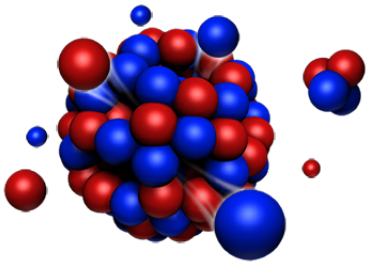

Contribution ID: **64** Type: **Oral Presentation**

# Assessment of shutdown dose rates at the ESS target cooling system using SCALE6.2

*Tuesday, 15 October 2019 12:10 (25 minutes)*

The European Spallation Source (ESS), now under construction in Lund, Sweden, will be the largest and most advanced neutron scattering facility in the world. In order to produce high-energy neutrons through the spallation process, a 2 GeV proton beam will interact with a Tungsten target. This interaction may cause an erosion of the target and the release of radionuclides into its helium cooling system. Within the cooling system, a main filter will catch most of the larger fragments, while auxiliary filters called "getters"are used to capture volatile elements and gases, in particular tritium, as well as remaining dust. Regularly, the getters have to be replaced either manually or by means of robotic equipment.

In this work we apply the ORNL´s SCALE6.2 modelling and simulation suite for nuclear safety analysis to assess shutdown dose rates and determine if added shielding and/or robotic arms are needed for replacing the getters [1,2]. SCALE6.2 is well suited to this kind of assessment as it allows for isotope selection; the effective fraction of radioisotopes from the target wheel that are caught by the getters, i.e. the source term, is external input to the SCALE6.2 simulation.

Using conservative assumptions, the photon dose rate is evaluated for a range of cooling times (1 day, and 1, 3, and 6 months) and for two distances from the getter: at 1 mm corresponding to the case of a worker handling the getter wearing gloves and at 10 cm, corresponding to the case of a worker applying handles to carry the getter. For a cooling time of one day, the maximum dose rate at 1 mm from the getter is 4,42 mSv/h ± 0,01 mSv/h, while it decreases to 1,50 mSv/h ± 3 µSv/h at 10 cm distance from the getter.

These results are based on the assumption that the main filter will catch almost all (99%) of the particles released from the target. In the presentation, we will examine the sensitivity of the shutdown dose rates to the assumed released fraction, e.g. due to malfunction in the main filter.

At ESS, MCNP and CINDER'90 are baseline tools to neutronics assessment [3,4]. For cross validation of these codes with SCALE6.2, results obtained with SCALE6.2 will be compared to an MCNP simulation for selected radioisotopes.

[1] SCALE code system, ORNL/TM-2005/39, Version, 6.2.3, 2018
[2] D. E Peplow, "Monte-Carlo Shielding Analysis Capabilities with MAVRIC", Nucl. Technol., 174 (2), 289-313, 2011
[3] J.T. Goorley et al., "Initial MCNP6 Release Overview - MCNP6 version 1.0", LA-UR-13-22934, 2013
[4] W.B Wilson et al., " A Manual for CINDER'90 Version 07.4 Codes and Data", LA-UR-07-8412, 2008

**Primary author:** CHAMBON, Amalia (DTU Nutech)

**Co-authors:** KLINKBY, Esben (DTU Nutech, Denmark); EMÅS, Leif (European Spallation Source); LAURITZEN, Bent (DTU Nutech)

**Presenter:** CHAMBON, Amalia (DTU Nutech)

**Session Classification:** Operations/Safety

**Track Classification:** Operation/Safety