

## Lawrence Livermore National Laboratory 7000 East Ave, Livermore CA, 94550

SUBJECT:	Report on Foreign Travel to the 17 <sup>th</sup> International Symposium on Reactor Dosimetry
DATE:	7/3/2023
то:	Dr. Angela Chambers, Nuclear Criticality Safety Program Manager, National Nuclear Security Administration / NA-511
	Catherine Percher, Task Manager of Nuclear Criticality Program at LLNL
FROM:	Aaron Tamashiro and Daniel Siefman

**MEETING TITLE:** 17<sup>th</sup> International Symposium on Reactor Dosimetry

MEETING LOCATION: Lausanne, Switzerland

MEETING DATES: May 21-26, 2023

ATTENDEES ON BEHALF OF NCSP: Aaron Tamashiro and Daniel Siefman

### **MEETING PURPOSE:**

The purpose of the event was to share progress in techniques in reactor dosimetry. These include neutron spectrum unfold algorithms, calculational methods, code validation with material neutron activation, gamma-ray and x-ray spectroscopy techniques, reactor surveillance, and plant life management. Our purpose was to present results from the Godiva-IV nuclear accident dosimeter exercise.

#### **MEETING BENEFITS TO THE NCSP:**

Understanding different techniques in reactor dosimetry. The most notable of these is Sandia National Laboratory's neutron spectrum unfolding code. The experts of this technique presented their work and shared some insights behind the mechanism of their neutron spectrum unfolding algorithm (used more than twenty foils for an irradiation). Neutron irradiation on materials and gamma-ray spectroscopy is a common theme for reactor dosimetry techniques. The application of these is for monitoring nuclear power plant life and validating nuclear power production for decommissioning reports. Measuring foil activity is used to validate calculational methods that simplify reactor core geometry. Measurement techniques and calculational methods may form a basis for future benchmarks.

#### PURPOSE OF TRAVEL

To present results from the Godiva-IV nuclear accident dosimeter exercise.

#### Persons Contacted at meeting:

Tommy	Holschuh	Idaho National Laboratory (USA)
William	Windes	Idaho National Laboratory (USA)
Nicholas	Whitman	Los Alamos National Laboratory (USA)
Daniel	Siefman	Lawrence Livermore National Laboratory (USA)
Aaron	Tamashiro	Lawrence Livermore National Laboratory (USA)



RussellDePriestSandia National Laboratory (USA)ThomasQuirkSandia National Laboratory (USA)DanielleRedhouseSandia National Laboratory (USA)GregFischerWestinghouse (USA)MariyaBrovchenkoInstitut De Radioprotection et de Sûreté Nucléaire (France)Valentyn BykovNagra (Switzerland)

## List of Attendees:

- 1. Matthew R. Sternat, mrstern@sandia.gov
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- 40. Jesse P. Jones, jjones8@sandia.gov
- 41. Alex Salazar, alesala@sandia.gov

### Presentations, Chair Responsibilities, Etc.:

One poster presentation given:

• "Godiva-IV Dosimetry Exercise 2022," Aaron Tamashiro, C. Percher, D. Heinrichs, et. al., LLNL-POST-847700

### Distribution:

Angela Chambers, <u>angela.chambers@nnsa.doe.gov</u> Doug Bowen, <u>bowendg@ornl.gov</u> Marsha Henley, <u>henleym@ornl.gov</u> Catherine Percher, <u>percher1@llnl.gov</u> ci@llnl.gov



## Appendix: Abstract

# Title: Godiva-IV Dosimetry Exercise 2022

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<sup>4</sup>Sandia National Laboratory
<sup>5</sup>Savannah River Site
<sup>6</sup>Hanford Site
<sup>7</sup>Y-12 National Security Complex
<sup>8</sup>Naval Dosimetry Center
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<sup>10</sup>Instut de Radioprotection et de Sûreté Nucléaire

Abstract: Integral Experiment Request (IER) 538 is part of a series of dose characterization and nuclear accident dosimetry (NAD) exercises performed under the Department of Energy (DOE) Nuclear Criticality Safety Program (NCSP). This is the second NAD exercise using the Godiva-IV critical assembly and the third NAD exercise overall. The participating laboratories provided their own dosimeters that were mounted on the Lawrence Livermore National Laboratory (LLNL) BOttle Manikin ABsorption (BOMAB) phantoms and aluminum plates. The BOMABs and plates were placed at two, three, and four meters away from the center of Godiva. Alongside the NADs, there was a LLNL Passive Neutron Spectrometer (PNS), Atomic Weapons Establishment (AWE) PNS, and Y-12 Sphere present to measure the neutron dose from Godiva. Two irradiations were conducted to test the NAD performance from each laboratory and asses their performance to the DOE-STD-1098-2017 part 515 criteria. Neutron and gamma doses were measured prior to this exercise. This work presents a model for the neutron and gamma dose respectively to serve as the reference value. A code written in C/C++/ROOT was used to fit the measured neutron and gamma dose with the new models. It was assumed that the neutron and gamma doses are proportional to the change in temperature of Godiva after a burst irradiation. Uncertainties for the reference values were calculated using error propagation of the model's parameters. Preliminary results (within twenty-four hours) and final results were compared for each laboratory. On average of all the participating laboratories, 32% of neutron doses and 78% of gamma doses were outside the DOE standards. One laboratory did not report their dose readings and were not included in this average. There is a bias for a lower neutron dose and a higher gamma dose based on the distribution of results. In comparison with the past Godiva-IV NAD exercise, there is an improvement in neutron dose readings by 20%.