

CRITICAL ASSEMBLY OPERATIONS

NCERC experimenters performed ten weeks of critical assembly operations during the quarter including the Prompt Fission Uranium Neutron Spectrum (PFUNS) Critical Experiment, the International Nuclear Accident Dosimetry (NAD) Intercomparison Exercise, and the Thermal/Epithermal eXperiments for Hafnium (TEX-Hf).

PROMPT FISSION URANIUM NEUTRON SPECTRUM (PFUNS) ON PLANET

The PFUNS Critical Experiment on Planet was designed to reduce the uncertainty in the U^{235} prompt fission neutron spectrum, which has been known to have up to 10% error. This experiment includes a benchmark evaluation of a nearly pure HEU system with minimized structural materials. The Rocky Flats (RF) shells made of highly enriched uranium metal, were chosen to provide a sufficiently high-power configuration while minimizing the likelihood of scattering neutron interactions. The prompt fission neutron spectrum was determined using activation and fission foils positioned within an aluminum shielded center cavity. The completion of this experiment is essential for providing U^{235} nuclear data validation.

INTERNATIONAL NUCLEAR ACCIDENT DOSIMETRY INTERCOMPARISON EXERCISE WITH GODIVA

The International Nuclear Accident Dosimetry (NAD) Intercomparison Exercise was conducted to validate the participants' NAD performance and verify the dosimetrists' ability to provide dose estimations required by ANSI/HPS-N13.3 *Dosimetry for Criticality Accidents* and DOE-STD-1098-2017 *Radiological Control*.



◀ Rene Sanchez (NEN-2) checks alignment of RF shells on Planet.



◀ Phantoms and plates positioned in preparation for Godiva burst.

Ten groups participated in the exercise including Los Alamos National Laboratory (LANL), Lawrence Livermore National Laboratory (LLNL), Sandia National Laboratory (SNL), Savannah River Site (SRS), Y-12 National Security Complex (Y-12), Hanford Site, Nevada National Security Site (NNSS), the United Kingdom's Atomic Weapons Establishment (AWE), the French Institut de Radioprotection et de Sûreté Nucléaire (IRSN), and the U.S. Naval Dosimetry Center (NDC). Two prompt-critical bursts of the Godiva IV critical assembly were used to simulate criticality accidents with dosimetry placed at known locations around the assembly. Dosimetry was mounted on either phantoms that simulate the human body or plates that simulate doses in free air. Preliminary results found that six of the participating organizations on the first burst and five on the second determined the doses to the ANSI/HPS-N13.3 required accuracy within 24 hours.

THERMAL/EPITHERMAL EXPERIMENTS FOR HAFNIUM ON COMET

TEX-Hf is a set of experiments to validate Hafnium (Hf) nuclear data as a joint project between LANL, LLNL and Naval Nuclear Laboratory (NNL). NNL requested the experiment and supplied the hafnium. The experiment uses three materials to achieve the desired neutron spectra; HEU in the form of 15" Jemima plates, thin Hafnium metal sheets, and polyethylene as a moderator/reflector. Four TEX-Hf configurations were completed that are directly comparable to previous TEX-HEU configurations measured in 2020. The TEX-Hf configurations differed solely by the amount of polyethylene moderator.



◀ TEX-Hf configuration on Comet hand-cranked table.

Each configuration included not only critical measurements but also extensive physical measurements with height and level gauges. Measurements of two of the four configurations also included reproducibility studies, where the full configuration was unstacked and restacked. The reproducibility of the two measured configurations was less than a cent of reactivity. The TEX-Hf experiments will continue next quarter and should conclude in October of 2022.

ADDITIONAL SUPPORT OPERATIONS

Quarterly Maintenance, Surveillance, and In-Service Inspection procedures were performed on schedule. Planet's 24V analog and digital power supplies and stepper motor driver were replaced and relocated to support the high-power critical assembly operations necessary for PFUNS and future experiments.