Shielding calculations in the Core Unloading Device area of the PBMR reactor.

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ABSTRACT

MCNP is extensively used for shielding and criticality calculations in the design phase of the Pebble Bed Modular Reactor (PBMR) project in South Africa. Maintenance work will have to be done timeously on equipment such as the Core Unloading Devices (CUDs), and thus the dose at which personnel will be exposed to, have to be known in the area around such devices.

The CUD area is situated just below the reactor core cavity and is separated from it by a thick concrete floor. Contributions to the dose rates in the CUD area are from four sources, mainly, streaming neutrons from the reactor core and induced gammas in the concrete, the fuel spheres in the defuel tubes which connects the CUDs to the reactor core, fuel spheres in the CUDs and neutron activation of the CUDs.

The MCNP results show that the major contribution to the dose rates in the CUD region is the streaming neutrons coming from the reactor core. A parametric study was then done in determining the thickness of the concrete shielding floor that ensures effective shielding. The modeling of the CUDs and the shielding results obtained with MCNP will be presented.