriers rather than the reliance on man-made liner systems and are increasingly recognised as a cost effective and preferred method of permanently isolating difficult to manage wastes.

The geological barrier provides isolation of wastes from the environment over the very long term (tens of thousands or millions of years), something a man-made barrier cannot achieve and creates significant additional opportunities for the future recovery and recycling of valuable materials from the waste which can re-enter the circular economy.

The tables below describe the benefits Tellus' geological repositories provide in the management of hazardous wastes over the lifecycle of the facilities and waste.



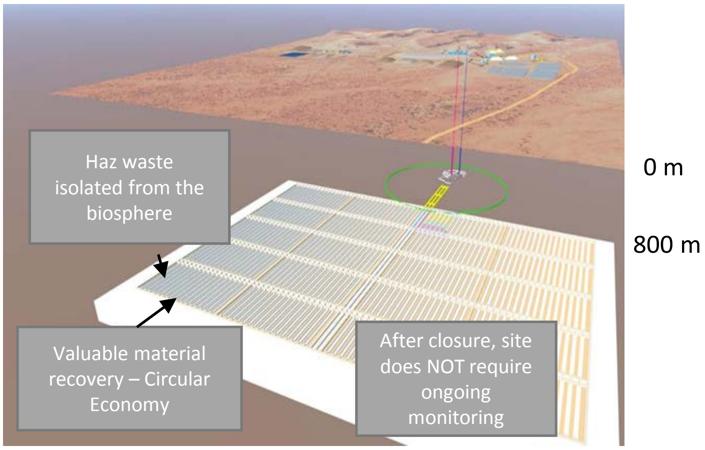
TELLUS

Benefits of a Geological Repository

Table 1: Evidence supporting Tellus' geological repositories over the lifecycle of the facilities

Characteristics	Sandy Ridge - ClayVault®	Chandler- SaltVault®
Can the haz waste be safely isolated from the biosphere for the long term?	• Waste safely isolated over the long term (hundreds of thousands to millions of years)	• Waste safely isolated over the long term (hundreds of thousands to millions of years)
Recycling opportunities and contribution to the Circular Economy	• Haz waste is seen as a valuable resource • Store like with like, securely and safely until find ways for waste to renter the circular economy or • Dispose of safely if no further use identified	• Haz waste is seen as a valuable resource • Store like with like, securely and safely until find ways for waste to renter the circular economy or • Dispose of safely if no further use identified
Does the site require ongoing monitoring after closure?	• No – the system is "passively safe" • Clay bed does not corrode or decay • Clay bed has self-healing characteristics (clay plasticity or clay creep)	• No • Salt bed does not corrode or decay • No, salt bed has self-healing characteristics (salt creep)
Liability	• No ongoing potential liability (permanent isolation in the geological barrier)	• No ongoing potential liability (permanent isolation in the geological barrier)

Fig. 1: Typical geological repository - Tellus' Chandler facility



TELLUS

Benefits of a Geological Repository

Table 2: Evidence supporting Tellus' geological repositories over the lifecycle of the facility

Characteristics	Sandy Ridge - ClayVault®	Chandler- SaltVault®
Type	• Near surface geological repository	• Deep geological repository
Geology	• 230 million year old • Geological stable thick, flat, extensive kaolin clay bed	• 500 million year old • Geological stable thick, flat, extensive salt bed
Safety barrier types	• Engineered barriers • Natural geological barrier (extensive kaolin clay bed) • If man-made system fails then "fail safe" stable extensive geology isolates waste from biosphere	• Engineered barriers • Natural geological barrier (extensive salt bed) and 750m of overlying low permeability sedimentary strata • If man-made system fails then "fail safe" stable extensive geology isolates waste from biosphere
Liner dimensions	• Kaolin bed and overlying sillcrete layer is the liner • ~ 160 km long • ~20 km wide & flat • Bed ~7 to 24m thick • No credible risk of water ingress or contamination leaving the site	• Salt bed and overlying strata is the liner • > 20 km long (TBC) • ~18 km wide & flat • ~700-800 m deep • ~200-300m thick • No credible risk of water ingress or contamination leaving the site
Permeability (Perm.) of the geology [indicator regarding the risk of seepage]	• Kaolin clay has very low Perm. • No credible risk of water ingress or contamination leaving the site (seepage)	• Rock salt has very low Perm. • No credible risk of seepage - salt is recognised as providing total containment of emplaced wastes
Climate	• Semi-arid – low erosion and water ingress risk	• Semi-arid – low erosion and negligible water ingress risk due to deep underground (800m) facility
Groundwater contamination	• A thick impermeable silcrete layer above clay bed (15 million years ago when climate became arid) No water table in clay bed • Very low rainfall • Clay bed has been dry for millions of years • No credible scenario for groundwater contamination	• Salt bed has been dry for 500 million years – if an aquifer had passed through the salt bed, there would be NO salt • No credible scenario for groundwater contamination