LAWRENCE
LIVERMORE
NATIONAL
LABORATORY

LLNL-ABS-676082

Recent International Intercomparison of the LLNL Nuclear Accident Dosimeters

M. L. Lobaugh, C. T. Wong, J. D. Topper, M. J. Merritt, D. P. Heinrichs, D. P. Hickman, A. R. Wysong

August 10, 2015

Health Physics Society 49th Midyear Meeting
Austin, TX, United States
January 31, 2016 through February 3, 2016

ABSTRACT

Lawrence Livermore National Laboratory (LLNL) uses thin neutron activation foils, sulfur, and threshold energy shielding to determine neutron component doses and the total dose from neutrons in the event of a nuclear criticality accident. The dosimeter also uses a DOELAP accredited Panasonic UD-810 thermoluminescent dosimetry system (TLD) for determining the gamma component of the total dose. LLNL has participated in three international intercomparisons of nuclear accident dosimeters. In October 2009, LLNL participated in an exercise at the French Commissariat à l'énergie atomique et aux énergies alternatives (Alternative Energies and Atomic Energy Commission- CEA) Research Center at Valduc utilizing the SILENE reactor . In September 2010, LLNL participated in a second intercomparison at CEA Valduc, this time with exposures at the CALIBAN reactor. This presentation discusses LLNL's results of a recent third intercomparison hosted by the French Institut de Radioprotection et de Sûreté Nucléaire (Institute for Radiation Protection and Nuclear Security- IRSN) with exposures at two CEA Valduc reactors (CALIBAN and PROSPERO) in September 2014. For each irradiation, there were four arrangements for the dosimeters: (1) placed on a phantom facing the core at a 0° orientation, (2) placed on a stand in free air facing the core at a 0° orientation, (3) on a phantom facing the core with a 45° orientation, or (4) on the back of a phantom facing the core with a 45° orientation (effectively a 225° orientation). After each irradiation at CEA Valduc, the dosimeters were transported by IRSN personnel to the Fontenay-aux-Roses facility, near Paris, approximately 3.5 hours away. The dosimeters arrived for measurement between 6 and 7 hours post irradiation. The LLNL PNAD performed extremely well for estimating neutron doses. The neutron KERMA results for the core-facing dosimeters were within 8% of the reference value. Personnel ion chambers as well as the Panasonic dosimeters evaluated the gamma dose and had internally consistent results. However, the accuracy and consistency of the gamma dose results were significantly different from the known gamma dose values provided by IRSN. Additional evaluation is needed into the applicability of the current gamma dosimetry system for nuclear criticality accidents.

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.