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Verification of the prompt radiation shielding design of the ESS Accelerator - Stage 2

Cooperative Research and Development Agreement Final Report

CRADA Number: FRA-2016-0058

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Summary Report

June 12, 2018

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CRADA number: FRA-2016-0058

CRADA Title: Verification of the prompt radiation shielding design of the ESS Accelerator - Stage 2

Parties to the Agreement: European Spallation Source, ESS ERIC and Fermi Research Alliance, LLC

Abstract of CRADA work:

The purpose of this CRADA is to perform additional analyses using MARS Monte-Carlo calculations code for verification of the prompt radiation shielding design of the ESS Accelerator. Stage 2 includes the following activities:

1. Activation assessment of the soil surrounding the wall of the ESS accelerator that may migrate with the groundwater
2. Shielding assessment of the HVAC exhaust duct

The existing ESS accelerator model (with possible minor modifications) shall be used in calculations. This work builds on the analysis originally performed under agreement CRADA FRA-2015-0302.

Summary of Research Results:

Activation of the soil surrounding the ESS accelerator tunnel calculated by the MARS15 code is presented. A detailed composition of the soil, that comprises about 30 chemical elements, is considered. Spatial distributions of the produced activity are provided in both transverse and longitudinal directions. A realistic irradiation profile for the entire planned lifetime of the facility is used. The nuclear transmutation and decay of the produced radionuclides is calculated with the DeTra code which is a built-in tool for the MARS15 code. Radionuclide production by low-energy neutrons is calculated using the ENDF/B-VII evaluated nuclear data library. In order to estimate quality of this activation assessment, a comparison between calculated and measured activation of various foils in a similar radiation environment is presented.

Related Reports, Publications, and Presentations:

“Activation assessment of the soil around the ESS accelerator tunnel”, I. L. Rakhno et al 2019 J. Phys: Conf. Ser 1046 012020 (OSTI Identifier 1413086)

Subject Inventions listing:

None

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