

From: Tae Ahn
To: C.W. (Bill) Reamer
Date: Fri, Feb 23, 2001 11:00 AM
Subject: PBMR

Bill, I have made a short note based on my experience in Ft.St.Vrain SNF (CLST IRST, Rev. 3), my association with BNL HTGR program in 80s, and website information (www.google.com).

Tae

CC: Larry Campbell, N. King Stablein

Main-70

PBMR NOTES

BACKGROUND

PEBBLE-BED MODULAR REACTOR (PBMR) is a type of a High Temperature Gas-Cooled Reactor (HTGR), utilizing helium as the coolant and with online refueling capability, similar to that developed in Germany. The current design is being developed in South Africa where a prototype module may be built and demonstrated. It is generally known that PBMR is very safe compared with other advanced or commercial reactors. U. K. operates 14 similar reactors cooled by carbon dioxide. Domestically, there remains some HTGR expertise, primarily at ORNL and General Atomic. BNL has limited expertise.

WASTE MANAGEMENT PERSPECTIVE

The PBMR uses pebbles of graphite-coated UO_2 and their sizes are of a base ball. After the reactor is shut down, this SNF will be stored at reactor for 40 years. The reactor is operated at 540 -900 C.

Current DOE-owned SNF (DSNF) includes Ft. St. Vrain HTGR SNF. The Ft. St. Vrain SNF is under the groups of the DSNF of 12 categories (CLST IRSR, Rev.3, 2001). Because the DSNF inventory is of a small amount compared with commercial SNF, its impact on PA is insignificant. Criticality to be caused by DSNF is treated separately and excluded based on the long WP life time.

From the experience with DSNF, as long as the total inventory of PBMR SNF is negligible, its impact on the HLW program is likely to be minimal (except criticality which is excluded based on the long lifetime of WP). The analysis of the potential PBMR SNF hazardness needs information primarily on

- the inventory, distribution and behavior of radionuclides including fissile materials
- radionuclide inventory of instantaneous release
- gaseous radionuclides (e.g., C-14 or I)
- no Zircaloy cladding protection

It is important to project the total inventory if these reactors are built as well as determining potential detailed hazardness even with a small amount of inventory.

WORK PLAN

- review SNF of HTGR, HTGRs for Pu disposition and UK gas-cooled reactors
- analyze the hazard radio nuclides and SNF degradation processes
- conduct PA

One to two months in FY 2001 and three to four months in FY 2002 are recommended. If the above work is performed as desired, the CLST staff's TPA related work will be less active. Expertise involved in this work may include materials science, physics/chemistry, and limited support by RES/NRR, geochemistry and PA.