Improvements of the Neutron Shielding around the VENUS Reactor Facility at the Belgian Nuclear Research Centre

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Body of Abstract:

The VENUS reactor facility is a zero-power research reactor mainly devoted to studies on LWR fuels. In the past, during a power run of this reactor, localised high neutron dose rates were found around the reactor. The neutron/gamma dose equivalent rate could be as high as three, giving need for optimised protection measures for the personnel. Some years ago studies were undertaken to determine the neutron spectra, and to test different personal neutron dosemeters around VENUS. Recently, the reactor was restructured, lowering the reactor core to use longer fuel rods. At the meantime the neutron shielding around the reactor was changed and improved. The present paper will describe the effect of the structural changes to the neutron field around the VENUS reactor. A survey of the dose rates around the reactor was done and is compared to previous values. An extensive modelisation was done with the MCNP code to know the neutron spectra at the different positions of importance for the exposure of the personnel.

The neutron field around the VENUS reactor was also one of the workplace fields that was part of the EVIDOS project (“Evaluation of Individual Dosimetry in Mixed Neutron and Photon Radiation Fields”), funded by the EC. The EVIDOS project aims at a significant improvement by spectrometric and dosimetric investigations in representative neutron/photon workplaces in the nuclear industry. In particular, new spectrometry methods are being developed which provide the energy and angle distribution of the neutron fluence from which the relevant dosimetric quantities are calculated and to which the readings of dosimeters are compared. Measurements have been performed by the partners of the project. Different neutron spectrometers (both in energy and angle), ambient monitors and personal dosemeters were tested at two workplace positions near the reactor. These data help in fully characterising the radiological situation around the reactor and give guidance for the protection measures to be taken and dosemeters to be used.