

PROGRESS ON THE ESTABLISHMENT OF THE CENTRALISED INTERIM STORAGE FACILITY IN RESPONSE TO SPENT FUEL MANAGEMENT SUSTAINABILITY IN SOUTH AFRICA.

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1. Background and Goal of the present work

South Africa's Spent Nuclear Fuel (SNF) is generated from the Nuclear Power Plant (NPP) at Koeberg managed by the power utility Eskom, and the SAFARI-1 Research Reactor at Pelindaba NECSA. The establishment of the Centralised Interim Storage Facility (CISF) follows recent reports of limited storage from the NPP. Moreover, the lifetime of the NPP has been extended to 2045, which implies that beyond 2045 SNF must be removed before decommissioning the plant, hence the need for an away from reactor facility at the only disposal facility Vaalputs in lieu of a Deep Geological Repository (DGR).

2. Introduction

The National Radioactive Waste Disposal Institute (NRWDI) is a state-owned entity mandated by the government of the Republic of South Africa to manage radioactive waste and disposal under the NRWDI act no. 53 of 2008 at a national level. The Institute is mandated by both the act and the minister of mineral resources and energy to establish the CISF for long-term storage of SNF from the country's nuclear reactors, SAFARI-1 research reactor and Koeberg Nuclear Power Plant (KNPP). The stages of the CISF project are evaluated and guided by the so-called Framework for Infrastructure Delivery and Procurement Management (FIDPM) guidelines.

South Africa's Koeberg Unit 1 went critical on 14th March 1984 and was commercially available on 21 July 1984. A year later, Unit 2 went critical on 7th July 1985. In 2024 it will record four decades of uninterrupted operation. The KNPP is now in its long-term operation, and will run until 2045 with the old huge reactor components like the steam generators, pressurised water tanks, and reactor pressure vessel heads replaced. Each Koeberg unit discharges a third of total spent fuel assemblies (SFAs) from its reactor core on a 16- to 18-month cycle. The discharged SFAs are temporarily stored in the reactor fuel pools for initial temperature cooling and radioactivity decay until they are safe enough to be handled. The storage pools have been re-racked to expand their storage capacity as it was envisaged that they would be full prior to 2000. During re-racking, four dry storage casks were obtained for transferring old SFAs from the wet storage facility and for subsequent use as additional storage capacity. At present, seven additional casks are being stored, together with the earlier four casks, in the cask storage building on the Koeberg site. At the Pelindaba site, SFAs discharged from the SAFARI-1 reactor are first stored in the spent fuel pools and then some of them transferred to the "pipe store", a licensed on-site dry storage facility, for continued storage. The operating license for the current pipe store is due to expire in 2035, which implies that the Safari SNF must be transferred to an off-site licensed facility.

With the two reactors continuing to run, SNF will continue to be generated and there will be storage constraints on reactor site for both the KNPP and SAFARI-1 at Pelindaba, and hence the urgent need for an offsite centralised facility. The said facility will be established at the South Africa's only radioactive waste disposal facility Vaalputs in the Northern Cape province. Currently the Vaalputs is disposing operational waste from the two nuclear reactors employing the Near Surface Disposal (NSD) methodology.



Near surface Disposal concept at the Vaalputs radioactive waste disposal facility.



3. The Centralised Interim Storage Facility

The CISF will be the South African medium-term solution for the long-term storage of SNF in lieu of the DGR or reprocessing should the need arise noting technological advancements globally. The CISF feasibility study proposes that spent fuel will be stored in dry storage systems following world's best practices. The CISF is required to provide storage for at least 5 000 SFAs (2 500 MTHM equivalent) from Koeberg reactors (1 800 MWe) and about 1 200 SFAs from NeCSA's SAFARI-1 research reactor (20 MWe), assuming a 60-year operating lifetime. It will be designed to allow for a modular phase construction. The proposed CISF is an aboveground spent fuel dry storage installation, made up of modular concrete pads, fuel processing building, auxiliary facilities, and related infrastructure.

The CISF feasibility study is undergoing a gateway review as per the FIDPM requirements, and it has been established in the gateway review report that there are critical and major findings in the critical path of this project which render the feasibility incomplete. However, the NRWDI is now in the process of addressing the findings. Amongst the findings, the Environmental Impact Assessment (EIA) is one finding that is crucial for the successful execution and completion of the feasibility study at the Vaalputs site.

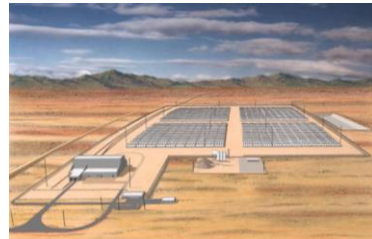


Illustration of a typical CISF



Typical illustration of a CISF

4. Challenges the project is facing

The main challenges that the project is currently facing are funding and human resources. Without dedicated funding and sufficient human resources and required capacity, the project might be delayed. In principle the NRWDI functions as per the act should be funded by the so-called Radioactive Waste Management Fund (RWMF). However, this fund is yet to be promulgated and effected. In the interim, NRWDI is trying its best to seek external funding for the project via funding assistance with the intention of making payments against any borrowing upon operationalisation of the Radioactive Waste Management Fund, so that the project is not unduly delayed. The NRWDI is working closely with the shareholder (Department of Minerals Resources and Energy), and the main operators who are producers of SNF which are Eskom and the Nuclear Energy Cooperation (NECSA) in the developmental stage of the project, and will continue to do so in the next stages.

5. Status on dry storage casks at the Koeberg Nuclear Plant

Since year 2000, some spent fuel has been removed from the pools to dry storage CASTOR X/28 Dual Purpose Cask for transport and storage; capacity = 28 PWR spent fuel assemblies; Vendor: GNS (Germany). Implying that they have been in dry storage for almost 13 yrs. Later due to lack of pool, capacity again, in the year 2018, some spent fuel was moved to dry storage in HI-STAR 100 Dual Purpose Cask for transport and storage; capacity = 32 PWR spent fuel assemblies; Vendor: Holtec International (USA); 14 casks have been in dry storage for almost 5 yrs.



Left: CASTOR X/28 casks and Right: HI STAR 100 casks at Koeberg NPP.

6. Conclusions

The Establishment of the CISF above ground at Vaalputs will provide a passive cooling sustainable SNF management even beyond the decommissioning of the plant and will help ease public perception on nuclear technologies. The paper has provided a general overview of the progress on the project. The project is at feasibility stage pending investigations for the EIA and the development of design.