Final Report for the "WSU Neutron Capture Therapy Facility Support", August 24, 2006
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The objective for the cooperative research program for which this report has been written was to provide separate NCT facility user support for the students, faculty and scientists who would be doing the U.S. Department of Energy Office (DOE) of Science supported advanced radiotargeted research at the WSU 1 megawatt TRIGA reactor. The participants were the Idaho National laboratory (INL, P.I., Dave Nigg), the Veterinary Medical Research Center of Washington State University (WSU, Janean Fidel and Patrick Gavin), and the Washington State University Nuclear Radiation Center (WSU, P.I., Gerald Tripard).

A significant number of DOE supported modifications were made to the WSU reactor in order to create an epithermal neutron beam while at the same time maintaining the other activities of the 1 MW reactor. These modifications were:

1. Removal of the old thermal column.
2. Construction and insertion of a new epithermal filter, collimator and shield.
3. Construction of a shielded room that could accommodate the very high radiation field created by an intense neutron beam.
4. Removal of the previous reactor core fuel cluster arrangement.
5. Design and loading of the new reactor core fuel cluster arrangement in order to optimize the neutron flux entering the epithermal neutron filter.
6. The integration of the shielded rooms interlocks and radiological controls into the SCRAM chain and operating electronics of the reactor.
7. Construction of a motorized mechanism for moving and remotely controlling the position of the entire reactor bridge.
8. The integration of the reactor bridge control electronics into the SCRAM chain and operating electronics of the reactor.
9. The design, construction and attachment to the support structure of the reactor of an irradiation box that could be inserted into position next to the face of the reactor. (Necessitated by the previously mentioned core rearrangement).

All of the above modifications were successfully completed and tested. The resulting epithermal beam of 1×10^9 n/sec-cm^2 was measured by Idaho National Laboratory with assistance from WSU's Neutron Activation Analysis Group. The beam is as good as our initial proposals for the project had predicted [(1-9)].

In addition to all of the design, construction and insertion of the hardware, shielding, electronics and radiation monitoring systems there was considerable manpower and effort put into changes in the Technical Specifications of the reactor and implementing procedures for use of the new facility. This staff involvement is one of the reasons we requested special facility support from the DOE.

Once the facility was competed and all of the recalibrations and measurements made to characterize the differences between this reactor core and the previous core we began to

assist INL in making their beam measurements with foils and phantoms. Although we proposed support for only one additional staff position to support this new NCT facility the staff support provided by the WSU Nuclear Radiation Center was greater than had been anticipated by our initial proposal.

INL was also assisted in the testing of a heavy water (deuterated water) bladder that can be inserted into the collimator in order to produce an intense, external thermal neutron beam.

The external epithermal and/or thermal neutron beam capability remains available for use, if funding becomes available for future research projects.

References:

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