SLAC-PUB-13776

The Linac Coherent Light Source and Radiological Issues during the Commissioning

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The Linac Coherent Light Source (LCLS) at SLAC National Accelerator Laboratory is the world's first X-ray free electron laser (XFEL). Pulses of x-ray laser light from LCLS will be many orders of magnitude brighter and several orders of magnitude shorter than what can be produced by other x-ray sources available in the world. These characteristics will enable frontier new science in many areas. This paper describes the LCLS beam parameters and lay-out. The general radiological issues during commissioning are presented, such as radiation dose rates and integrated doses outside the enclosure. Also, specific radiological issues related to X-ray free electron lasers are discussed. XFEL with high peak power will burn through high-Z materials. The X-ray beam needs to be blocked by stoppers when the downstream areas are occupied. LCLS stoppers feature a piece of boron carbide (B_4C), 10 mm thick. B_4C is one of the best materials since it has a low absorption coefficient for X-rays and a high melting temperature. Theoretical calculations indicate that the unfocused fluence of the LCLS XFEL beam should be about one order of magnitude below the damage threshold for bulk B_4C, for 830 eV FEL radiation. However, these calculations have not been tested experimentally and cannot be validated until LCLS begins providing 830 eV XFEL pulses. This paper describes the test plan for using the initial LCLS radiation to evaluate the survivability of B_4C and reports the preliminary results. Another major issue for LCLS is the potential radiation damage to the LCLS undulator magnets during operation. TLD dosimeters were installed along the LCLS undulators for each period of two or three weeks. This paper reports the integrated doses along the undulators with and without XFEL generation.

Work supported in part by US Department of Energy contract DE-AC02-76SF00515.