

Why Deep Geological Repositories for Spent Fuel Now?

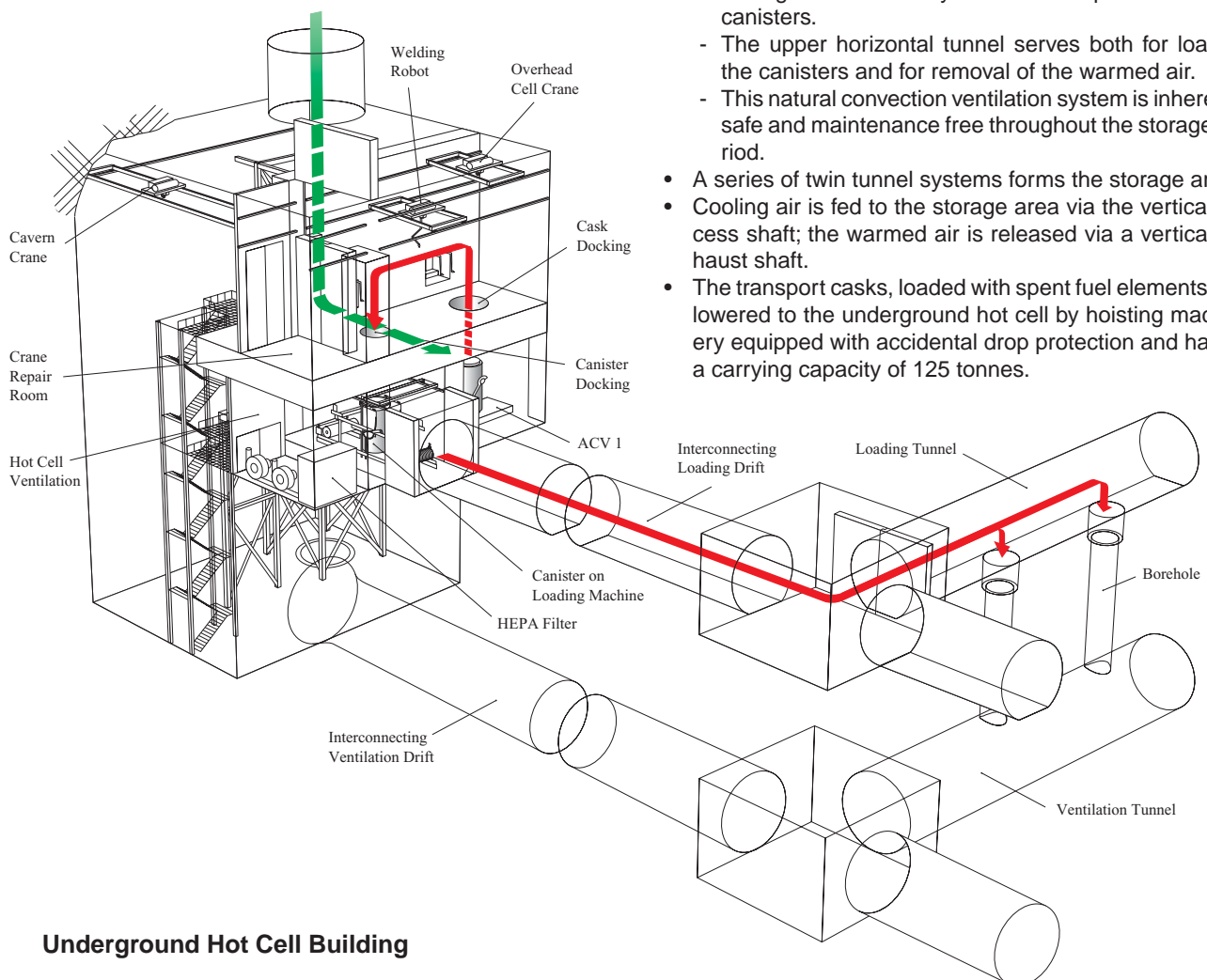
An International Underground Twin Tunnel Long-Term Interim Storage Concept

by Dr. Peter Leister

In order to overcome the world-wide shortage of capacity for the final disposal of spent nuclear fuel, Colenco proposes the promotion of the idea of international long-term underground interim storage for a period of approximately one hundred years in preference to opening a discussion on the internationalisation of final repositories. This idea, which could help to relieve the current bottleneck in the exploration of repository sites, represents a cost effective option for storing spent fuel in suitable geological formations, such as granite. Furthermore, interim storage allows the decision on reprocessing or direct disposal to be postponed. The choice can be made more rationally, and less emotionally, towards the end of the 100 year storage period. The delay will also help to reduce the risk of money being wasted as a result of a wrong decision made under pressure.

The long-term underground interim storage concept is based on the following features:

- Handling of spent fuel assemblies at the NPP and shipping in standard transport casks remain unchanged.
- At the storage site, spent fuel assemblies from the power plants are transferred from the transport casks into thin, double-walled canisters in an underground hot cell. The transfer and the subsequent welding shut of the canisters is performed by remote handling.
- The sealed canisters are emplaced in vertical boreholes between two horizontal tunnels. The two horizontal tunnels and the connecting boreholes comprise a twin tunnel system.
 - The lower tunnel serves to provide a supply of fresh cooling air to each vertical borehole. This cooling air passes through the annular space between the canister and the borehole wall, driven by natural convection arising from the decay heat of the spent fuel in the canisters.
 - The upper horizontal tunnel serves both for loading the canisters and for removal of the warmed air.
 - This natural convection ventilation system is inherently safe and maintenance free throughout the storage period.
- A series of twin tunnel systems forms the storage area
- Cooling air is fed to the storage area via the vertical access shaft; the warmed air is released via a vertical exhaust shaft.
- The transport casks, loaded with spent fuel elements, are lowered to the underground hot cell by hoisting machinery equipped with accidental drop protection and having a carrying capacity of 125 tonnes.



Underground Hot Cell Building

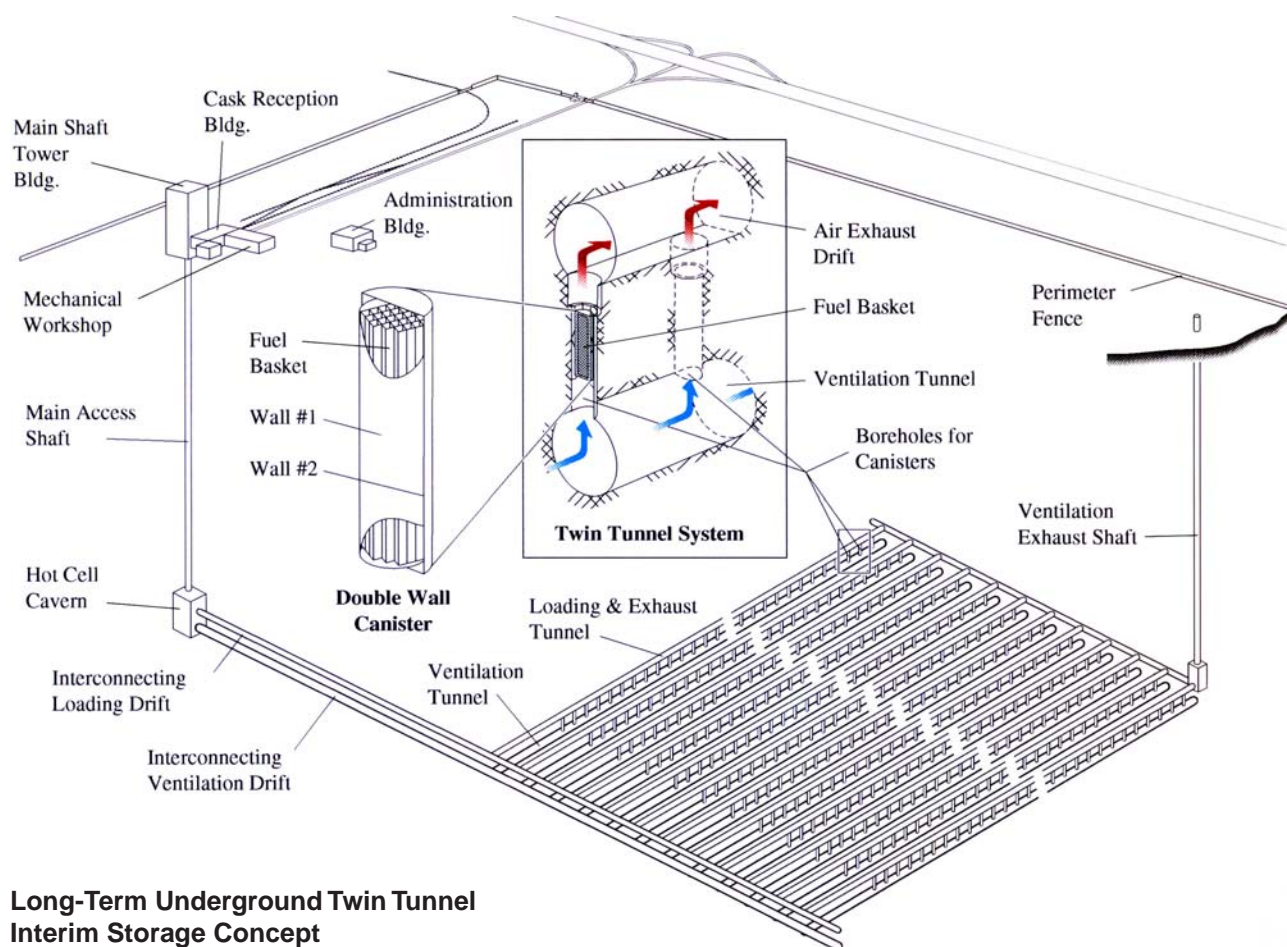
Investigations of total specific storage costs (US\$/kgU) have shown that such an underground interim storage facility can prove significantly less expensive than any equivalent surface store.

The internationalisation of long-term underground interim storage offers additional advantages. Every country which has a suitable host rock formation, and which is willing to be open for the interim storage of spent fuel, could offer such a facility. Site selection would then be subject to competition, offering additional potential for reducing specific storage costs.

Moreover, for such an extended time period, a centralized long-term interim underground storage for spent fuel can be monitored much better with respect to non-proliferation than any surface storage. The unauthorized removal of spent fuel from the underground area is physically impossible when

the shaft hoisting machine is not available. Hence, surveying of the spent fuel is reduced to observing the hoisting machinery and the international surveillance of such an interim storage facility will no longer be a challenging task.

With respect to legislation and licensing, interim underground storage is state-of-the-art in those countries which offer re-processing services. The adaptation of the legislation in the selected host country for the long-term interim storage is seen to be easier than for the case of international repositories. Interim storage of spent fuel is not a question of importing/exporting waste, it should be regarded as an international service of valuable goods, in compliance with the Basel Convention on Transboundary Movement of Hazardous Wastes. Patents are pending for the twin tunnel concept, the double wall canister and a non-contacting, maintenance free canister monitoring system.



Long-Term Underground Twin Tunnel Interim Storage Concept

Colenco Power Engineering Ltd., a Swiss company with a long tradition in engineering and consulting to the nuclear industry world-wide, is collaborating in this area with a renowned Japanese company.

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