

# IER 484: AFRRI Field Characterization Measurements

NCSP Technical Program Review 2024

Aaron S. Tamashiro, C. Percher, D. Heinrichs  
Nuclear Criticality Safety Division  
tamashiro1@llnl.gov

February 20-22, 2024



# DOE Requirements

- 10 CFR §835.1304

- “an individual SHALL be issued a personal NAD if there is a possibility for a nuclear accident to occur resulting in excessive exposure of radiation to the individual”

- DOE-STD-1098-2017 part 515

particle	absorbed dose in or on a phantom (Gy)	required accuracy (%)
neutron	0.1 — 10	30
photon	0.1 — 10	20

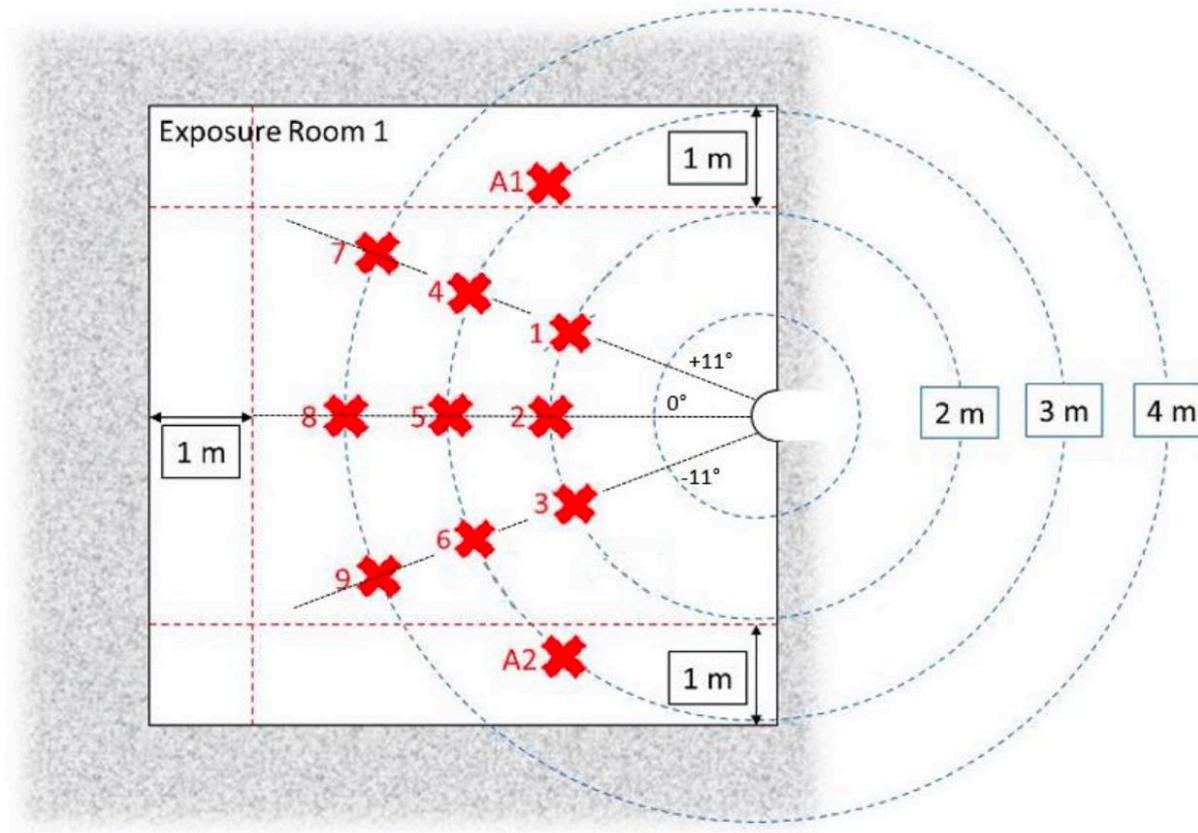
- ANSI/HPS N13.3 2013 (R2019)

total dose (Gy)	required accuracy (%)
0.1 — 1	50
1 — 10	25
>10	positive indication

# DOE NCSP

- DOE NCSP series of dose characterization and dosimetry exercises
  - IER-147 (Godiva-IV dose characterization, 2014)
  - IER-148 (Godiva-IV intercomparison exercise, 2016)
  - IER-252 (Flattop dose characterization, 2017)
  - IER-253 (Flattop intercomparison exercise, 2018)
  - IER-538 (Godiva-IV intercomparison exercise, 2022)
  - **IER-484 (AFRRI dose characterization, 2023)**
  - IER-602 (AFRRI intercomparison exercise, 2024)

# Irradiation Positions



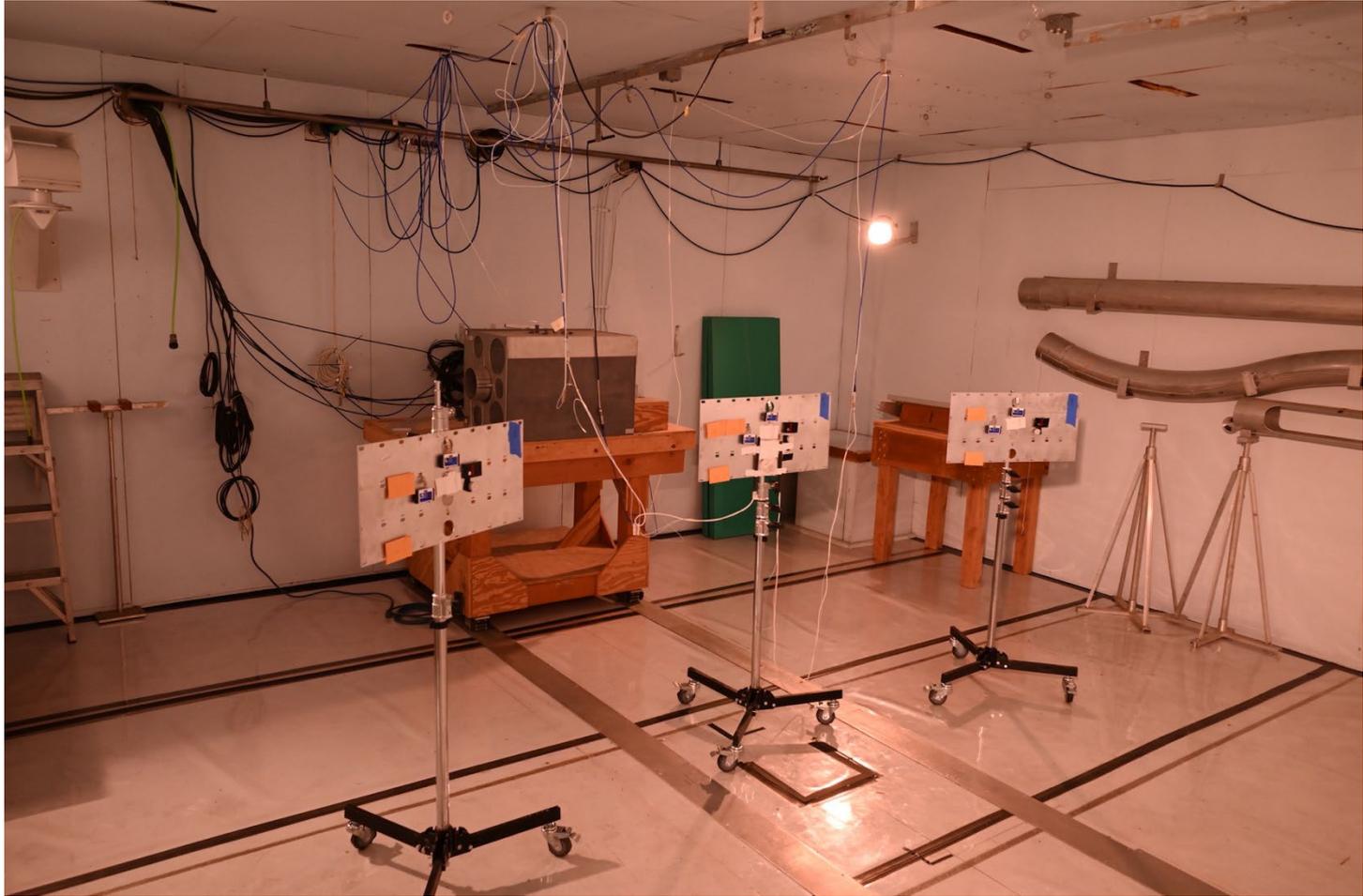
# Equipment – PNS Sphere



# Equipment – BOMAB Phantoms



# Equipment – Free-In-Air Stands



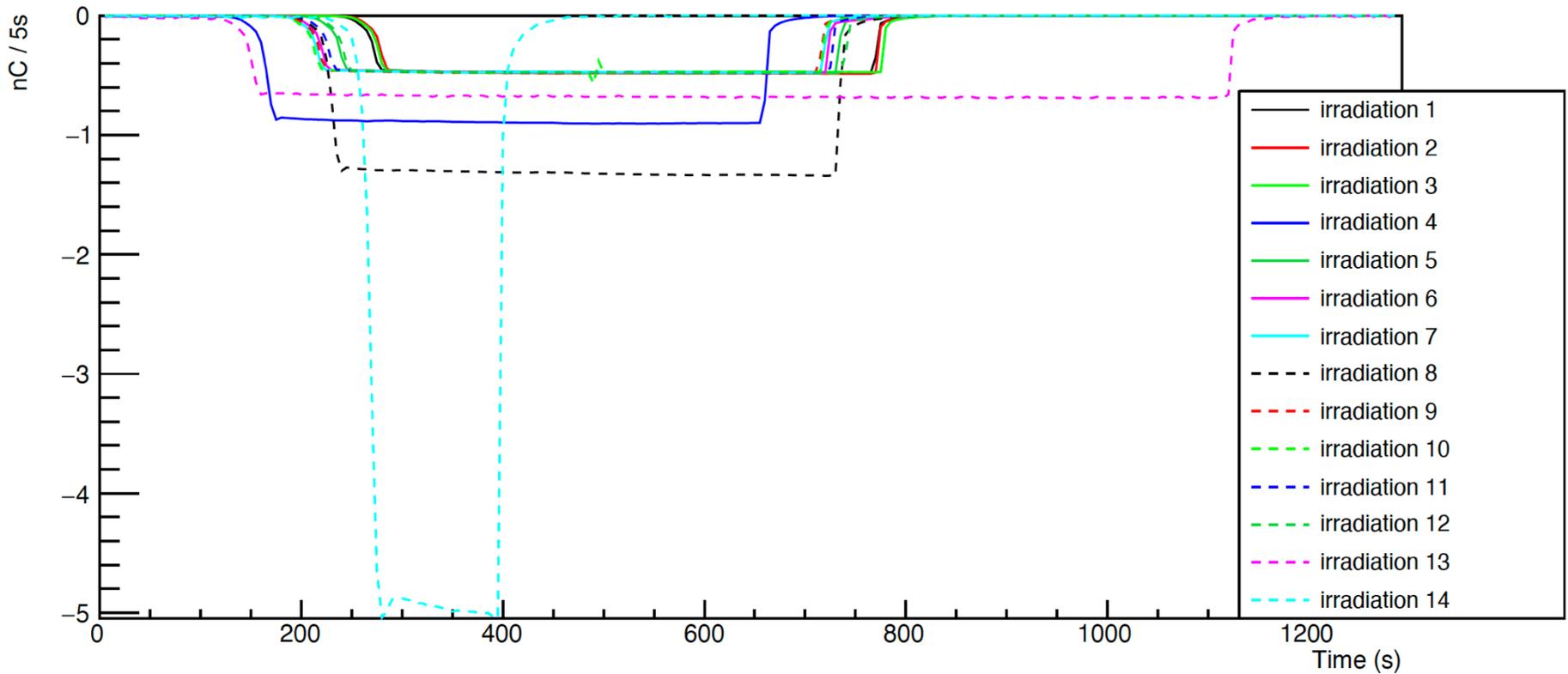
# Equipment – CaF<sub>2</sub> TLDs



# Irradiation Log

Date	Irradiation	Time (EDT)	Event	Position
August 21, 2023	1	12:31:07	AI stand irradiation at power	1, 2, 3
		12:39:16	AI stand irradiation SCRAM	
	2	13:47:19	BOMAB irradiation at power	2, 6, 7
		13:55:02	BOMAB irradiation SCRAM	
	3	15:17:47	LLNL TLD PNS irradiation at power	2
		15:25:57	LLNL TLD PNS irradiation SCRAM	
August 22, 2023	4	08:51:11	AI stand irradiation at power	4, 5, 6
		08:59:12	AI stand irradiation SCRAM	
	5	10:54:51	BOMAB irradiation at power	1, 5, 9
		11:02:44	BOMAB irradiation SCRAM	
	6	13:13:38	LLNL Au PNS irradiation at power	2
		13:21:55	LLNL Au PNS irradiation SCRAM	
	7	14:50:47	BOMAB irradiation at power	3, 4, 8
14:59:01		BOMAB irradiation SCRAM		
August 23, 2023	8	09:06:25	AI stand irradiation at power	7, 8, 9
		09:14:40	AI stand SCRAM	
	9	10:51:51	LLNL TLD PNS irradiation at power	8
		11:00:00	LLNL TLD PNS irradiation SCRAM	
10	12:28:33	LLNL Au PNS irradiation at power	5	
	12:36:48	LLNL Au PNS irradiation SCRAM		
August 24, 2023	11	09:20:43	AFRRI phantom irradiation at power	2
		09:28:58	AFRRI phantom irradiation SCRAM	
	12	10:19:46	LLNL Au PNS irradiation at power	8
		10:29:32	LLNL Au PNS irradiation SCRAM	
	13	13:39:50	Low power irradiation at power	8
		13:55:56	Low power irradiation SCRAM	
14	15:06:12	High power irradiation at power	8	
	15:08:15	High power irradiation SCRAM		

# AFRRI Ion Chamber Data



# Future works

---

- Finalize data analysis
  - Dose as a function of radial distance and ion chamber integral
- Write manuscript of AFRRI dose characterization
- Write manuscripts of all NCSP-funded NAD work
  - Publish in Radiation Measurements special issue

# Auspices

---

- This work was supported by the Nuclear Criticality Safety Program, funded and managed by the National Nuclear Security Administration for the Department of Energy.
- This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract No DE-AC52-07NA27344.
- This work was performed with the assistance of the Armed Forces Radiobiology Research Institute at Uniformed Services University.



#### **Disclaimer**

This document was prepared as an account of work sponsored by an agency of the United States government. Neither the United States government nor Lawrence Livermore National Security, LLC, nor any of their employees makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States government or Lawrence Livermore National Security, LLC. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States government or Lawrence Livermore National Security, LLC, and shall not be used for advertising or product endorsement purposes.

This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract DE-AC52-07NA27344. Lawrence Livermore National Security, LLC