IER-538 CED4A Report: Godiva-IV Dosimetry Exercise 2022

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Disclaimer

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1 Introduction

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) [1, 4, 5, 6]. This is the second NAD exercise using the Godiva-IV critical assembly [7]. The participating laboratories consist of seven Department of Energy (DOE) laboratories and one lab from the United States Navy, United Kingdom, and France respectively. The ten institutions are listed below:

- Lawrence Livermore National Laboratory (LLNL)
- Los Alamos National Laboratory (LANL)
- Sandia National Laboratory (SNL)
- Savanah River Site (SRS)
- Hanford Site
- Missions Support and Test Services (MSTS)
- Y-12 National Security Complex (Y-12)
- Naval Dosimetry Center (NDC)
- Atomic Weapons Establishment (AWE)
- Institut de Radioprotection et de Sûreté Nucléaire (IRSN)

All laboratories provided their dosimeters to be irradiated, but MSTS did not participate in the exercise. The exercise took place at the Nevada National Security Site (NNSS) where the measurements were preformed in the LLNL NAD lab in Mercury, Nevada. This report will present the methodology of the exercise, reported results, comparison to past results, and a discussion of results.

2 Background

According to Title 10 of the Code of Federal Regulations Section 835.1304 (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 [8]. The performance of the personal NAD should be able to comply with the Department of Energy (DOE) criteria found in DOE-STD-1098-2017 part 515 [9] (see Table 1). The neutron and photon doses from each lab are compared to the DOE standard. Another set of criteria is provided by the Health Physics Society (HPS) found in ANSI/HPS N13.3-2013 (R2019)[2] (see Table 2). The goal of this exercise is to assess the NADs from the participating institutions to the DOE standard.

Table 1: DOE-STD-1098-99 part 515 criteria for personal NAD performance.

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

Table 2: ANSI/HPS N13.3-2013 criteria for personal NAD performance.

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

3 Method

The methodology of the NAD exercise is similar to the previous exercises using Godiva [4] and Flattop [6]. The procedure for this exercise is briefly described in this section for continuity. The dosimeters used are described in a previous report [7] and summarized in Table 3. Two prompt burst irradiations were performed using the Godiva-IV critical assembly on August 24 and 25, 2022. For each burst, dosimeters were placed on four LLNL seamless BOttle Manikin ABsorption (BOMAB [10], see Figure 3.1) phantoms and on eight aluminum plates (see Figure 3.2). The BOMABs are comprised of polyethylene containers where two were filled with Ringer's lactate solution and the other two were filled with a saline solution. The Ringer's Lactate simulated human blood (blood vial) and contained Reference Man levels of sodium while the remaining BOMAB phantoms were filled with water mixed with Reference Man-levels of sodium. During the second irradiation, hair samples were placed on the heads of the BOMABs. Each BOMAB was accompanied with two parallel aluminum plates placed just to the left and right side with the same distance from Godiva. The BOMABs and plates were positioned at two, three, and four meters away from the center of Godiva. Up to twenty two dosimeters were placed on each BOMAB where eleven can be placed on the front and back. Up to eleven dosimeters were placed on each aluminum plate. During the irradiations, the BOMABs and aluminum plates were placed in specific positions along with a LLNL Passive Neutron Spectrometer (PNS), an AWE PNS, and a Y-12 Sphere to measure the neutron fluence at their respective distances (see Figures 3.3 and Table 4).

Table 3: NADs used for this exercise.

Lab	Dosimeter
LLNL	Panasonic UD-810 TLD
	Thermo Scientific™ TLD-400
	LLNL PNAD
LANL	LANL 8823 dosimeter
	Los Alamos Criticality Dosimeter
	SWX-PNAD
SNL	SNL Criticality Dosimeter
	CaF_2:Mn TLD
	Arrow-Tech Direct Reading Dosimeter 740
	Arrow-Tech Direct Reading Dosimeter 742
SRS	Criticality Neutron Dosimeter
	InLIght Model 2T dosimeter
	nanoDot dosimeter
Hanford Site	SWX-PNAD-2
	Hanford Combination Neutron Dosimeter
Y-12	Harshaw Model 8805
	Mirion DMC 3000™
NDC	NCL-03
AWE	Harwell MKIV Criticality Locket
	Harshaw Model 8825
IRSN	SNAC2
	SNAC50
	IRSN Criticality belt
	Technol Corp. RPL dosimeter type 351
	Silicon diode

Figure 3.1: Example of four BOMABs assembled on stands with dosimeters placed on the front.

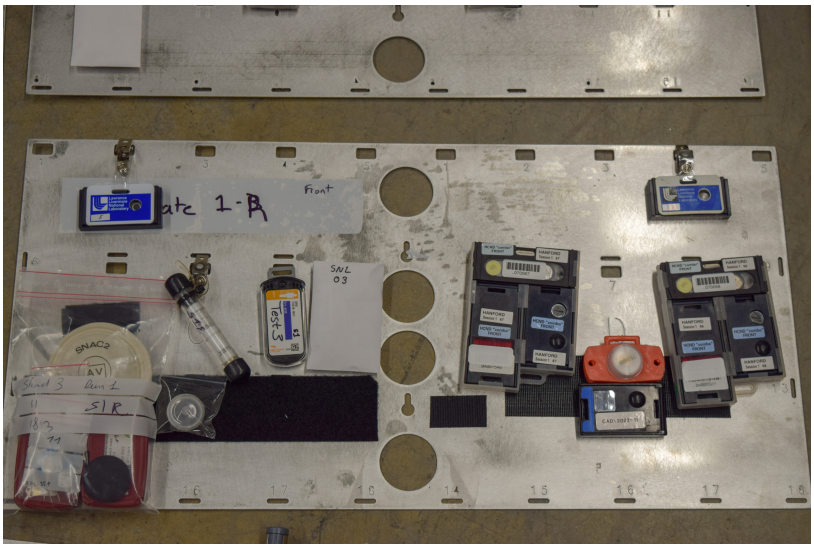


Figure 3.2: Example of a plate with a variety of dosimeters placed on the front.

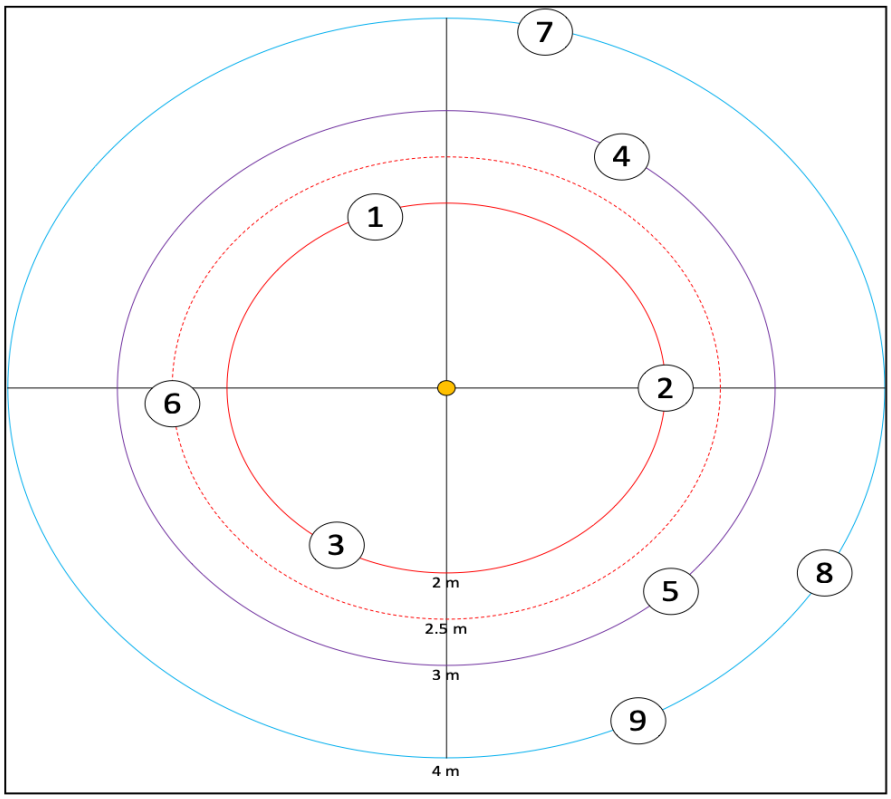


Figure 3.3: NAD position map with Godiva IV in the center. Figure provided in [1].

Table 4: Target positions for irradiation one and two. Positions two and six were not utilized for this exercise.

Position	Distance (m)	Target	BOMAB 45° rotation
1	2	BOMAB with adjacent Al plates	For irradiation 2
2	2	–	–
3	2	Y-12 Sphere	–
4	3	BOMAB with adjacent Al plates	–
5	3	BOMAB with adjacent Al plates	For irradiation 1 and 2
6	2.5	–	–
7	4	LLNL PNS	–
8	4	BOMAB with adjacent Al plates	–
9	4	AWE PNS	–

3.1 Godiva-IV Irradiation

The Godiva-IV dose characterization was performed in 2014 [1], which formed the basis for the predicted neutron and photon doses to the phantoms. Table 5 lists the details for each irradiation. The reference doses are related to the Godiva burst change in temperature ΔT, which is measured by a Resistance Temperature Detector (RTD) closest to the glory hole.

Table 5: Godiva-IV burst information. The uncertainties for the measured temperature is from the International Electrotechnical Commission (IEC) standard 751 for class A RTD [3]. The uncertainties from the before and after temperature were added in quadrature for the uncertainty in ΔT.

Date	Time	Target ΔT (°C)	Measured ΔT (°C)
Aug. 24, 2022	10:10 AM PDT	70	74.3(4)
Aug. 25, 2022	9:48 AM PDT	150	130.5(5)

The neutron dose was characterized by integrating the neutron fluence multiplied by a neutron dose conversion factor. The neutron fluence was measured using passive Bonner sphere spectrometers (PBSS) [11] and converted to neutron kerma per burst temperature change ΔT, $K(r)$, at multiple distances [1]. Neutron kerma per burst temperature change is used to incorporate a more recent measurement of neutron kerma using Godiva IV [12]. The distances were assumed to be measured using a meter stick with 1 mm divisions. Therefore, the uncertainty in distance, δr, is ± 0.5 mm by interpolation [13]. A code written in C++ and ROOT was used to fit the data points with the following:

$$K(r) = n_0 e^{-n_1 r} + \frac{n_2}{r^2}, \tag{1}$$

where n_i are fit parameters and r is the radial distance from the Godiva center. The exponential term represents the attenuation of neutrons before reaching it's target and the $1/r^2$ is the point source term. The uncertainty $\delta K(r)$ is calculated using error propagation:

$$\delta K(r) = \sqrt{\left(\delta n_0 e^{-n_1 r}\right)^2 + \left(-\delta n_1 n_0 r e^{-n_1 r}\right)^2 + \left(\frac{\delta n_2}{r^2}\right)^2 + \left(\delta r \left(-n_0 n_1 e^{-n_1 r} - \frac{2n_2}{r^3}\right)\right)^2} \tag{2}$$

where δn_i are error for each fit parameter n_i. Figure 3.4 shows the multiple data points at two, three, and four meters with the resulting fit and error band. The fit parameters and error are tabulated below.

Table 6: $K(r)$ fit parameters.

n_i	Value
n_0	$8.3(7)\times10^{-3}$
n_1	$1.0(2)\times10^{-1}$
n_2	$6.5(2)\times10^{-2}$

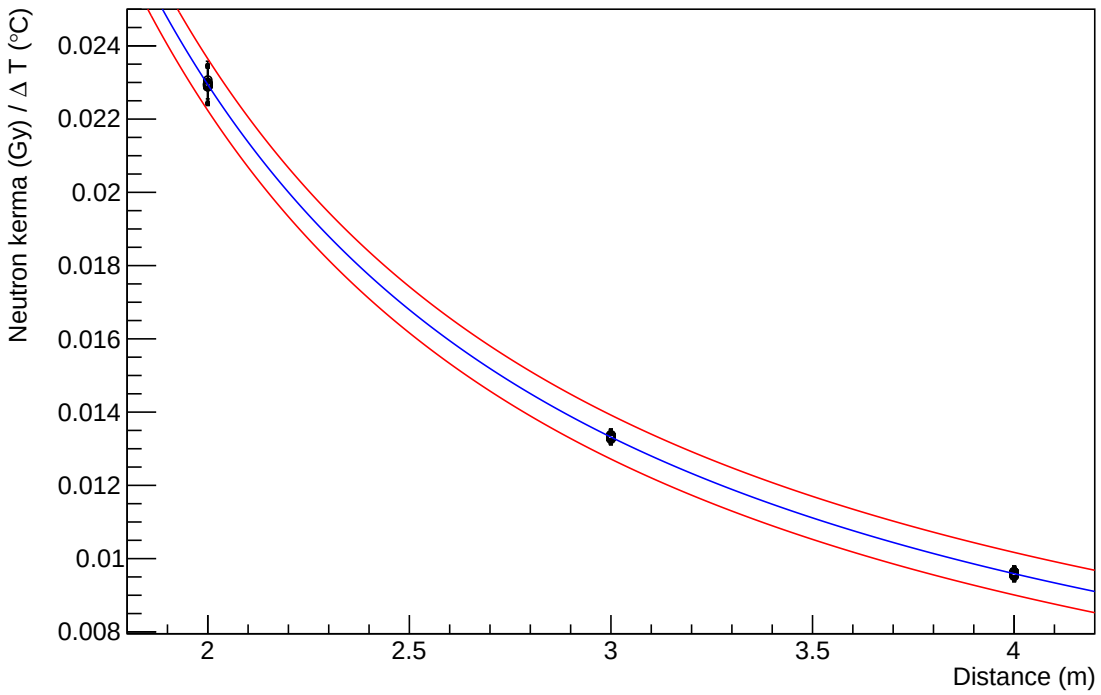


Figure 3.4: Measured neutron kerma normalized to Godiva burst temperature change. Equation 1 was used to fit the data points and represented as the middle blue line. Equation 2 was used to calculate the error band of the fit function and represented as the top and bottom red lines.

In order to relate neutron kerma to dose, the neutron fluence must be well understood to use the proper dose correction factors. The neutron fluence at different positions were measured using Bonner spheres by AWE [1] (see Figure 3.5 and Appendix A). The neutron dose conversion factor used is provided by ANSI/HPS N13.3-2013 [2] (see Figure 3.6). The neutron dose to a personal, $Dp(10)$, is calculated by the following:

$$Dp(10) = \sum_g \Phi_g(E) \left(\frac{Dp(10)}{\Phi} \right)_g , \tag{3}$$

where $\Phi(E)$ is neutron fluence, $Dp(10)/\Phi$ is the neutron fluence to dose to a personal conversion factor, and g is neutron group energy. A kerma to $Dp(10)$ conversion factor was extracted and used from calculated dose at multiple positions for $\Delta T = 68.8$ °C (see Table 7). This combined results from the original 2016 Godiva-IV characterization [1] and 2018 criticality accident alarm detector testing at Godiva IV [12]. The resulting reference neutron dose is tabulated in Table 8.

Table 7: Calculated neutron doses for a burst change in temperature of 68.8 °C using a PBSS. The relationship from neutron kerma to dose can be assumed 1.3(1) to extrapolate to different distances.

ΔT (°C)	Distance (m)	Position	Calculated $Dp(10)$ (Gy)	$\overline{Dp(10)}$ (Gy)	kerma (Gy)	$\overline{Dp(10)}$ per kerma
68.6	2.0000(5)	1	2.14	2.11(2)	1.57(5)	1.34(4)
		2	2.05			
		3	2.13			
	3.0000(5)	4	1.24	1.25(1)	0.91(4)	1.37(6)
		5	1.26			
	4.0000(5)	7	0.86	0.880(9)	0.66(4)	1.33(8)
		8	0.88			
		9	0.89			

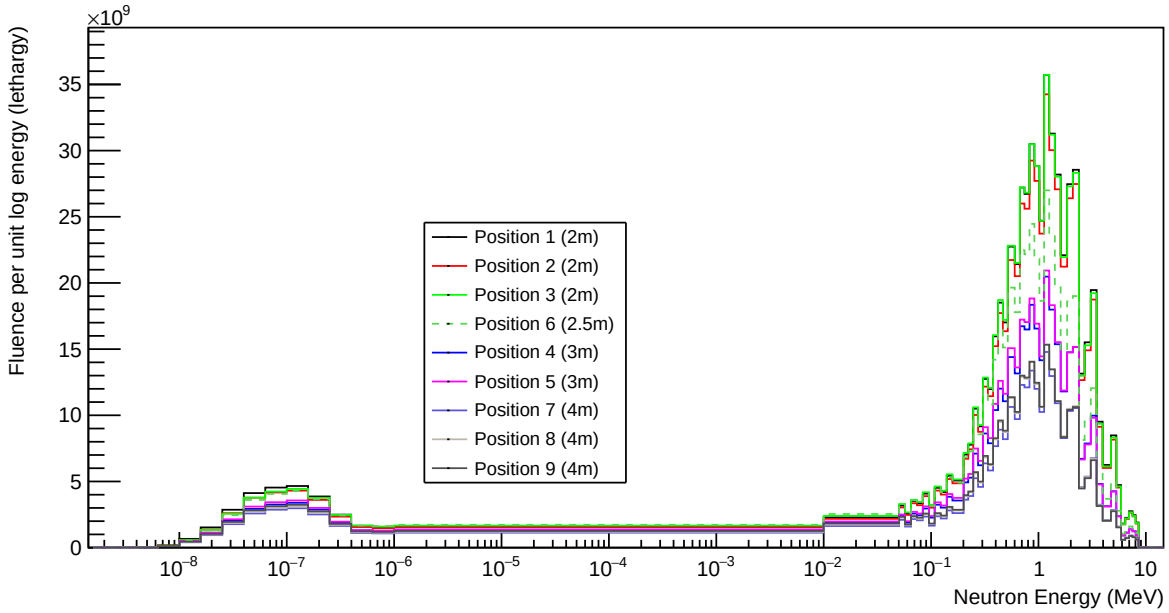


Figure 3.5: PBSS neutron fluence per unit log energy (lethargy) at different positions and distances from Godiva. This neutron spectrum represents a burst change in temperature of 68.6 °C. The neutron spectrum can be described by three regions. The higher energy peak is caused by the ^{235}U fission spectrum neutrons. The middle region was calculated using a broader energy resolution. The lower energy peak is caused by neutrons thermalizing towards 0.025 eV as they travel to their positions. The epithermal and thermal neutrons are also a result of room-return.

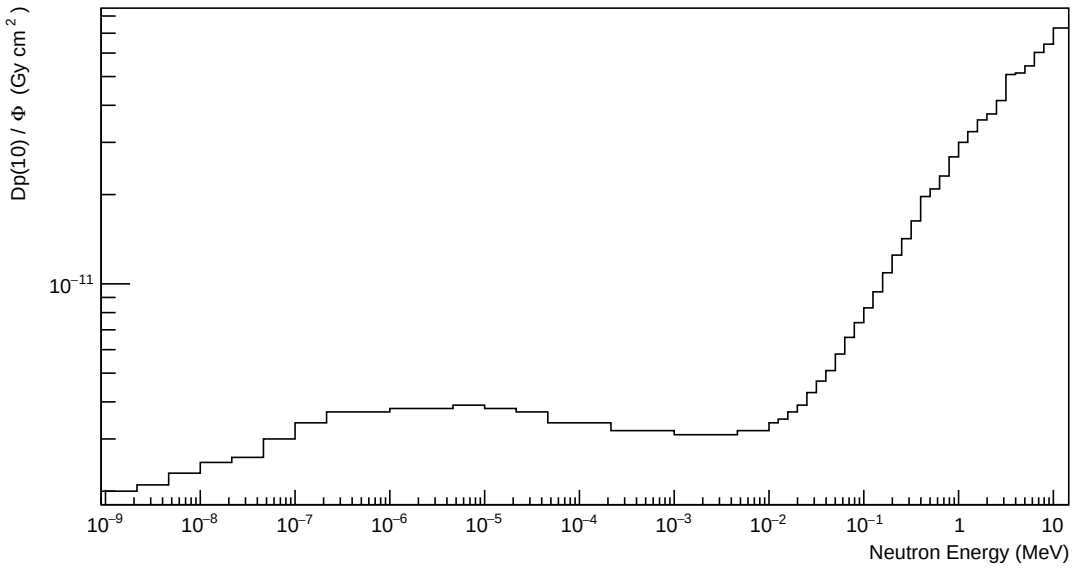


Figure 3.6: Neutron fluence to personal dose conversion factor according to ANSI/HPS N13.3-2013 [2].

Table 8: Reference neutron doses for the first and second irradiations.

ΔT (°C)	Distance (m)	kerma (Gy)	$\overline{Dp(10)}$ per kerma	$Dp(10)$ (Gy)
74.3(4)	2.0000(5)	1.70(5)	1.34(4)	2.2(1)
	3.0000(5)	0.99(4)	1.37(6)	1.36(8)
	4.0000(5)	0.71(4)	1.33(8)	0.95(8)
130.5(5)	2.0000(5)	2.99(9)	1.34(4)	4.0(2)
	3.0000(5)	1.74(8)	1.37(6)	2.4(2)
	4.0000(5)	1.25(8)	1.33(8)	1.7(1)

The photon dose was measured in the 2017 Godiva dose characterization [1]. It was concluded that post-irradiation delayed photons are negligible in terms of total photon dose to the dosimeters after 120 seconds [1]. The photon dose was characterized as a function of dose per ΔT and distance in centimeters. The original model was a quadratic function and the calculated dose goes to infinity as distance goes to infinity. A new model is used to characterize the photon dose per ΔT at different distances by the following:

$$D_g(r) = g_0 + \frac{g_1}{r^2}, \tag{4}$$

where $D_g(r)$ is photon dose per ΔT in Gy per °C, r is distance in centimeters, and g_i are fit parameters. A code written in C/C++/ROOT was used to fit the data points [14]. The results of the fit is tabulated in Table 9. The uncertainty, $\delta D_g(r)$, is calculated by propagating the error of the fit parameters. The form of the uncertainty is the following:

$$\delta D_g(r) = \sqrt{(\delta g_0)^2 + \left(\frac{\delta g_1}{r^2}\right)^2 + \left(-\frac{2 g_1 \delta r}{r^3}\right)^2}, \tag{5}$$

Table 9: $D_g(r)$ fit parameters.

g_i	Value
g_0	$1.10(6)\times10^{-3}$
g_1	$8.4(5)\times10^{1}$

where δg_i is the error associated with the parameter g_i. Calculated photon doses for the two measured ΔT are tabulated in Table 10

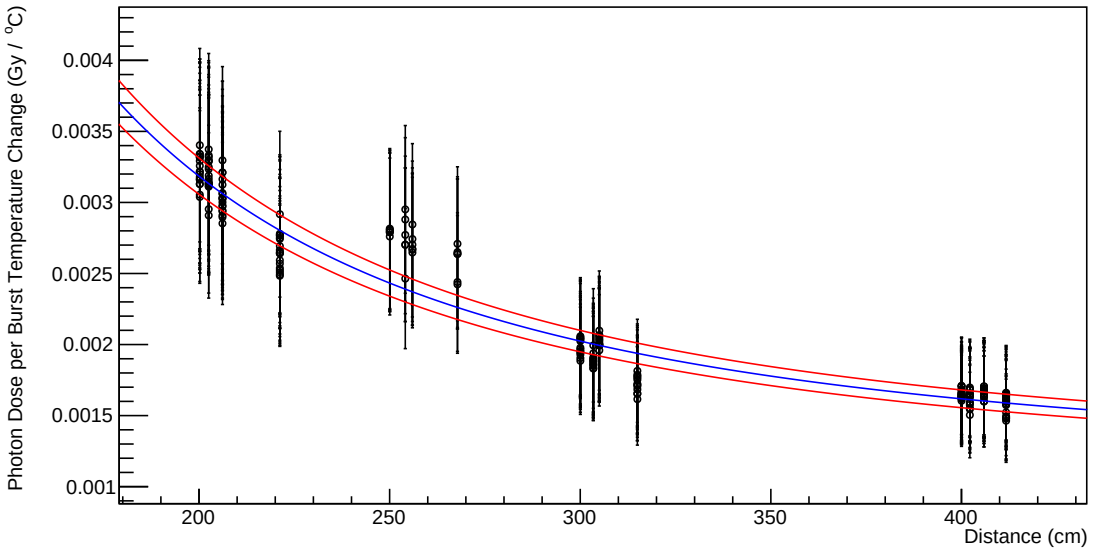


Figure 3.7: photon dose per ΔT as a function of distance. The data points were assumed to have a 20% relative uncertainty. Equation 4 was used to fit the data points (represented as the middle blue line). Equation 5 was used to calculate the error band of the function fit (represented as the two red lines above and below the blue line).

Table 10: Reference photon doses for the first and second irradiations performed.

ΔT (°C)	Distance (m)	Dose (Gy)
74.3(4)	2.0000(5)	0.237(9)
	3.0000(5)	0.150(6)
	4.0000(5)	0.120(5)
130.5(5)	2.0000(5)	0.42(2)
	3.0000(5)	0.26(1)
	4.0000(5)	0.211(8)

3.2 Post-Irradiation

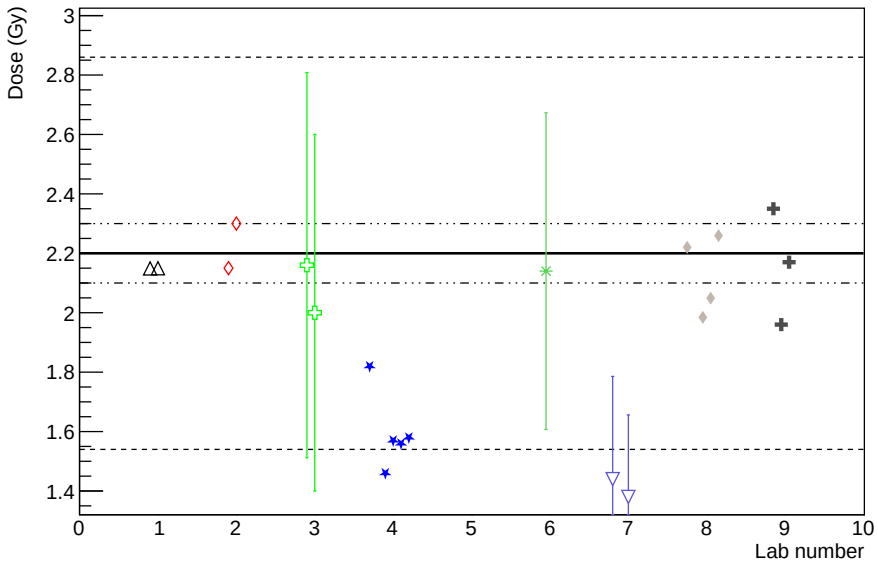
After each irradiation, the BOMAB and aluminum plates were disassembled and transported to the LLNL NAD lab. This time between irradiation and measurement was roughly three hours. Upon

arrival to the NAD lab, the dosimeters were organized and retrieved by each lab. Hair samples and vials of Ringer's lactate were available to each lab for further analysis. Afterwards, each lab performed their activity measurements and dose analysis. Within 24-hours, some of the labs shared their preliminary results. Three weeks from the exercise, each lab is given the opportunity to share their updated results. This is presented in the IER-538 CED3b report [15]. This report is an update for the dose results from each lab, which are presented in the following section.

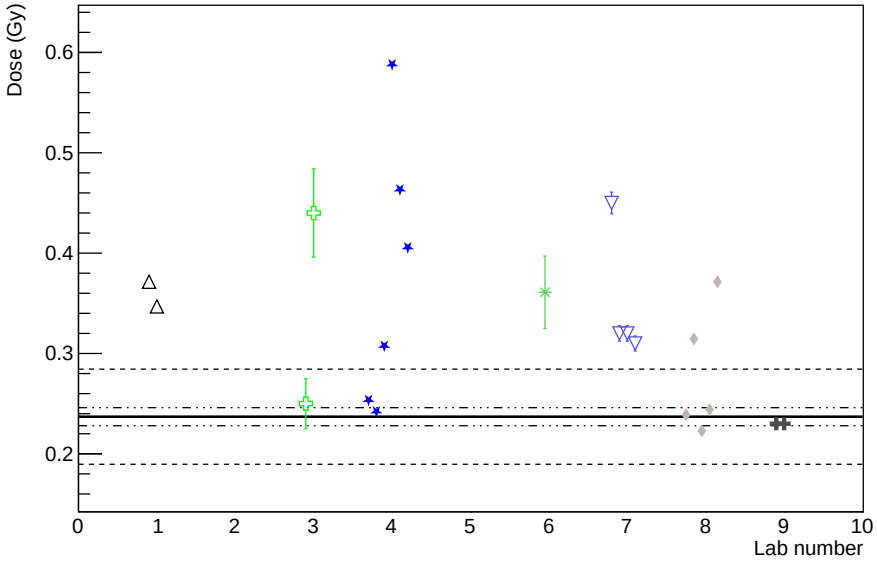
4 Results

Reported doses from each lab are plotted against the reference value shown as a solid black line with the DOE accuracy criteria shown as two outer dotted black line. The inner dotted black lines are the reference uncertainty. In order to protect the identity of each lab, a random lab number is used. Missing results are left blank in the plots.

4.1 Neutron and photon Doses For The First Irradiation

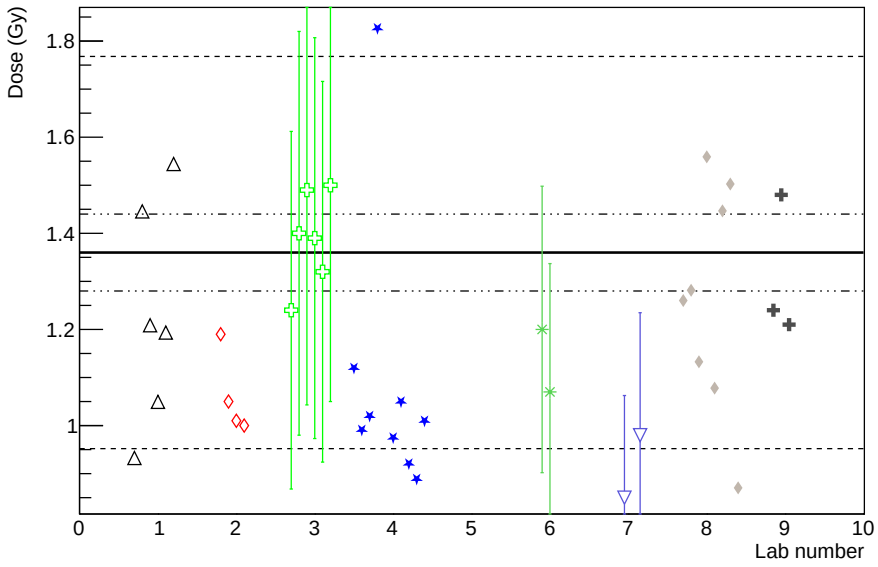


(a) Neutron dose

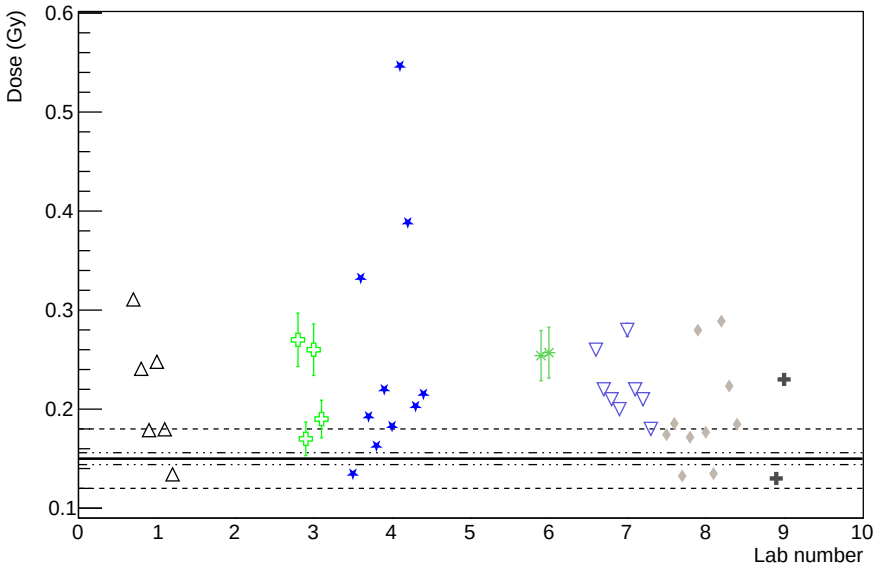


(b) photon dose

Figure 4.8: Final neutron and photon doses for the first irradiation. These dosimeters were placed two meters away from Godiva IV.

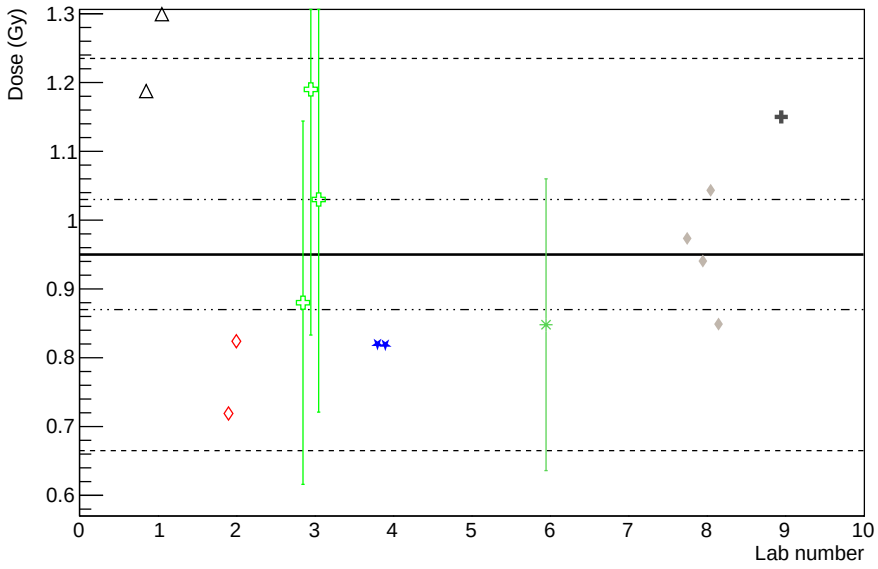


(a) Neutron dose

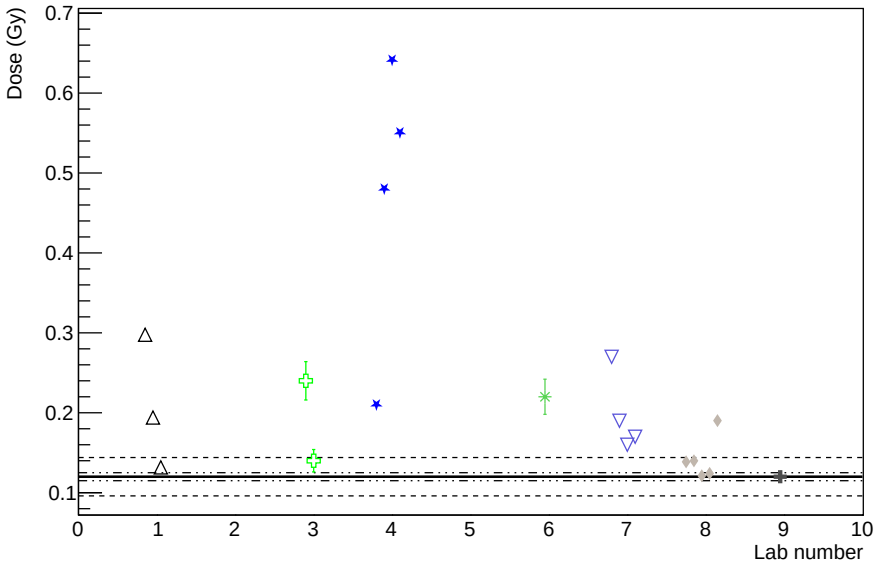


(b) photon dose

Figure 4.9: Final neutron and photon doses for the first irradiation. These dosimeters were placed three meters away from Godiva IV.



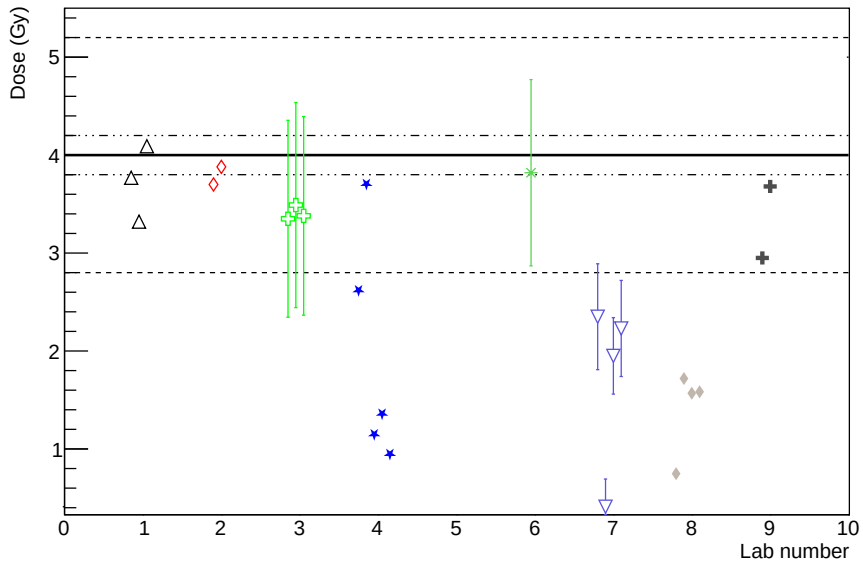
(a) Neutron dose



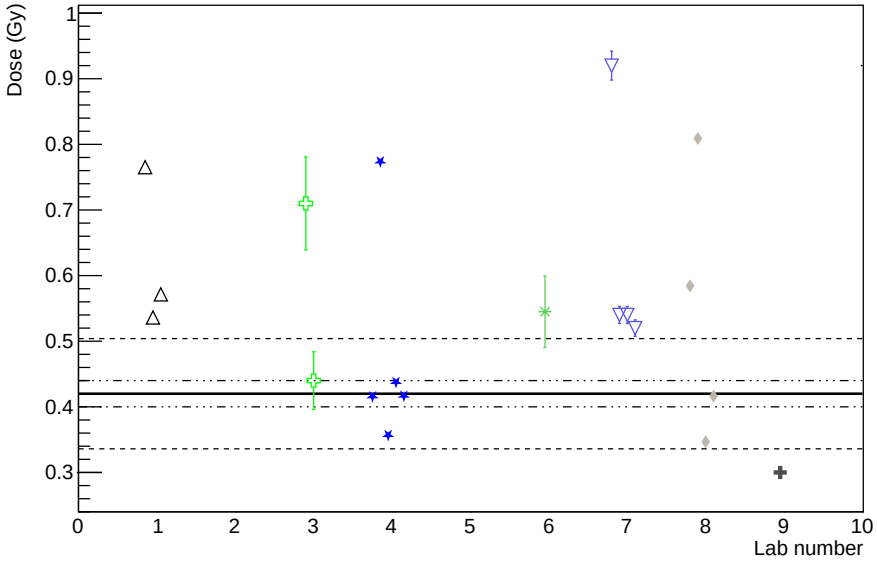
(b) photon dose

Figure 4.10: Final neutron and photon doses for the first irradiation. These dosimeters were placed four meters away from Godiva IV.

4.2 Neutron and photon Doses For The Second Irradiation

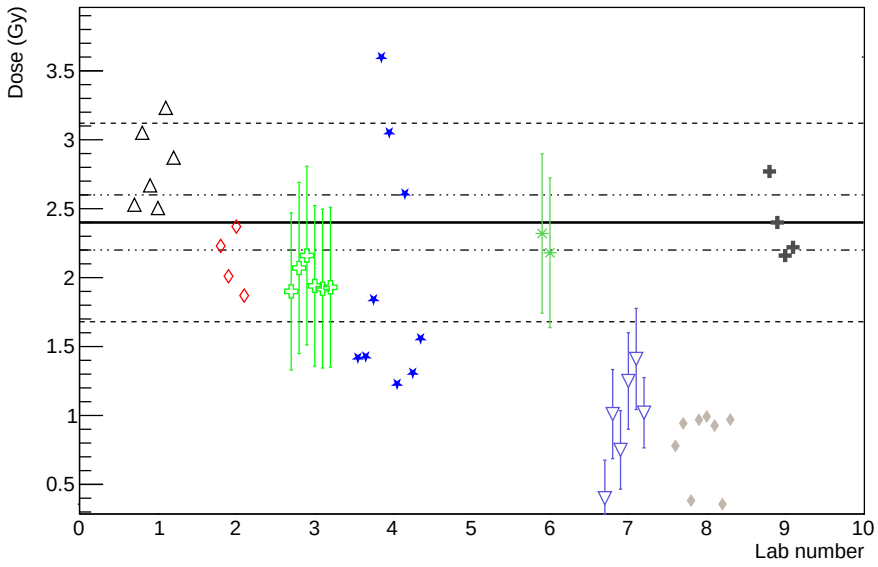


(a) Neutron dose

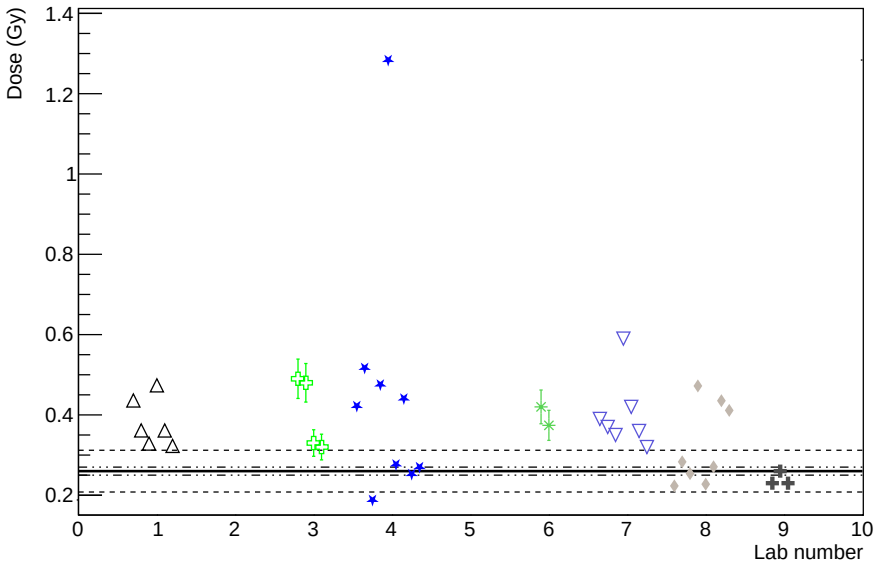


(b) photon dose

Figure 4.11: Final neutron and photon doses for the second irradiation. These dosimeters were placed two meters away from Godiva IV.

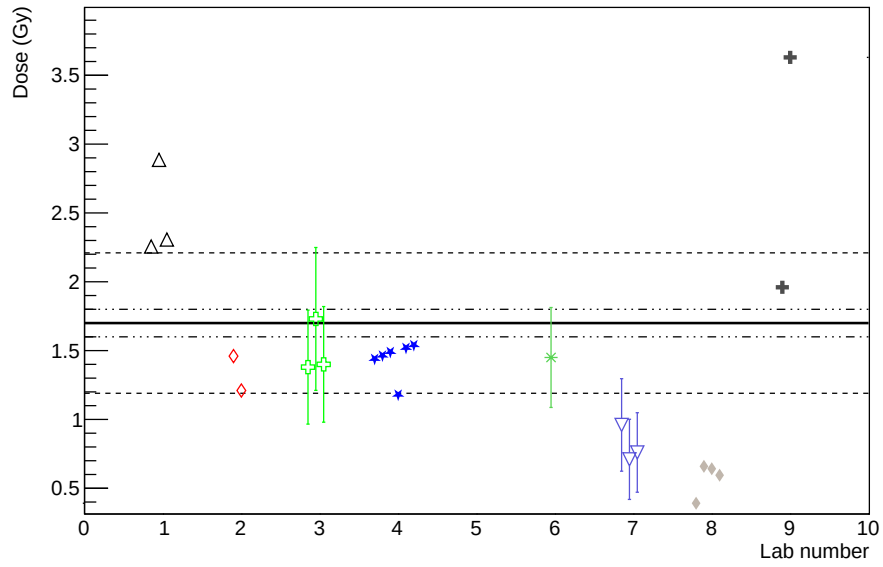


(a) Neutron dose

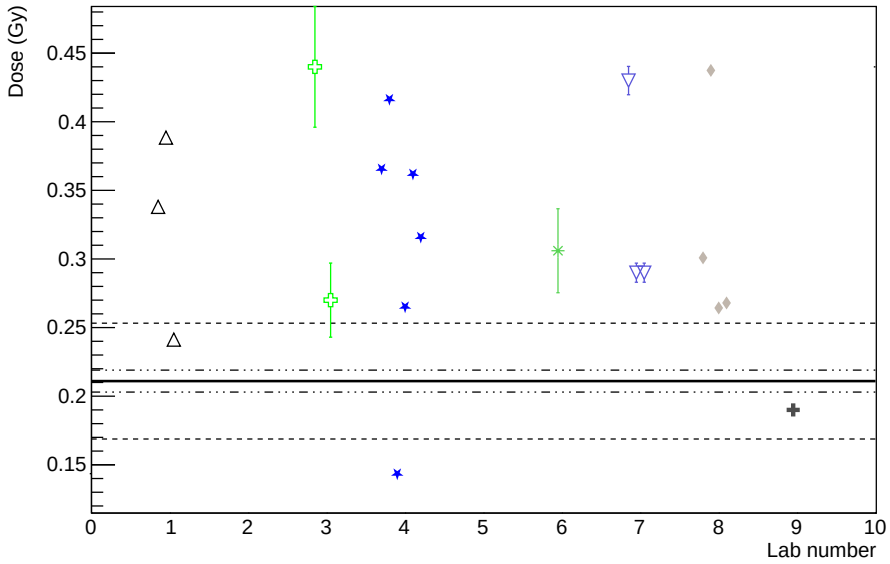


(b) photon dose

Figure 4.12: Final neutron and photon doses for the second irradiation. These dosimeters were placed three meters away from Godiva IV.



(a) Neutron dose

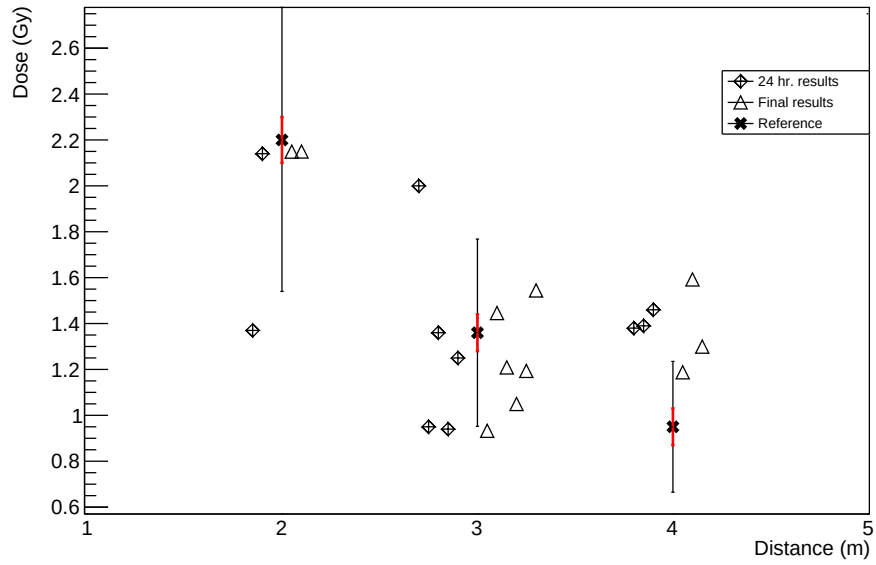


(b) photon dose

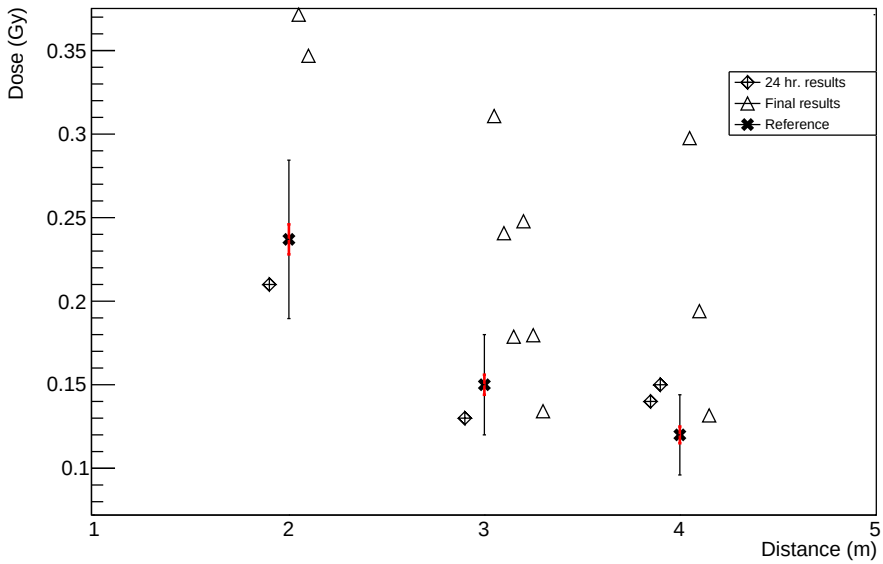
Figure 4.13: Final neutron and photon doses for the second irradiation. These dosimeters were placed four meters away from Godiva IV.

4.3 Neutron and photon 24 hr and Final Dose Comparison

The 24 hour and final results for each lab are compared. The plots show distance as the x-axis, but the 24 hour and final results do not reflect this in terms of x position. The data points are grouped with the reference values at each distances, where the 24 hour results are on the left of the reference point and the final results are on the right of the reference point. The reference value uncertainty is show as a red error bar and the DOE accuracy standard is show as the black error bar.

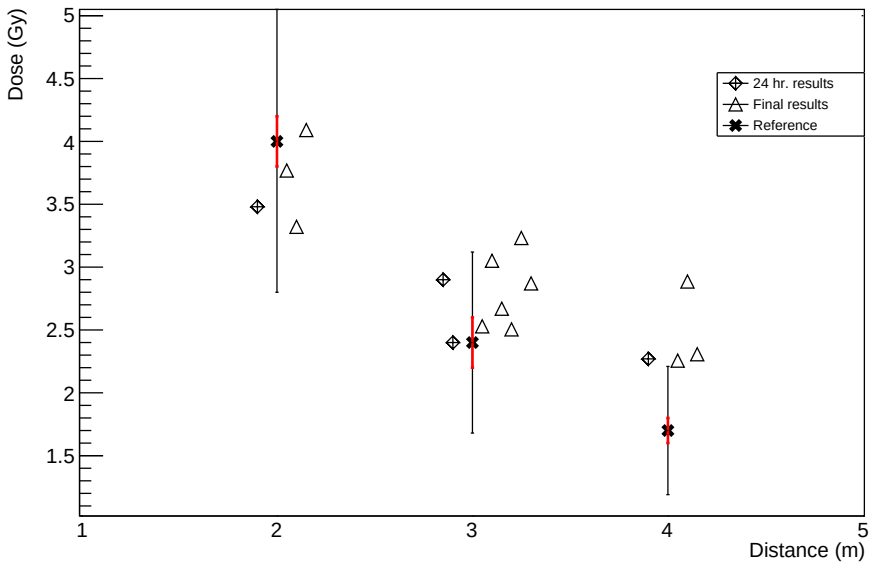


(a) Neutron dose

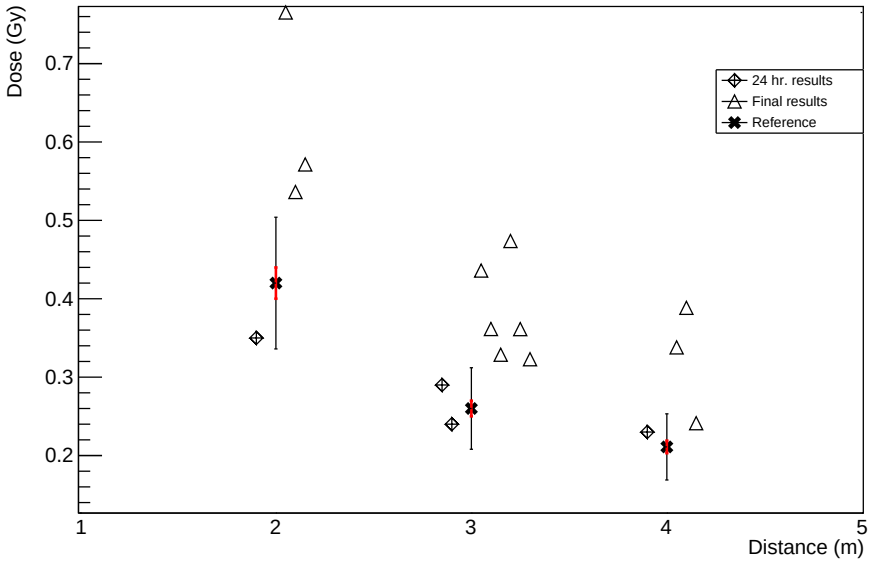


(b) photon dose

Figure 4.14: Lab 1 comparison of the 24 hour and final results of the neutron and photon doses for the first irradiaton.

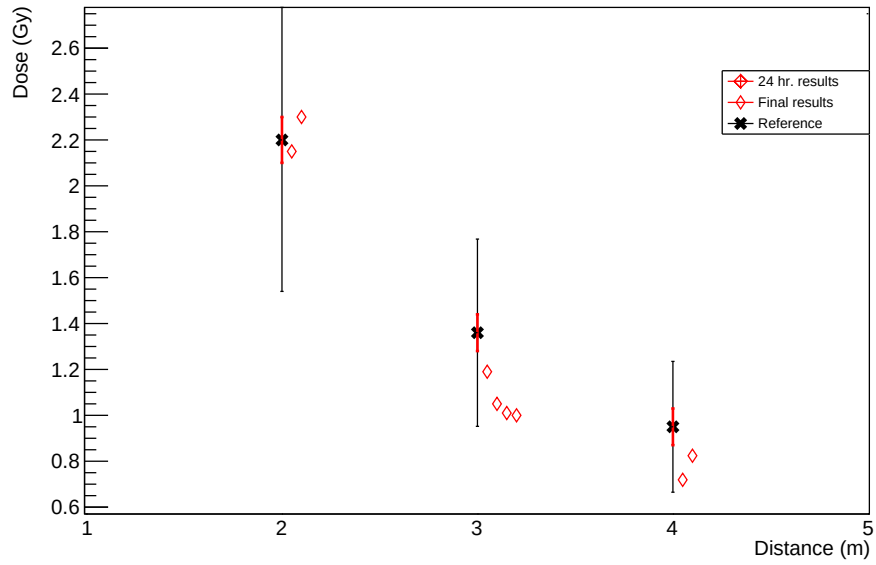


(a) Neutron dose

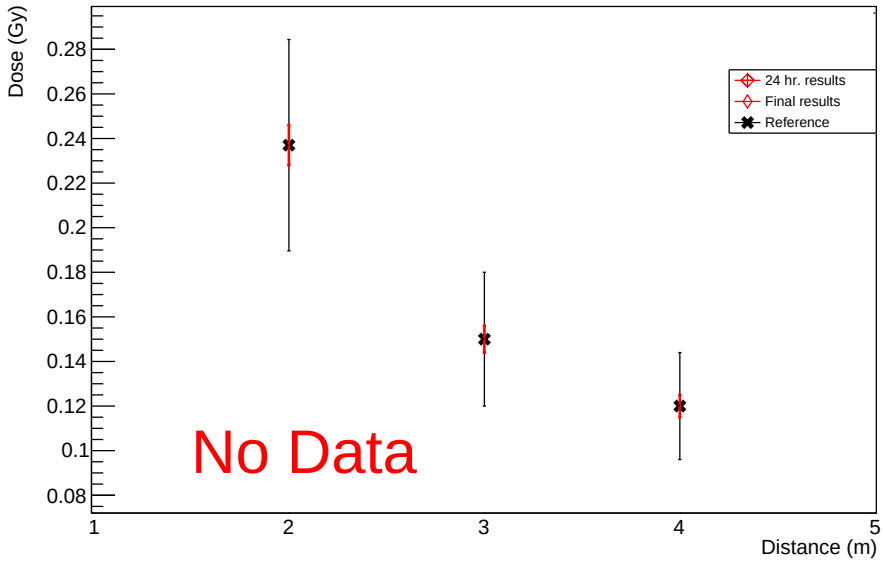


(b) photon dose

Figure 4.15: Lab 1 comparison of the 24 hour and final results of the neutron and photon doses for the second irradiaton.

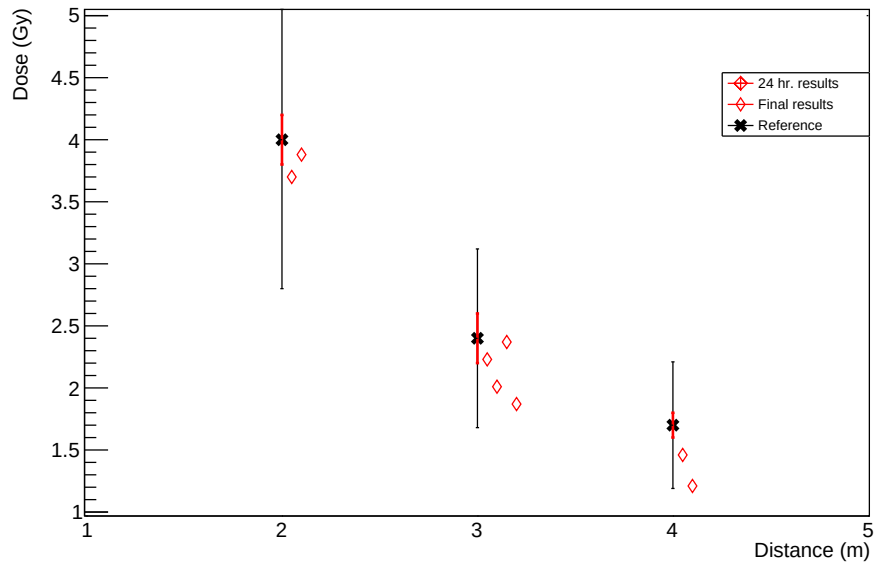


(a) Neutron dose

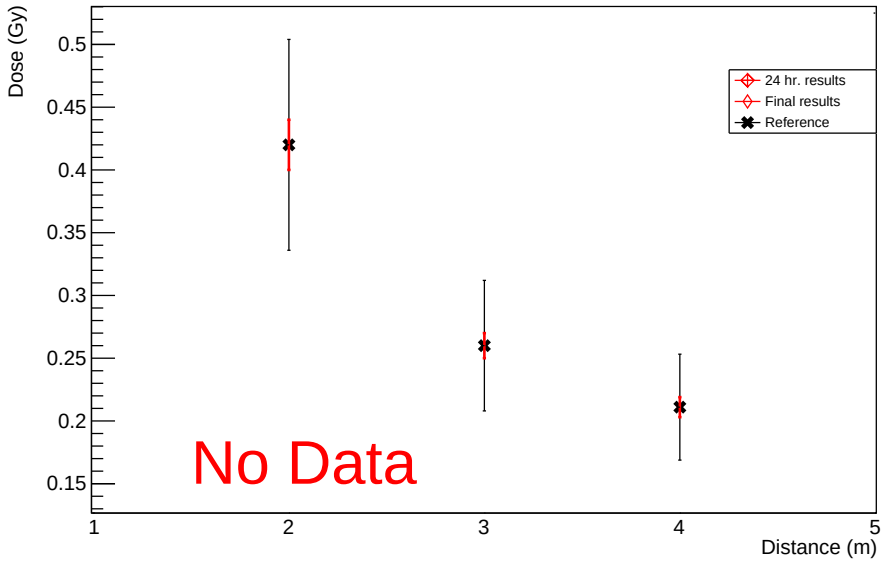


(b) photon dose

Figure 4.16: Lab 2 comparison of the 24 hour and final results of the neutron and photon doses for the first irradiaton.

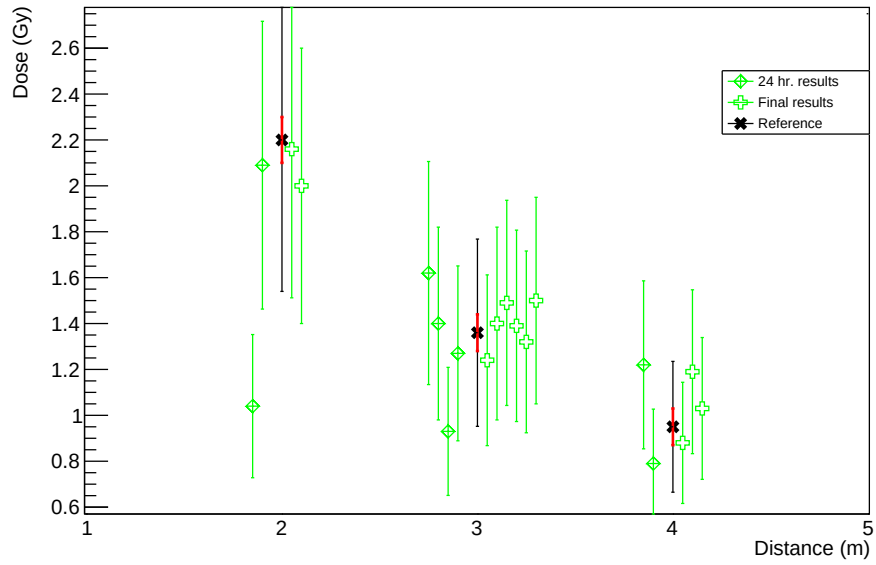


(a) Neutron dose

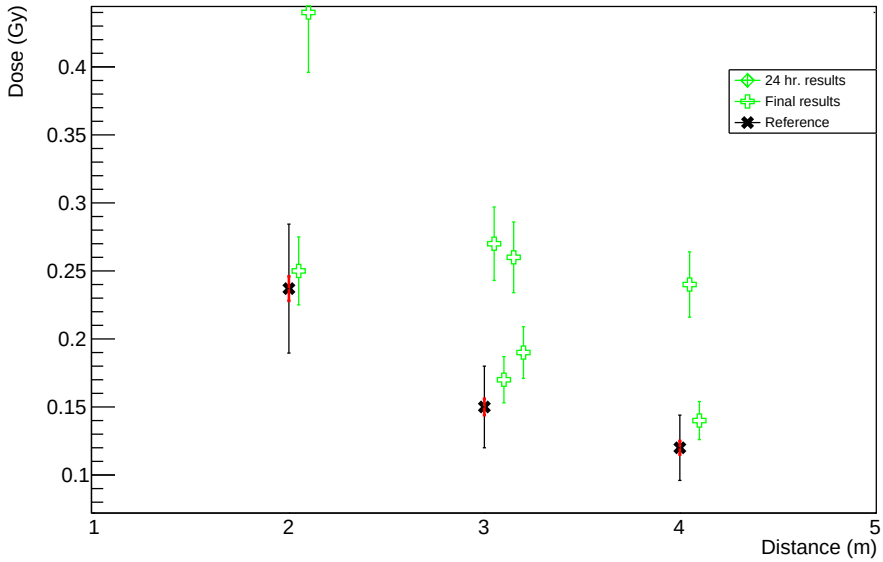


(b) photon dose

Figure 4.17: Lab 2 comparison of the 24 hour and final results of the neutron and photon doses for the second irradiaton.

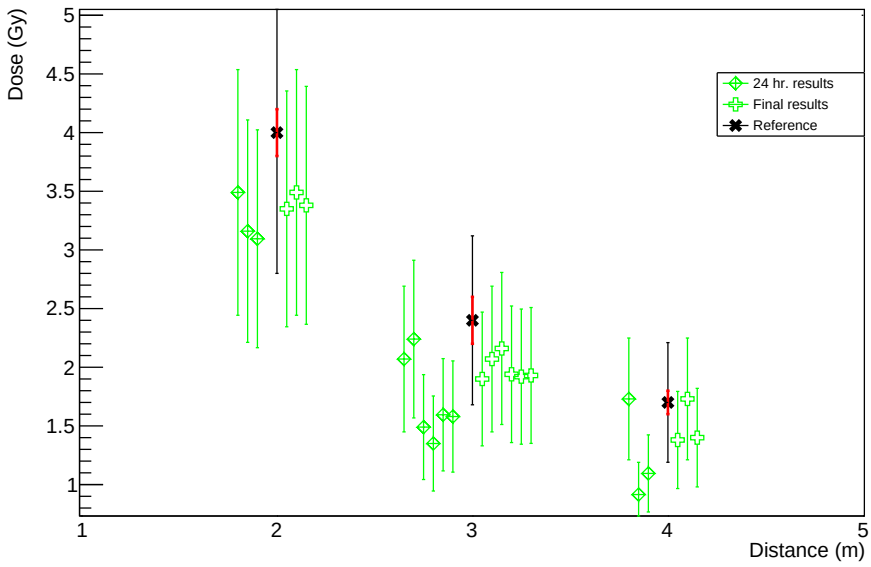


(a) Neutron dose

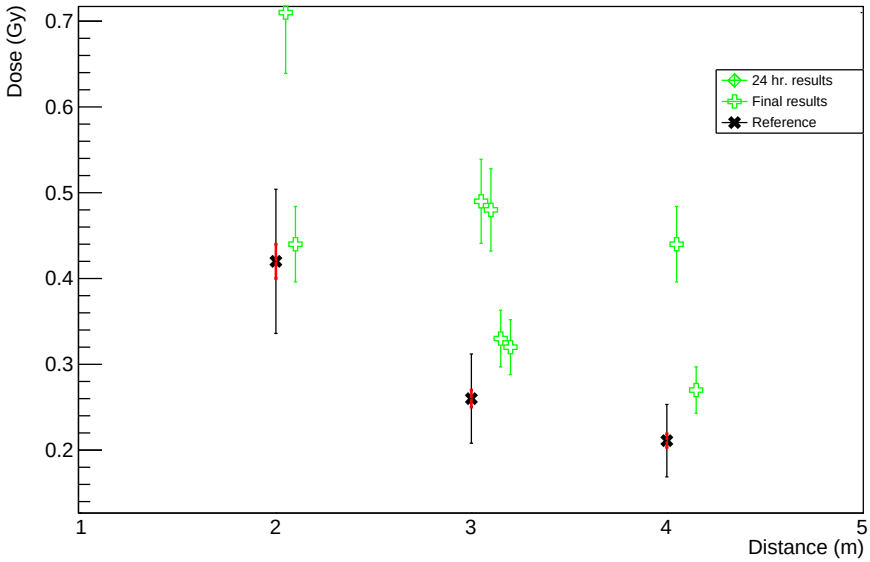


(b) photon dose

Figure 4.18: Lab 3 comparison of the 24 hour and final results of the neutron and photon doses for the first irradiaton.

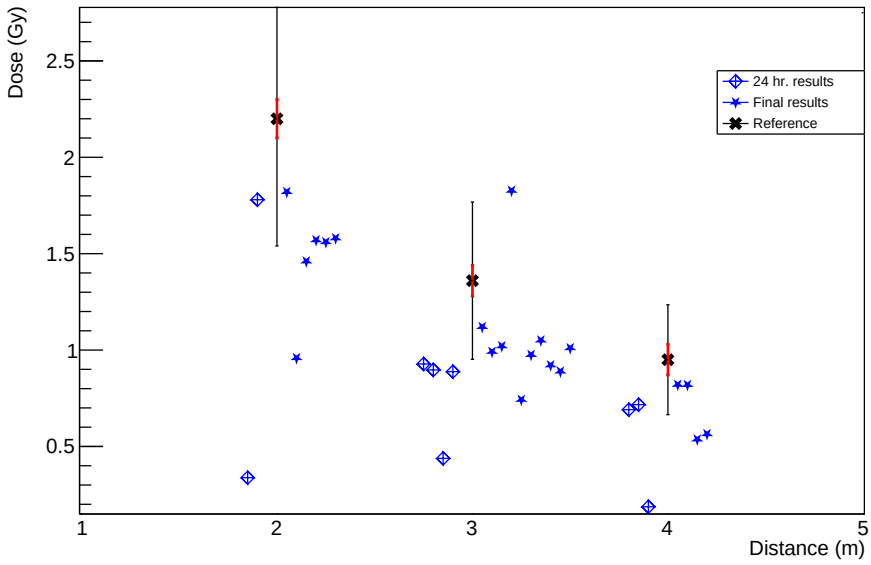


(a) Neutron dose

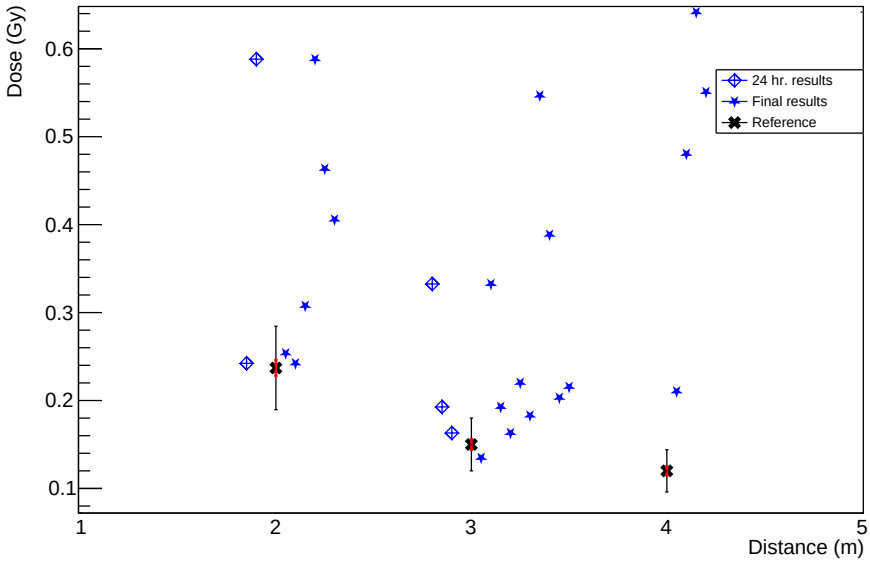


(b) photon dose

Figure 4.19: Lab 3 comparison of the 24 hour and final results of the neutron and photon doses for the second irradiaton.

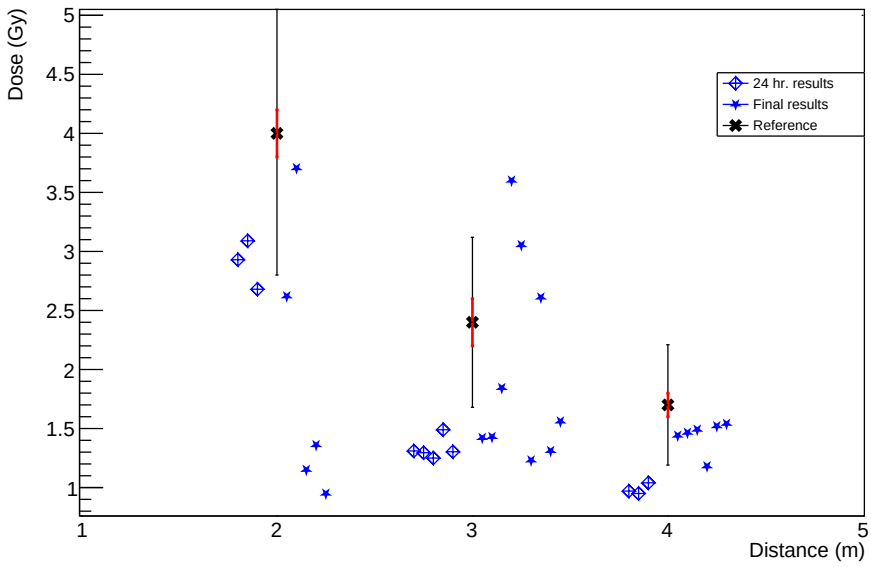


(a) Neutron dose

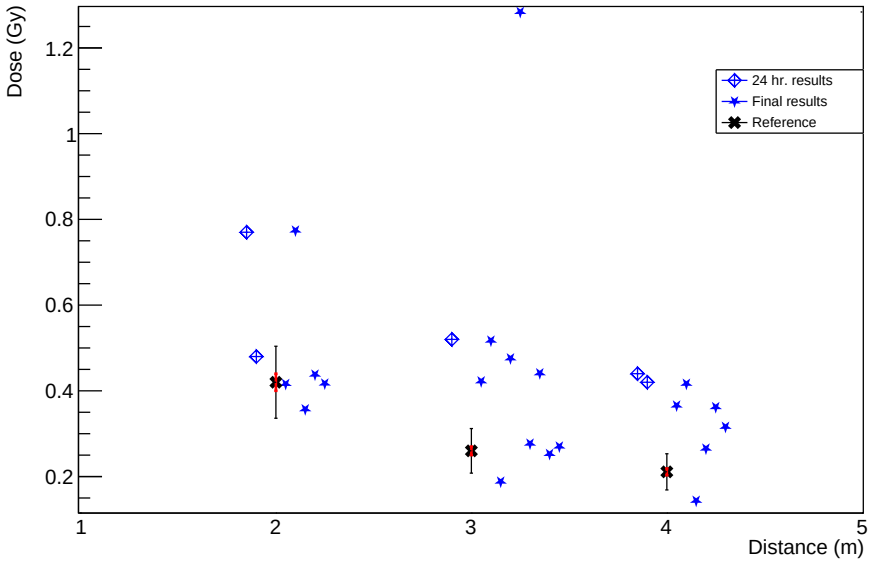


(b) photon dose

Figure 4.20: Lab 4 comparison of the 24 hour and final results of the neutron and photon doses for the first irradiaton.

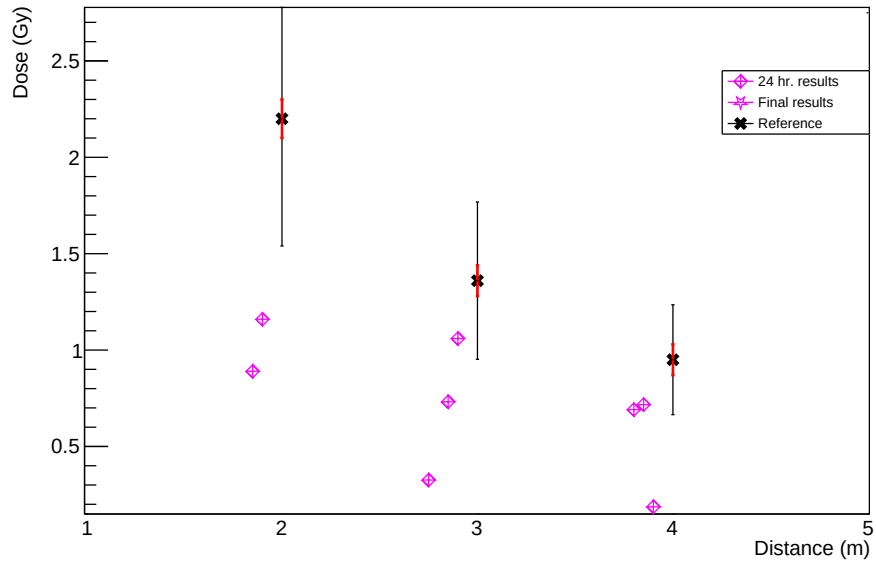


(a) Neutron dose

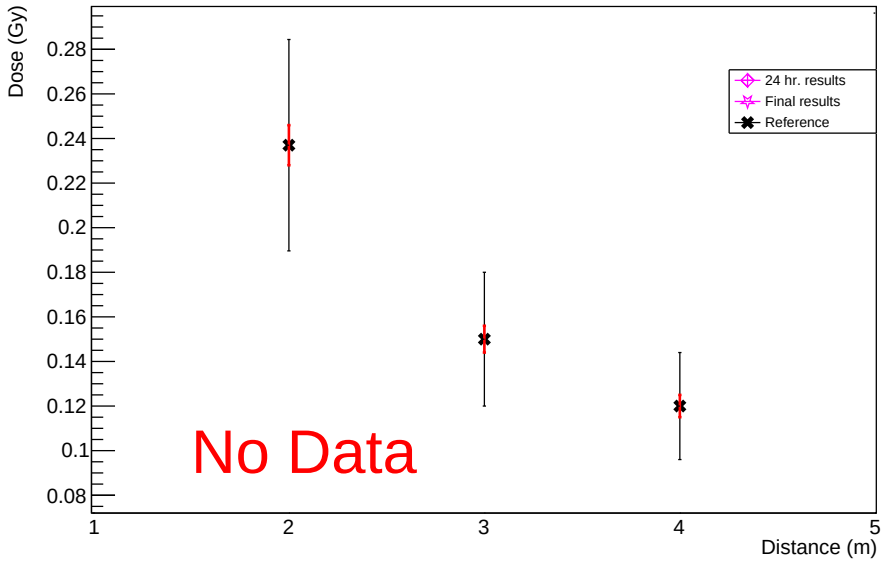


(b) photon dose

Figure 4.21: Lab 4 comparison of the 24 hour and final results of the neutron and photon doses for the second irradiaton.

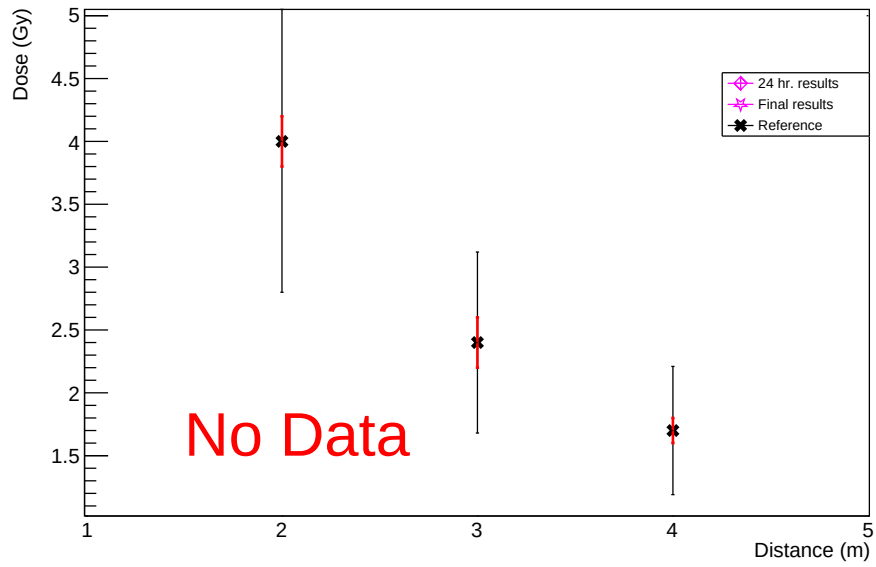


(a) Neutron dose

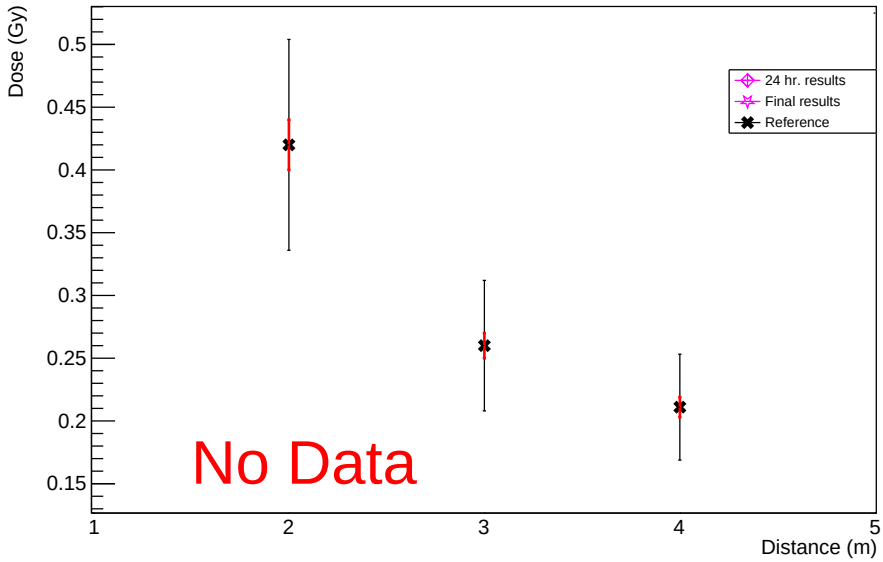


(b) photon dose

Figure 4.22: Lab 5 comparison of the 24 hour and final results of the neutron and photon doses for the first irradiaton.

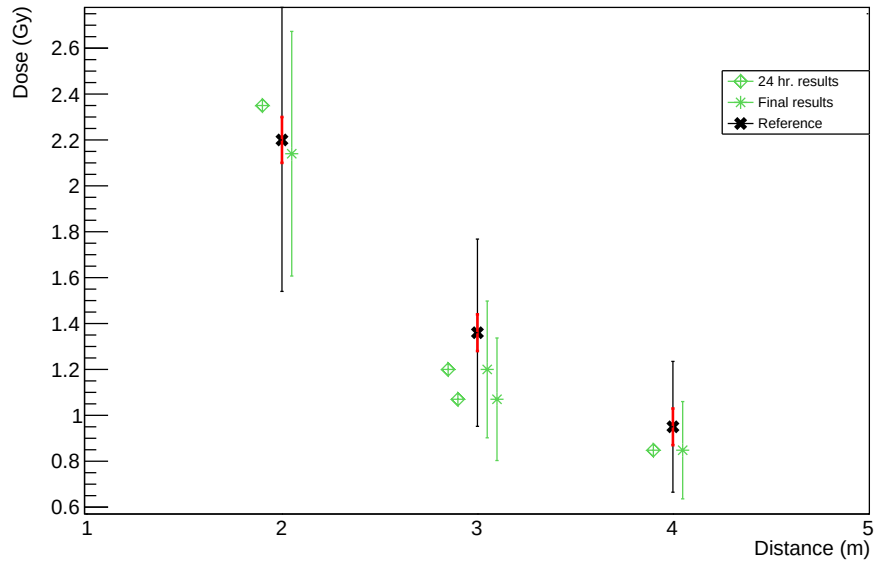


(a) Neutron dose

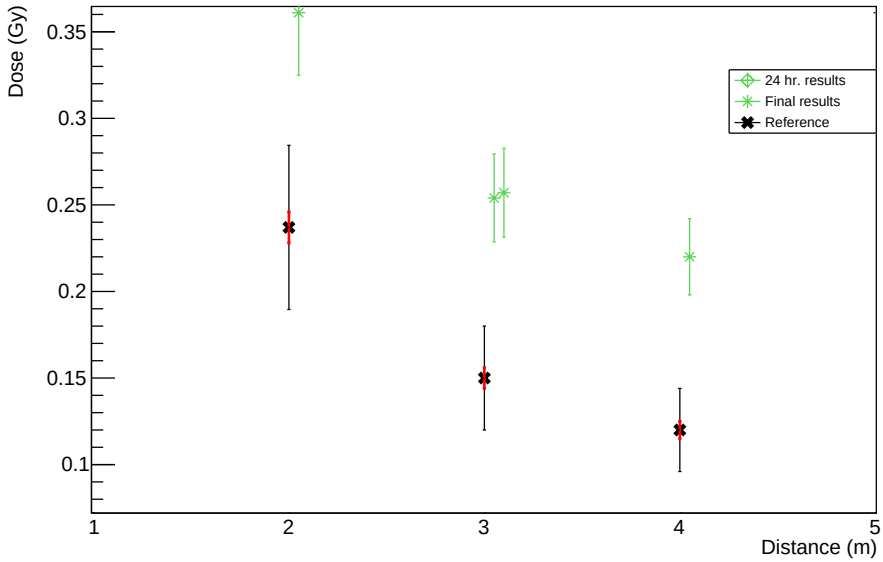


(b) photon dose

Figure 4.23: Lab 5 comparison of the 24 hour and final results of the neutron and photon doses for the second irradiaton.

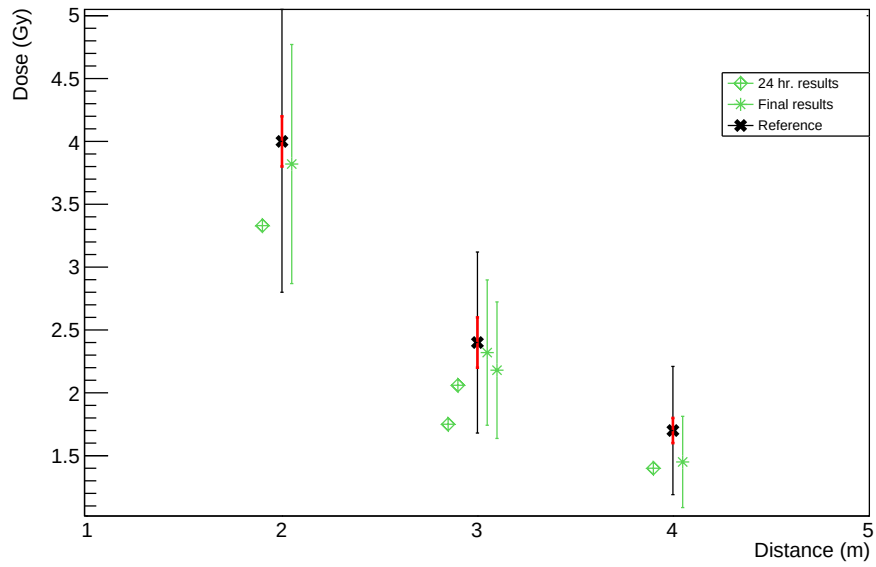


(a) Neutron dose

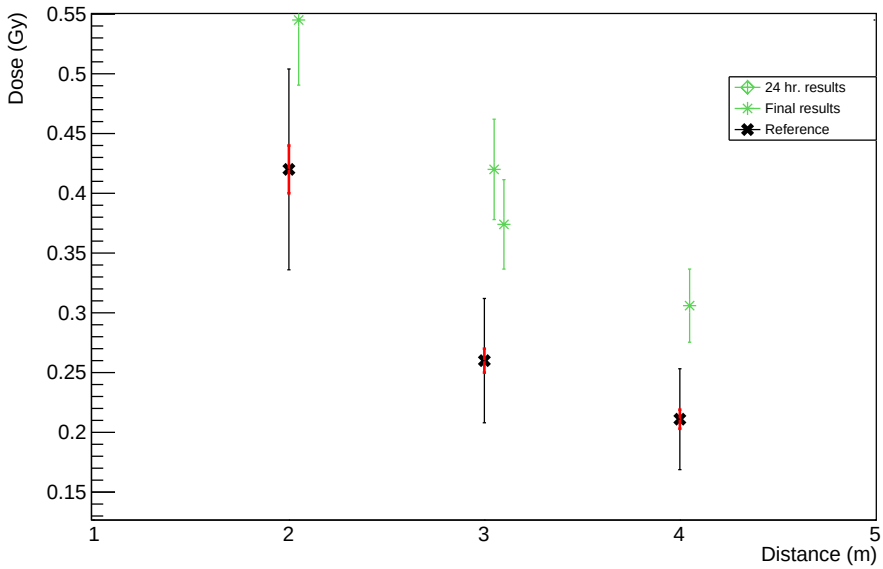


(b) photon dose

Figure 4.24: Lab 6 comparison of the 24 hour and final results of the neutron and photon doses for the first irradiaton.

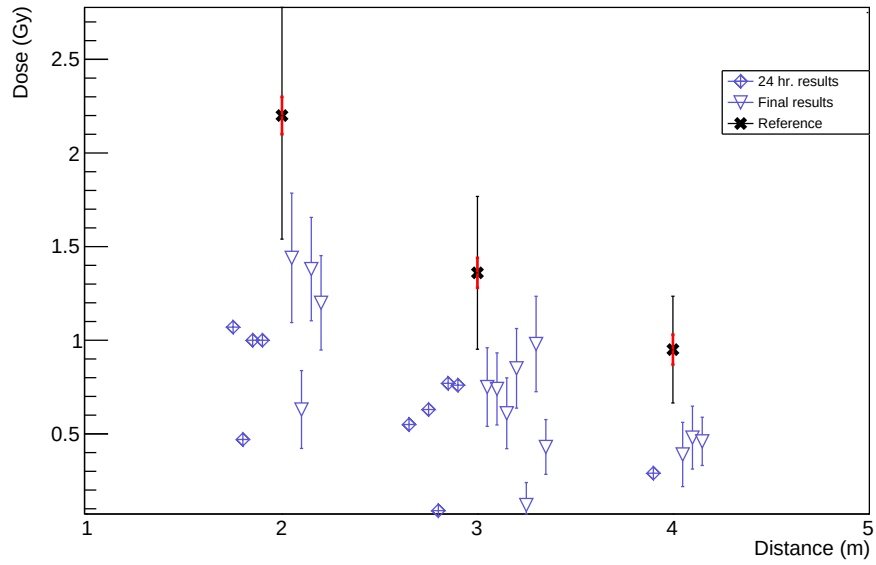


(a) Neutron dose

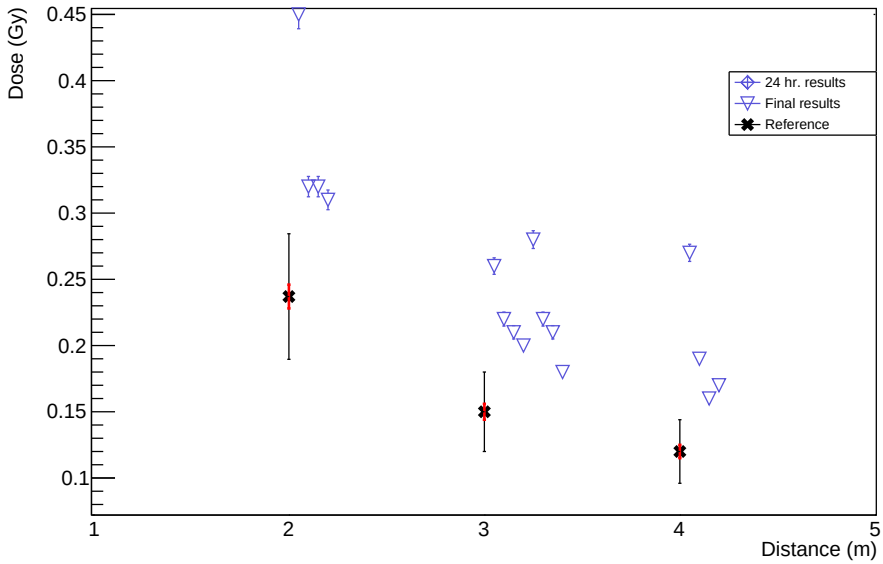


(b) photon dose

Figure 4.25: Lab 6 comparison of the 24 hour and final results of the neutron and photon doses for the second irradiaton.

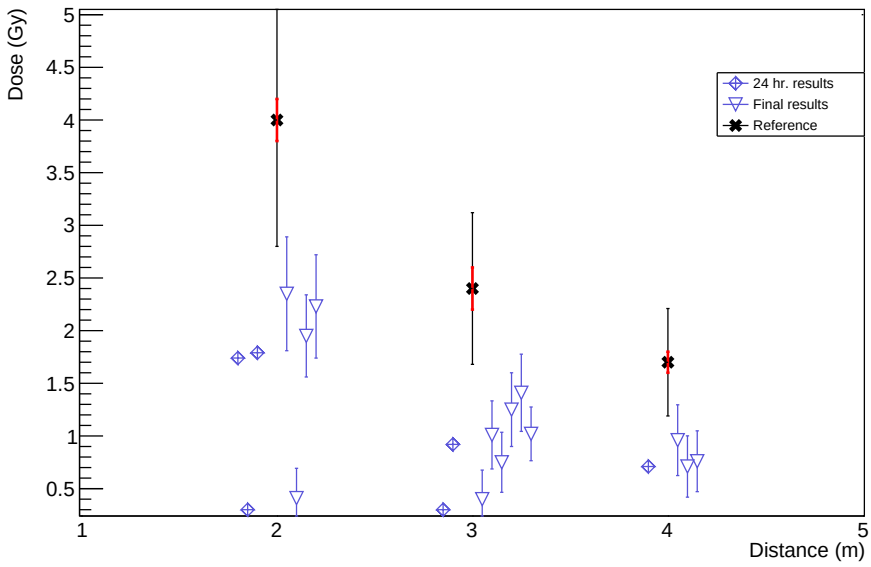


(a) Neutron dose

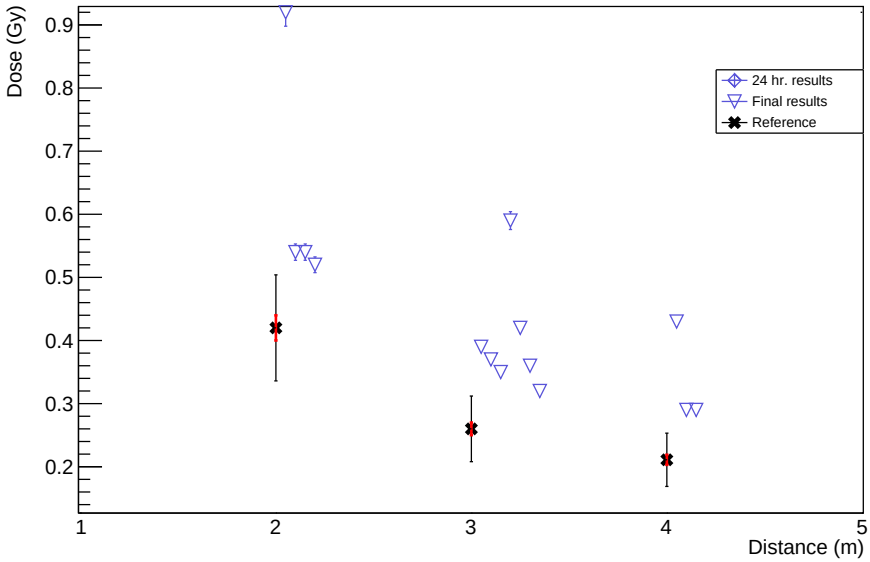


(b) photon dose

Figure 4.26: Lab 7 comparison of the 24 hour and final results of the neutron and photon doses for the first irradiaton.

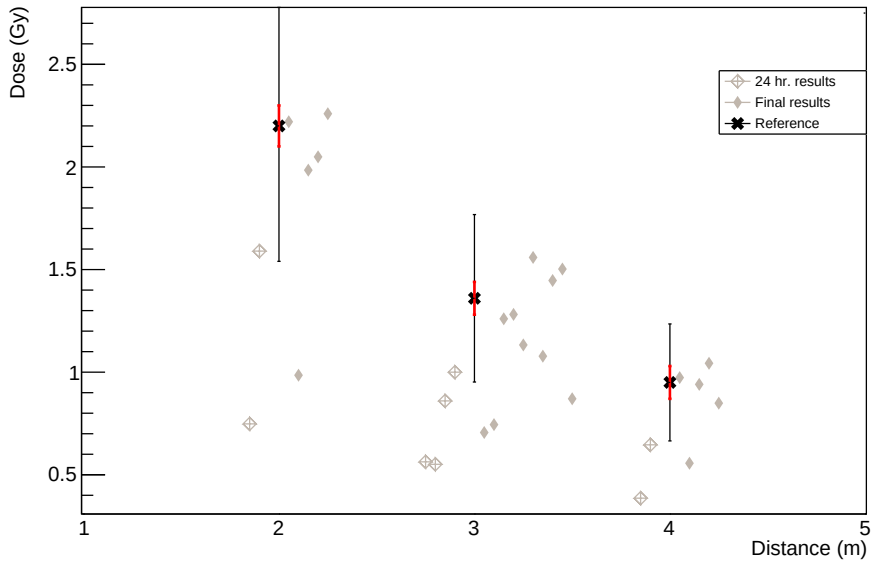


(a) Neutron dose

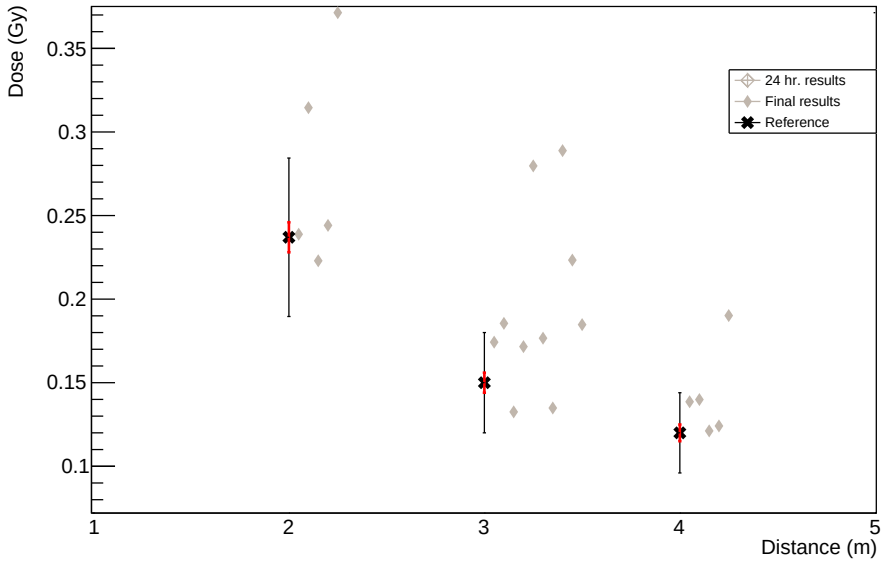


(b) photon dose

Figure 4.27: Lab 7 comparison of the 24 hour and final results of the neutron and photon doses for the second irradiaton.

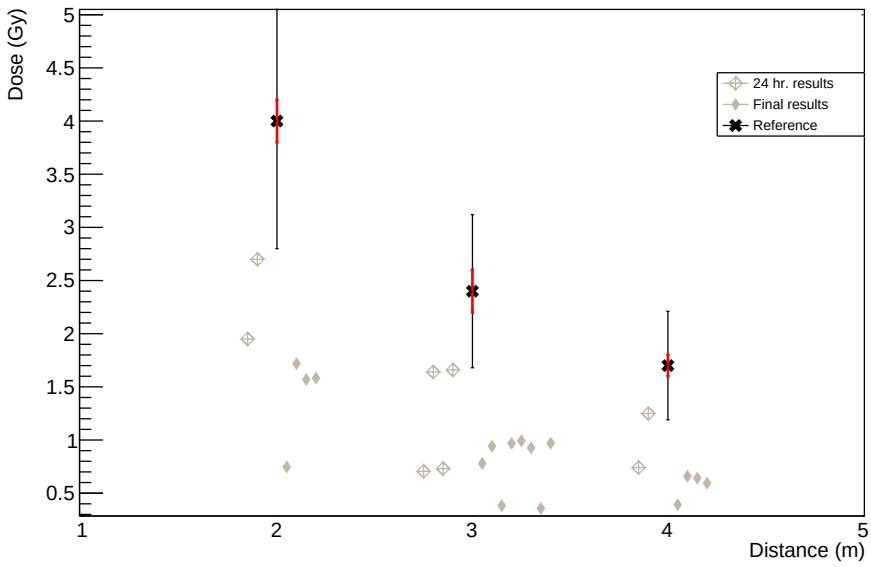


(a) Neutron dose

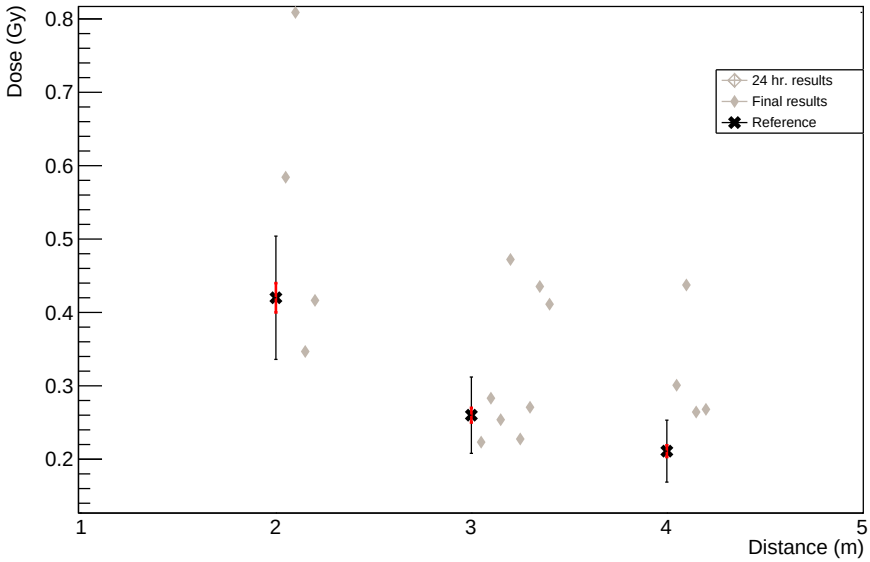


(b) photon dose

Figure 4.28: Lab 8 comparison of the 24 hour and final results of the neutron and photon doses for the first irradiaton.

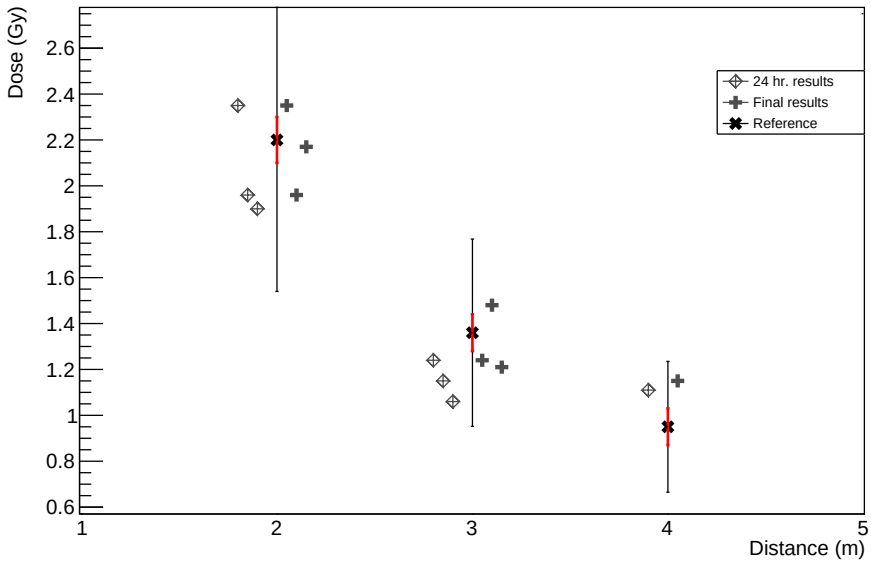


(a) Neutron dose

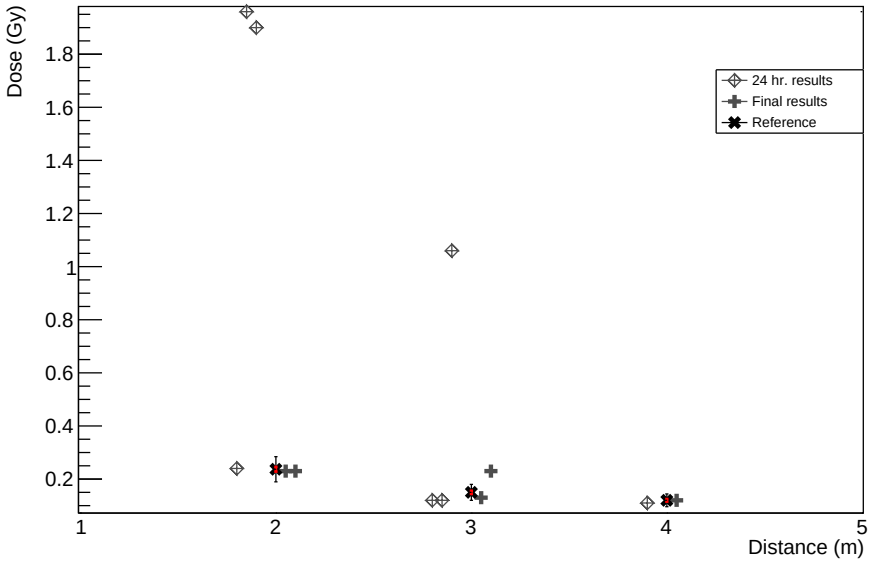


(b) photon dose

Figure 4.29: Lab 8 comparison of the 24 hour and final results of the neutron and photon doses for the second irradiaton.

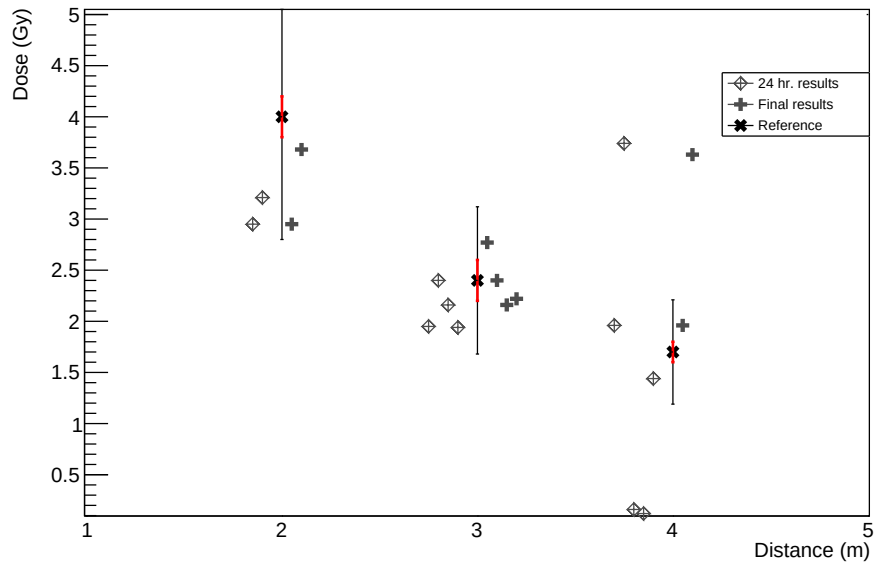


(a) Neutron dose

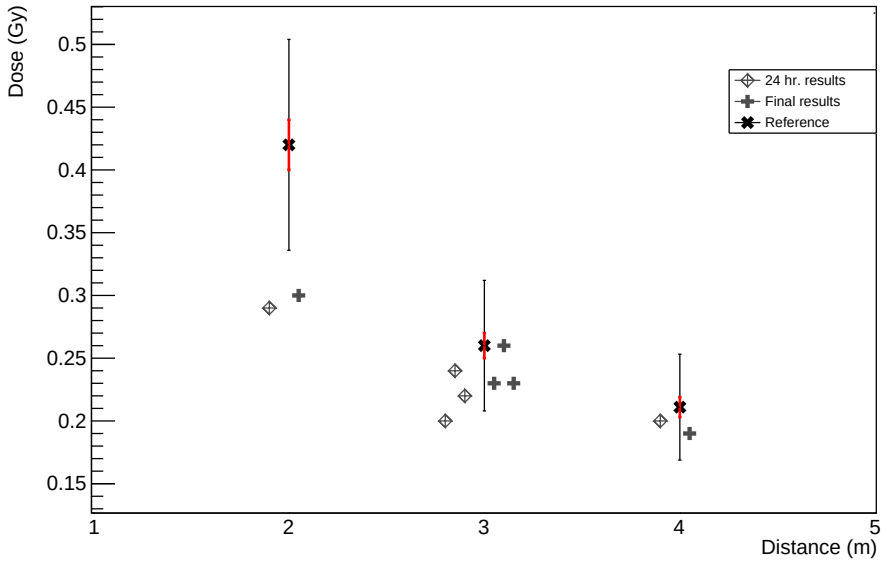


(b) photon dose

Figure 4.30: Lab 9 comparison of the 24 hour and final results of the neutron and photon doses for the first irradiaton.



(a) Neutron dose



(b) photon dose

Figure 4.31: Lab 9 comparison of the 24 hour and final results of the neutron and photon doses for the second irradiaton.

5 Discussion

The evaluation of lab dosimetry performance is described in percentage of reported dose values outside the DOE standards. Table 11 summarizes the 2022 intercomparison NAD performance per lab. One third of labs provided uncertainties to their dose value. On average, 32% of dose results were outside of DOE standards for neutron dose and 78% of dose results were outside of DOE standards for photon dose. Lab number five was not included in the average due to no reported results. In comparison to past results (summarized in Table 12), there has been a 20% improvement for reported neutron dose that meet DOE standards from the past Godiva NAD exercise in 2016. The 2018 results were reported as total doses and compared to the DOE standards. Of the 32% of the neutron doses outside of DOE standards, 27% were below and 5% were above. There is a bias for a lower neutron dose compared to the reference value. Of the 78% of the photon doses outside of DOE standards, 22% were below and 56% were above. There is a bias for a higher photon dose compared to the reference value.

Table 11: Percentage of dose results outside of DOE standards.

Lab	Provided Uncertainties	Below Neutron Dose Standard (%)	Above Neutron Dose Standard (%)	Outside Neutron Dose Standard (%)	Below photon Dose Standard (%)	Above photon Dose Standard (%)	Outside photon Dose Standard (%)
1	–	8	25	33	4	75	79
2	–	11	0	11	100	0	100
3	✓	0	0	0	30	52	83
4	–	43	5	48	5	68	73
5	–	–	–	–	–	–	–
6	✓	0	0	0	0	100	100
7	✓	0	96	96	0	97	97
8	–	58	0	58	0	47	47
9	–	0	7	7	40	7	47
Average	33%	27	5	32	22	56	78

Table 12: Past percentage of dose results outside of DOE standards. The lab numbers for the past exercises do not correspond to the same labs throughout the years.

Godiva IV 2016 [4]		Flattop 2018 [6]	
Lab	Outside Neutron Dose (%)	Lab	Outside Total Dose (%)
1_{2016}	38	1_{2018}	11
2_{2016}	3	2_{2018}	41
3_{2016}	71	3_{2018}	81
4_{2016}	0	4_{2018}	32
5_{2016}	85	5_{2018}	23
6_{2016}	67	6_{2018}	58
7_{2016}	58	7_{2018}	100
8_{2016}	92	8_{2018}	26
–	–	9_{2018}	36
–	–	10_{2018}	78
Average_{2016}	52	Average_{2018}	49

6 Conclusion

During the NAD exercise, there have been multiple labs that did not report neutron or photon dose values within the first 24 hours. One limitation for measuring photon dose is that the equipment to analyze photon dose was not present in the lab space. A solution is to have a photon dose reader present, although equipment and shipping may be limited. One limitation for measuring neutron dose is that high-purity germanium (HPGe) detectors that are used to measure the NAD activated γ rays can risk damage via shipment. Also, it was observed that some detectors experienced a shift in energy calibration. This could have been caused by the changing room temperature as the pre-amplifiers can be affected by this. Normally, the NAD lab uses air conditioning to control the room temperature, but the air conditioner failed prior to the exercise. A swamp cooler was used to keep the lab space comfortable, but the electronics may have experienced a large enough temperature change.

The reference dose values were recalculated with a new model for neutron dose and photon dose. These values have an associated uncertainty, which was not reported in the past. For this study, one third of the participating laboratories provided their uncertainty to their reported doses. Even though there has been an improvement in reported neutron doses, there are existing NADs that do not meet DOE standards. A new NAD design and/or NAD algorithm should be considered. In conclusion, this type of exercise needs to be performed more frequently to provide the practice in case of an actual nuclear accident.

References

[1] D. P. HICKMAN, D. P. HEINRICHS, R. HUDSON, C. WONG, D. WARD, C. WILSON, L. CLARK, and F. TROMPIER, "Dosimetry characterization of the Godiva Reactor under burst conditions," (6 2017), Available here.

[2] "Dosimetry for Criticality Accidents," (2013), ANSI/HPS N13.3.

[3] "IEC Standard 751," IEC Standard 751.

[4] D. HICKMAN and B. HUDSON, "International Intercomparison Exercise for Nuclear Accident Dosimetry at the DAF Using GODIVA-IV," (12 2016), Available here.

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A Neutron Fluence Tables

A description of lethargy is found here [16].

Table 13: Neutron fluence at position 1 for a burst change in temperature of 68.6 °C.

E_i	E_{i+1}	Fluence per lethargy	lethargy	Fluence
1.58E-09	2.51E-09	6.83E+05	4.63E-01	3.16E+05
2.51E-09	3.98E-09	4.97E+06	4.61E-01	2.29E+06
3.98E-09	6.31E-09	3.56E+07	4.61E-01	1.64E+07
6.31E-09	1.00E-08	1.74E+08	4.60E-01	8.02E+07
1.00E-08	1.58E-08	6.62E+08	4.57E-01	3.03E+08
1.58E-08	2.51E-08	1.53E+09	4.63E-01	7.08E+08
2.51E-08	3.98E-08	2.86E+09	4.61E-01	1.32E+09
3.98E-08	6.31E-08	4.12E+09	4.61E-01	1.90E+09
6.31E-08	1.00E-07	4.54E+09	4.60E-01	2.09E+09
1.00E-07	1.58E-07	4.66E+09	4.57E-01	2.13E+09
1.58E-07	2.51E-07	3.87E+09	4.63E-01	1.79E+09
2.51E-07	3.98E-07	2.49E+09	4.61E-01	1.15E+09
3.98E-07	6.31E-07	1.65E+09	4.61E-01	7.61E+08
6.31E-07	1.00E-06	1.56E+09	4.60E-01	7.19E+08
1.00E-06	1.00E-02	1.62E+09	9.21E+00	1.49E+10
1.00E-02	5.04E-02	2.29E+09	1.62E+00	3.70E+09
5.04E-02	5.72E-02	3.18E+09	1.27E-01	4.02E+08
5.72E-02	6.51E-02	2.59E+09	1.29E-01	3.35E+08
6.51E-02	7.39E-02	3.51E+09	1.27E-01	4.45E+08
7.39E-02	8.37E-02	3.36E+09	1.25E-01	4.18E+08
8.37E-02	9.55E-02	4.08E+09	1.32E-01	5.38E+08
9.55E-02	1.08E-01	3.16E+09	1.23E-01	3.89E+08
1.08E-01	1.23E-01	4.52E+09	1.30E-01	5.88E+08
1.23E-01	1.40E-01	4.20E+09	1.29E-01	5.44E+08
1.40E-01	1.58E-01	5.43E+09	1.21E-01	6.57E+08
1.58E-01	2.01E-01	5.07E+09	2.41E-01	1.22E+09
2.01E-01	2.22E-01	7.03E+09	9.94E-02	6.99E+08
2.22E-01	2.47E-01	7.78E+09	1.07E-01	8.30E+08
2.47E-01	2.74E-01	1.05E+10	1.04E-01	1.09E+09
2.74E-01	3.05E-01	9.16E+09	1.07E-01	9.82E+08
3.05E-01	3.38E-01	1.28E+10	1.03E-01	1.31E+09
3.38E-01	3.78E-01	1.20E+10	1.12E-01	1.34E+09
3.78E-01	4.21E-01	1.60E+10	1.08E-01	1.72E+09
4.21E-01	4.66E-01	1.85E+10	1.02E-01	1.88E+09
4.66E-01	5.18E-01	1.70E+10	1.06E-01	1.80E+09
5.18E-01	6.01E-01	2.27E+10	1.49E-01	3.38E+09
6.01E-01	6.71E-01	2.14E+10	1.10E-01	2.36E+09
6.71E-01	7.41E-01	2.72E+10	9.92E-02	2.70E+09
7.41E-01	8.25E-01	2.67E+10	1.07E-01	2.87E+09
8.25E-01	9.16E-01	3.05E+10	1.05E-01	3.19E+09
9.16E-01	1.02E+00	2.88E+10	1.08E-01	3.10E+09

1.02E+00	1.13E+00	2.47E+10	1.02E-01	2.53E+09
1.13E+00	1.26E+00	3.57E+10	1.09E-01	3.89E+09
1.26E+00	1.42E+00	3.13E+10	1.20E-01	3.74E+09
1.42E+00	1.61E+00	2.82E+10	1.26E-01	3.54E+09
1.61E+00	1.85E+00	2.21E+10	1.39E-01	3.07E+09
1.85E+00	2.09E+00	2.75E+10	1.22E-01	3.35E+09
2.09E+00	2.38E+00	2.86E+10	1.30E-01	3.71E+09
2.38E+00	2.69E+00	1.31E+10	1.22E-01	1.61E+09
2.69E+00	3.07E+00	1.55E+10	1.32E-01	2.05E+09
3.07E+00	3.48E+00	1.95E+10	1.25E-01	2.44E+09
3.48E+00	3.96E+00	9.52E+09	1.29E-01	1.23E+09
3.96E+00	4.73E+00	6.25E+09	1.78E-01	1.11E+09
4.73E+00	5.31E+00	8.48E+09	1.16E-01	9.81E+08
5.31E+00	5.88E+00	4.73E+09	1.02E-01	4.82E+08
5.88E+00	6.43E+00	1.82E+09	8.94E-02	1.63E+08
6.43E+00	6.98E+00	2.25E+09	8.21E-02	1.85E+08
6.98E+00	7.52E+00	2.75E+09	7.45E-02	2.05E+08
7.52E+00	8.04E+00	2.45E+09	6.69E-02	1.64E+08
8.04E+00	8.56E+00	1.90E+09	6.27E-02	1.19E+08
8.56E+00	9.07E+00	0.00E+00	5.79E-02	0.00E+00
9.07E+00	9.57E+00	0.00E+00	5.37E-02	0.00E+00
9.57E+00	1.06E+01	0.00E+00	1.02E-01	0.00E+00
1.06E+01	1.16E+01	0.00E+00	9.02E-02	0.00E+00
1.16E+01	1.45E+01	0.00E+00	2.23E-01	0.00E+00

Table 14: Neutron fluence at position 2 for a burst change in temperature of 68.6 °C.

E_i	E_{i+1}	Fluence per lethargy	lethargy	Fluence
1.58E-09	2.51E-09	6.16E+05	4.63E-01	2.85E+05
2.51E-09	3.98E-09	4.36E+06	4.61E-01	2.01E+06
3.98E-09	6.31E-09	3.15E+07	4.61E-01	1.45E+07
6.31E-09	1.00E-08	1.54E+08	4.60E-01	7.11E+07
1.00E-08	1.58E-08	5.90E+08	4.57E-01	2.70E+08
1.58E-08	2.51E-08	1.37E+09	4.63E-01	6.36E+08
2.51E-08	3.98E-08	2.60E+09	4.61E-01	1.20E+09
3.98E-08	6.31E-08	3.78E+09	4.61E-01	1.74E+09
6.31E-08	1.00E-07	4.17E+09	4.60E-01	1.92E+09
1.00E-07	1.58E-07	4.31E+09	4.57E-01	1.97E+09
1.58E-07	2.51E-07	3.61E+09	4.63E-01	1.67E+09
2.51E-07	3.98E-07	2.34E+09	4.61E-01	1.08E+09
3.98E-07	6.31E-07	1.56E+09	4.61E-01	7.17E+08
6.31E-07	1.00E-06	1.47E+09	4.60E-01	6.79E+08
1.00E-06	1.00E-02	1.53E+09	9.21E+00	1.41E+10
1.00E-02	5.04E-02	2.18E+09	1.62E+00	3.52E+09
5.04E-02	5.72E-02	3.03E+09	1.27E-01	3.84E+08
5.72E-02	6.51E-02	2.47E+09	1.29E-01	3.20E+08
6.51E-02	7.39E-02	3.35E+09	1.27E-01	4.25E+08
7.39E-02	8.37E-02	3.20E+09	1.25E-01	3.99E+08
8.37E-02	9.55E-02	3.89E+09	1.32E-01	5.13E+08
9.55E-02	1.08E-01	3.02E+09	1.23E-01	3.71E+08
1.08E-01	1.23E-01	4.31E+09	1.30E-01	5.61E+08
1.23E-01	1.40E-01	4.01E+09	1.29E-01	5.19E+08
1.40E-01	1.58E-01	5.18E+09	1.21E-01	6.27E+08
1.58E-01	2.01E-01	4.86E+09	2.41E-01	1.17E+09
2.01E-01	2.22E-01	6.71E+09	9.94E-02	6.67E+08
2.22E-01	2.47E-01	7.43E+09	1.07E-01	7.93E+08
2.47E-01	2.74E-01	1.00E+10	1.04E-01	1.04E+09
2.74E-01	3.05E-01	8.75E+09	1.07E-01	9.38E+08
3.05E-01	3.38E-01	1.22E+10	1.03E-01	1.25E+09
3.38E-01	3.78E-01	1.14E+10	1.12E-01	1.28E+09
3.78E-01	4.21E-01	1.52E+10	1.08E-01	1.64E+09
4.21E-01	4.66E-01	1.77E+10	1.02E-01	1.80E+09
4.66E-01	5.18E-01	1.64E+10	1.06E-01	1.73E+09
5.18E-01	6.01E-01	2.17E+10	1.49E-01	3.23E+09
6.01E-01	6.71E-01	2.05E+10	1.10E-01	2.26E+09
6.71E-01	7.41E-01	2.60E+10	9.92E-02	2.58E+09
7.41E-01	8.25E-01	2.56E+10	1.07E-01	2.75E+09
8.25E-01	9.16E-01	2.92E+10	1.05E-01	3.06E+09
9.16E-01	1.02E+00	2.77E+10	1.08E-01	2.98E+09
1.02E+00	1.13E+00	2.37E+10	1.02E-01	2.43E+09
1.13E+00	1.26E+00	3.43E+10	1.09E-01	3.73E+09
1.26E+00	1.42E+00	3.00E+10	1.20E-01	3.59E+09

1.42E+00	1.61E+00	2.71E+10	1.26E-01	3.40E+09
1.61E+00	1.85E+00	2.12E+10	1.39E-01	2.95E+09
1.85E+00	2.09E+00	2.64E+10	1.22E-01	3.22E+09
2.09E+00	2.38E+00	2.75E+10	1.30E-01	3.57E+09
2.38E+00	2.69E+00	1.27E+10	1.22E-01	1.55E+09
2.69E+00	3.07E+00	1.49E+10	1.32E-01	1.97E+09
3.07E+00	3.48E+00	1.87E+10	1.25E-01	2.35E+09
3.48E+00	3.96E+00	9.13E+09	1.29E-01	1.18E+09
3.96E+00	4.73E+00	6.02E+09	1.78E-01	1.07E+09
4.73E+00	5.31E+00	8.16E+09	1.16E-01	9.44E+08
5.31E+00	5.88E+00	4.54E+09	1.02E-01	4.63E+08
5.88E+00	6.43E+00	1.76E+09	8.94E-02	1.57E+08
6.43E+00	6.98E+00	2.17E+09	8.21E-02	1.78E+08
6.98E+00	7.52E+00	2.64E+09	7.45E-02	1.97E+08
7.52E+00	8.04E+00	2.36E+09	6.69E-02	1.58E+08
8.04E+00	8.56E+00	1.82E+09	6.27E-02	1.14E+08
8.56E+00	9.07E+00	0.00E+00	5.79E-02	0.00E+00
9.07E+00	9.57E+00	0.00E+00	5.37E-02	0.00E+00
9.57E+00	1.06E+01	0.00E+00	1.02E-01	0.00E+00
1.06E+01	1.16E+01	0.00E+00	9.02E-02	0.00E+00
1.16E+01	1.45E+01	0.00E+00	2.23E-01	0.00E+00

Table 15: Neutron fluence at position 3 for a burst change in temperature of 68.6 °C.

E_i	E_{i+1}	Fluence per lethargy	lethargy	Fluence
1.58E-09	2.51E-09	5.98E+05	4.63E-01	2.77E+05
2.51E-09	3.98E-09	4.06E+06	4.61E-01	1.87E+06
3.98E-09	6.31E-09	2.95E+07	4.61E-01	1.36E+07
6.31E-09	1.00E-08	1.47E+08	4.60E-01	6.77E+07
1.00E-08	1.58E-08	5.68E+08	4.57E-01	2.60E+08
1.58E-08	2.51E-08	1.34E+09	4.63E-01	6.20E+08
2.51E-08	3.98E-08	2.56E+09	4.61E-01	1.18E+09
3.98E-08	6.31E-08	3.78E+09	4.61E-01	1.74E+09
6.31E-08	1.00E-07	4.23E+09	4.60E-01	1.95E+09
1.00E-07	1.58E-07	4.44E+09	4.57E-01	2.03E+09
1.58E-07	2.51E-07	3.76E+09	4.63E-01	1.74E+09
2.51E-07	3.98E-07	2.47E+09	4.61E-01	1.14E+09
3.98E-07	6.31E-07	1.67E+09	4.61E-01	7.69E+08
6.31E-07	1.00E-06	1.59E+09	4.60E-01	7.34E+08
1.00E-06	1.00E-02	1.66E+09	9.21E+00	1.53E+10
1.00E-02	5.04E-02	2.40E+09	1.62E+00	3.88E+09
5.04E-02	5.72E-02	3.29E+09	1.27E-01	4.17E+08
5.72E-02	6.51E-02	2.67E+09	1.29E-01	3.45E+08
6.51E-02	7.39E-02	3.61E+09	1.27E-01	4.58E+08
7.39E-02	8.37E-02	3.45E+09	1.25E-01	4.30E+08
8.37E-02	9.55E-02	4.19E+09	1.32E-01	5.52E+08
9.55E-02	1.08E-01	3.24E+09	1.23E-01	3.98E+08
1.08E-01	1.23E-01	4.62E+09	1.30E-01	6.01E+08
1.23E-01	1.40E-01	4.30E+09	1.29E-01	5.57E+08
1.40E-01	1.58E-01	5.54E+09	1.21E-01	6.70E+08
1.58E-01	2.01E-01	5.15E+09	2.41E-01	1.24E+09
2.01E-01	2.22E-01	7.15E+09	9.94E-02	7.11E+08
2.22E-01	2.47E-01	7.87E+09	1.07E-01	8.40E+08
2.47E-01	2.74E-01	1.06E+10	1.04E-01	1.10E+09
2.74E-01	3.05E-01	9.26E+09	1.07E-01	9.93E+08
3.05E-01	3.38E-01	1.28E+10	1.03E-01	1.32E+09
3.38E-01	3.78E-01	1.21E+10	1.12E-01	1.35E+09
3.78E-01	4.21E-01	1.61E+10	1.08E-01	1.73E+09
4.21E-01	4.66E-01	1.87E+10	1.02E-01	1.90E+09
4.66E-01	5.18E-01	1.72E+10	1.06E-01	1.82E+09
5.18E-01	6.01E-01	2.28E+10	1.49E-01	3.39E+09
6.01E-01	6.71E-01	2.15E+10	1.10E-01	2.37E+09
6.71E-01	7.41E-01	2.72E+10	9.92E-02	2.70E+09
7.41E-01	8.25E-01	2.68E+10	1.07E-01	2.88E+09
8.25E-01	9.16E-01	3.05E+10	1.05E-01	3.19E+09
9.16E-01	1.02E+00	2.88E+10	1.08E-01	3.10E+09
1.02E+00	1.13E+00	2.47E+10	1.02E-01	2.53E+09
1.13E+00	1.26E+00	3.57E+10	1.09E-01	3.89E+09
1.26E+00	1.42E+00	3.12E+10	1.20E-01	3.73E+09

1.42E+00	1.61E+00	2.80E+10	1.26E-01	3.52E+09
1.61E+00	1.85E+00	2.20E+10	1.39E-01	3.05E+09
1.85E+00	2.09E+00	2.73E+10	1.22E-01	3.33E+09
2.09E+00	2.38E+00	2.83E+10	1.30E-01	3.68E+09
2.38E+00	2.69E+00	1.30E+10	1.22E-01	1.59E+09
2.69E+00	3.07E+00	1.53E+10	1.32E-01	2.02E+09
3.07E+00	3.48E+00	1.92E+10	1.25E-01	2.41E+09
3.48E+00	3.96E+00	9.36E+09	1.29E-01	1.21E+09
3.96E+00	4.73E+00	6.13E+09	1.78E-01	1.09E+09
4.73E+00	5.31E+00	8.32E+09	1.16E-01	9.62E+08
5.31E+00	5.88E+00	4.63E+09	1.02E-01	4.72E+08
5.88E+00	6.43E+00	1.78E+09	8.94E-02	1.59E+08
6.43E+00	6.98E+00	2.21E+09	8.21E-02	1.81E+08
6.98E+00	7.52E+00	2.67E+09	7.45E-02	1.99E+08
7.52E+00	8.04E+00	2.39E+09	6.69E-02	1.60E+08
8.04E+00	8.56E+00	1.85E+09	6.27E-02	1.16E+08
8.56E+00	9.07E+00	0.00E+00	5.79E-02	0.00E+00
9.07E+00	9.57E+00	0.00E+00	5.37E-02	0.00E+00
9.57E+00	1.06E+01	0.00E+00	1.02E-01	0.00E+00
1.06E+01	1.16E+01	0.00E+00	9.02E-02	0.00E+00
1.16E+01	1.45E+01	0.00E+00	2.23E-01	0.00E+00

Table 16: Neutron fluence at position 4 for a burst change in temperature of 68.6 °C.

E_i	E_{i+1}	Fluence per lethargy	lethargy	Fluence
1.58E-09	2.51E-09	4.69E+05	4.63E-01	2.17E+05
2.51E-09	3.98E-09	3.49E+06	4.61E-01	1.61E+06
3.98E-09	6.31E-09	2.50E+07	4.61E-01	1.15E+07
6.31E-09	1.00E-08	1.22E+08	4.60E-01	5.63E+07
1.00E-08	1.58E-08	4.66E+08	4.57E-01	2.13E+08
1.58E-08	2.51E-08	1.08E+09	4.63E-01	4.98E+08
2.51E-08	3.98E-08	2.03E+09	4.61E-01	9.34E+08
3.98E-08	6.31E-08	2.93E+09	4.61E-01	1.35E+09
6.31E-08	1.00E-07	3.26E+09	4.60E-01	1.50E+09
1.00E-07	1.58E-07	3.39E+09	4.57E-01	1.55E+09
1.58E-07	2.51E-07	2.87E+09	4.63E-01	1.33E+09
2.51E-07	3.98E-07	1.88E+09	4.61E-01	8.65E+08
3.98E-07	6.31E-07	1.28E+09	4.61E-01	5.88E+08
6.31E-07	1.00E-06	1.23E+09	4.60E-01	5.68E+08
1.00E-06	1.00E-02	1.30E+09	9.21E+00	1.20E+10
1.00E-02	5.04E-02	1.87E+09	1.62E+00	3.03E+09
5.04E-02	5.72E-02	2.39E+09	1.27E-01	3.02E+08
5.72E-02	6.51E-02	1.89E+09	1.29E-01	2.45E+08
6.51E-02	7.39E-02	2.57E+09	1.27E-01	3.26E+08
7.39E-02	8.37E-02	2.45E+09	1.25E-01	3.05E+08
8.37E-02	9.55E-02	2.96E+09	1.32E-01	3.90E+08
9.55E-02	1.08E-01	2.27E+09	1.23E-01	2.79E+08
1.08E-01	1.23E-01	3.24E+09	1.30E-01	4.22E+08
1.23E-01	1.40E-01	3.02E+09	1.29E-01	3.91E+08
1.40E-01	1.58E-01	3.84E+09	1.21E-01	4.65E+08
1.58E-01	2.01E-01	3.56E+09	2.41E-01	8.57E+08
2.01E-01	2.22E-01	4.93E+09	9.94E-02	4.90E+08
2.22E-01	2.47E-01	5.29E+09	1.07E-01	5.64E+08
2.47E-01	2.74E-01	7.10E+09	1.04E-01	7.37E+08
2.74E-01	3.05E-01	6.22E+09	1.07E-01	6.67E+08
3.05E-01	3.38E-01	8.62E+09	1.03E-01	8.86E+08
3.38E-01	3.78E-01	7.89E+09	1.12E-01	8.82E+08
3.78E-01	4.21E-01	1.04E+10	1.08E-01	1.12E+09
4.21E-01	4.66E-01	1.20E+10	1.02E-01	1.22E+09
4.66E-01	5.18E-01	1.11E+10	1.06E-01	1.17E+09
5.18E-01	6.01E-01	1.44E+10	1.49E-01	2.14E+09
6.01E-01	6.71E-01	1.32E+10	1.10E-01	1.45E+09
6.71E-01	7.41E-01	1.67E+10	9.92E-02	1.66E+09
7.41E-01	8.25E-01	1.65E+10	1.07E-01	1.77E+09
8.25E-01	9.16E-01	1.83E+10	1.05E-01	1.92E+09
9.16E-01	1.02E+00	1.66E+10	1.08E-01	1.78E+09
1.02E+00	1.13E+00	1.42E+10	1.02E-01	1.45E+09
1.13E+00	1.26E+00	2.05E+10	1.09E-01	2.23E+09
1.26E+00	1.42E+00	1.80E+10	1.20E-01	2.15E+09

1.42E+00	1.61E+00	1.54E+10	1.26E-01	1.93E+09
1.61E+00	1.85E+00	1.18E+10	1.39E-01	1.64E+09
1.85E+00	2.09E+00	1.48E+10	1.22E-01	1.80E+09
2.09E+00	2.38E+00	1.52E+10	1.30E-01	1.97E+09
2.38E+00	2.69E+00	6.71E+09	1.22E-01	8.22E+08
2.69E+00	3.07E+00	7.87E+09	1.32E-01	1.04E+09
3.07E+00	3.48E+00	9.97E+09	1.25E-01	1.25E+09
3.48E+00	3.96E+00	4.81E+09	1.29E-01	6.22E+08
3.96E+00	4.73E+00	3.13E+09	1.78E-01	5.56E+08
4.73E+00	5.31E+00	4.26E+09	1.16E-01	4.93E+08
5.31E+00	5.88E+00	2.37E+09	1.02E-01	2.42E+08
5.88E+00	6.43E+00	9.19E+08	8.94E-02	8.22E+07
6.43E+00	6.98E+00	1.14E+09	8.21E-02	9.32E+07
6.98E+00	7.52E+00	1.38E+09	7.45E-02	1.03E+08
7.52E+00	8.04E+00	1.24E+09	6.69E-02	8.27E+07
8.04E+00	8.56E+00	9.51E+08	6.27E-02	5.96E+07
8.56E+00	9.07E+00	0.00E+00	5.79E-02	0.00E+00
9.07E+00	9.57E+00	0.00E+00	5.37E-02	0.00E+00
9.57E+00	1.06E+01	0.00E+00	1.02E-01	0.00E+00
1.06E+01	1.16E+01	0.00E+00	9.02E-02	0.00E+00
1.16E+01	1.45E+01	0.00E+00	2.23E-01	0.00E+00

Table 17: Neutron fluence at position 5 for a burst change in temperature of 68.6 °C.

E_i	E_{i+1}	Fluence per lethargy	lethargy	Fluence
1.58E-09	2.51E-09	4.97E+05	4.63E-01	2.30E+05
2.51E-09	3.98E-09	3.75E+06	4.61E-01	1.73E+06
3.98E-09	6.31E-09	2.69E+07	4.61E-01	1.24E+07
6.31E-09	1.00E-08	1.31E+08	4.60E-01	6.01E+07
1.00E-08	1.58E-08	4.94E+08	4.57E-01	2.26E+08
1.58E-08	2.51E-08	1.14E+09	4.63E-01	5.28E+08
2.51E-08	3.98E-08	2.14E+09	4.61E-01	9.88E+08
3.98E-08	6.31E-08	3.10E+09	4.61E-01	1.43E+09
6.31E-08	1.00E-07	3.43E+09	4.60E-01	1.58E+09
1.00E-07	1.58E-07	3.56E+09	4.57E-01	1.63E+09
1.58E-07	2.51E-07	3.00E+09	4.63E-01	1.39E+09
2.51E-07	3.98E-07	1.96E+09	4.61E-01	9.05E+08
3.98E-07	6.31E-07	1.33E+09	4.61E-01	6.14E+08
6.31E-07	1.00E-06	1.29E+09	4.60E-01	5.94E+08
1.00E-06	1.00E-02	1.37E+09	9.21E+00	1.26E+10
1.00E-02	5.04E-02	1.97E+09	1.62E+00	3.19E+09
5.04E-02	5.72E-02	2.50E+09	1.27E-01	3.17E+08
5.72E-02	6.51E-02	1.99E+09	1.29E-01	2.58E+08
6.51E-02	7.39E-02	2.71E+09	1.27E-01	3.43E+08
7.39E-02	8.37E-02	2.58E+09	1.25E-01	3.21E+08
8.37E-02	9.55E-02	3.12E+09	1.32E-01	4.11E+08
9.55E-02	1.08E-01	2.39E+09	1.23E-01	2.94E+08
1.08E-01	1.23E-01	3.42E+09	1.30E-01	4.45E+08
1.23E-01	1.40E-01	3.18E+09	1.29E-01	4.12E+08
1.40E-01	1.58E-01	4.05E+09	1.21E-01	4.90E+08
1.58E-01	2.01E-01	3.76E+09	2.41E-01	9.05E+08
2.01E-01	2.22E-01	5.21E+09	9.94E-02	5.18E+08
2.22E-01	2.47E-01	5.57E+09	1.07E-01	5.94E+08
2.47E-01	2.74E-01	7.49E+09	1.04E-01	7.77E+08
2.74E-01	3.05E-01	6.56E+09	1.07E-01	7.03E+08
3.05E-01	3.38E-01	9.10E+09	1.03E-01	9.35E+08
3.38E-01	3.78E-01	8.28E+09	1.12E-01	9.26E+08
3.78E-01	4.21E-01	1.09E+10	1.08E-01	1.17E+09
4.21E-01	4.66E-01	1.26E+10	1.02E-01	1.28E+09
4.66E-01	5.18E-01	1.16E+10	1.06E-01	1.23E+09
5.18E-01	6.01E-01	1.51E+10	1.49E-01	2.24E+09
6.01E-01	6.71E-01	1.36E+10	1.10E-01	1.50E+09
6.71E-01	7.41E-01	1.72E+10	9.92E-02	1.71E+09
7.41E-01	8.25E-01	1.70E+10	1.07E-01	1.83E+09
8.25E-01	9.16E-01	1.88E+10	1.05E-01	1.97E+09
9.16E-01	1.02E+00	1.69E+10	1.08E-01	1.82E+09
1.02E+00	1.13E+00	1.45E+10	1.02E-01	1.48E+09
1.13E+00	1.26E+00	2.09E+10	1.09E-01	2.28E+09
1.26E+00	1.42E+00	1.83E+10	1.20E-01	2.19E+09

1.42E+00	1.61E+00	1.55E+10	1.26E-01	1.95E+09
1.61E+00	1.85E+00	1.19E+10	1.39E-01	1.65E+09
1.85E+00	2.09E+00	1.48E+10	1.22E-01	1.80E+09
2.09E+00	2.38E+00	1.52E+10	1.30E-01	1.97E+09
2.38E+00	2.69E+00	6.66E+09	1.22E-01	8.15E+08
2.69E+00	3.07E+00	7.79E+09	1.32E-01	1.03E+09
3.07E+00	3.48E+00	9.81E+09	1.25E-01	1.23E+09
3.48E+00	3.96E+00	4.78E+09	1.29E-01	6.17E+08
3.96E+00	4.73E+00	3.11E+09	1.78E-01	5.52E+08
4.73E+00	5.31E+00	4.23E+09	1.16E-01	4.89E+08
5.31E+00	5.88E+00	2.36E+09	1.02E-01	2.41E+08
5.88E+00	6.43E+00	9.18E+08	8.94E-02	8.21E+07
6.43E+00	6.98E+00	1.13E+09	8.21E-02	9.31E+07
6.98E+00	7.52E+00	1.38E+09	7.45E-02	1.03E+08
7.52E+00	8.04E+00	1.24E+09	6.69E-02	8.26E+07
8.04E+00	8.56E+00	9.51E+08	6.27E-02	5.96E+07
8.56E+00	9.07E+00	0.00E+00	5.79E-02	0.00E+00
9.07E+00	9.57E+00	0.00E+00	5.37E-02	0.00E+00
9.57E+00	1.06E+01	0.00E+00	1.02E-01	0.00E+00
1.06E+01	1.16E+01	0.00E+00	9.02E-02	0.00E+00
1.16E+01	1.45E+01	0.00E+00	2.23E-01	0.00E+00

Table 18: Neutron fluence at position 6 for a burst change in temperature of 68.6 °C.

E_i	E_{i+1}	Fluence per lethargy	lethargy	Fluence
1.58E-09	2.51E-09	5.60E+05	4.63E-01	2.59E+05
2.51E-09	3.98E-09	3.99E+06	4.61E-01	1.84E+06
3.98E-09	6.31E-09	2.89E+07	4.61E-01	1.33E+07
6.31E-09	1.00E-08	1.43E+08	4.60E-01	6.58E+07
1.00E-08	1.58E-08	5.51E+08	4.57E-01	2.52E+08
1.58E-08	2.51E-08	1.29E+09	4.63E-01	5.96E+08
2.51E-08	3.98E-08	2.45E+09	4.61E-01	1.13E+09
3.98E-08	6.31E-08	3.60E+09	4.61E-01	1.66E+09
6.31E-08	1.00E-07	4.06E+09	4.60E-01	1.87E+09
1.00E-07	1.58E-07	4.28E+09	4.57E-01	1.96E+09
1.58E-07	2.51E-07	3.67E+09	4.63E-01	1.70E+09
2.51E-07	3.98E-07	2.43E+09	4.61E-01	1.12E+09
3.98E-07	6.31E-07	1.67E+09	4.61E-01	7.71E+08
6.31E-07	1.00E-06	1.63E+09	4.60E-01	7.51E+08
1.00E-06	1.00E-02	1.73E+09	9.21E+00	1.59E+10
1.00E-02	5.04E-02	2.54E+09	1.62E+00	4.11E+09
5.04E-02	5.72E-02	3.31E+09	1.27E-01	4.19E+08
5.72E-02	6.51E-02	2.63E+09	1.29E-01	3.40E+08
6.51E-02	7.39E-02	3.56E+09	1.27E-01	4.52E+08
7.39E-02	8.37E-02	3.40E+09	1.25E-01	4.24E+08
8.37E-02	9.55E-02	4.10E+09	1.32E-01	5.41E+08
9.55E-02	1.08E-01	3.15E+09	1.23E-01	3.87E+08
1.08E-01	1.23E-01	4.51E+09	1.30E-01	5.86E+08
1.23E-01	1.40E-01	4.19E+09	1.29E-01	5.42E+08
1.40E-01	1.58E-01	5.32E+09	1.21E-01	6.43E+08
1.58E-01	2.01E-01	4.90E+09	2.41E-01	1.18E+09
2.01E-01	2.22E-01	6.82E+09	9.94E-02	6.78E+08
2.22E-01	2.47E-01	7.27E+09	1.07E-01	7.76E+08
2.47E-01	2.74E-01	9.74E+09	1.04E-01	1.01E+09
2.74E-01	3.05E-01	8.56E+09	1.07E-01	9.18E+08
3.05E-01	3.38E-01	1.19E+10	1.03E-01	1.22E+09
3.38E-01	3.78E-01	1.08E+10	1.12E-01	1.21E+09
3.78E-01	4.21E-01	1.42E+10	1.08E-01	1.53E+09
4.21E-01	4.66E-01	1.64E+10	1.02E-01	1.67E+09
4.66E-01	5.18E-01	1.51E+10	1.06E-01	1.60E+09
5.18E-01	6.01E-01	1.96E+10	1.49E-01	2.92E+09
6.01E-01	6.71E-01	1.78E+10	1.10E-01	1.96E+09
6.71E-01	7.41E-01	2.25E+10	9.92E-02	2.23E+09
7.41E-01	8.25E-01	2.22E+10	1.07E-01	2.38E+09
8.25E-01	9.16E-01	2.45E+10	1.05E-01	2.56E+09
9.16E-01	1.02E+00	2.19E+10	1.08E-01	2.35E+09
1.02E+00	1.13E+00	1.86E+10	1.02E-01	1.91E+09
1.13E+00	1.26E+00	2.70E+10	1.09E-01	2.94E+09
1.26E+00	1.42E+00	2.37E+10	1.20E-01	2.83E+09

1.42E+00	1.61E+00	1.97E+10	1.26E-01	2.47E+09
1.61E+00	1.85E+00	1.49E+10	1.39E-01	2.07E+09
1.85E+00	2.09E+00	1.86E+10	1.22E-01	2.27E+09
2.09E+00	2.38E+00	1.90E+10	1.30E-01	2.47E+09
2.38E+00	2.69E+00	8.13E+09	1.22E-01	9.96E+08
2.69E+00	3.07E+00	9.54E+09	1.32E-01	1.26E+09
3.07E+00	3.48E+00	1.20E+10	1.25E-01	1.51E+09
3.48E+00	3.96E+00	5.73E+09	1.29E-01	7.40E+08
3.96E+00	4.73E+00	3.69E+09	1.78E-01	6.55E+08
4.73E+00	5.31E+00	5.01E+09	1.16E-01	5.80E+08
5.31E+00	5.88E+00	2.79E+09	1.02E-01	2.84E+08
5.88E+00	6.43E+00	1.06E+09	8.94E-02	9.50E+07
6.43E+00	6.98E+00	1.32E+09	8.21E-02	1.08E+08
6.98E+00	7.52E+00	1.60E+09	7.45E-02	1.19E+08
7.52E+00	8.04E+00	1.43E+09	6.69E-02	9.55E+07
8.04E+00	8.56E+00	1.10E+09	6.27E-02	6.89E+07
8.56E+00	9.07E+00	0.00E+00	5.79E-02	0.00E+00
9.07E+00	9.57E+00	0.00E+00	5.37E-02	0.00E+00
9.57E+00	1.06E+01	0.00E+00	1.02E-01	0.00E+00
1.06E+01	1.16E+01	0.00E+00	9.02E-02	0.00E+00
1.16E+01	1.45E+01	0.00E+00	2.23E-01	0.00E+00

Table 19: Neutron fluence at position 7 for a burst change in temperature of 68.6 °C.

E_i	E_{i+1}	Fluence per lethargy	lethargy	Fluence
1.58E-09	2.51E-09	4.13E+05	4.63E-01	1.91E+05
2.51E-09	3.98E-09	3.06E+06	4.61E-01	1.41E+06
3.98E-09	6.31E-09	2.19E+07	4.61E-01	1.01E+07
6.31E-09	1.00E-08	1.07E+08	4.60E-01	4.94E+07
1.00E-08	1.58E-08	4.07E+08	4.57E-01	1.86E+08
1.58E-08	2.51E-08	9.42E+08	4.63E-01	4.36E+08
2.51E-08	3.98E-08	1.77E+09	4.61E-01	8.18E+08
3.98E-08	6.31E-08	2.58E+09	4.61E-01	1.19E+09
6.31E-08	1.00E-07	2.87E+09	4.60E-01	1.32E+09
1.00E-07	1.58E-07	2.97E+09	4.57E-01	1.36E+09
1.58E-07	2.51E-07	2.51E+09	4.63E-01	1.16E+09
2.51E-07	3.98E-07	1.64E+09	4.61E-01	7.55E+08
3.98E-07	6.31E-07	1.11E+09	4.61E-01	5.12E+08
6.31E-07	1.00E-06	1.08E+09	4.60E-01	4.95E+08
1.00E-06	1.00E-02	1.13E+09	9.21E+00	1.04E+10
1.00E-02	5.04E-02	1.63E+09	1.62E+00	2.64E+09
5.04E-02	5.72E-02	2.10E+09	1.27E-01	2.66E+08
5.72E-02	6.51E-02	1.59E+09	1.29E-01	2.06E+08
6.51E-02	7.39E-02	2.16E+09	1.27E-01	2.74E+08
7.39E-02	8.37E-02	2.06E+09	1.25E-01	2.57E+08
8.37E-02	9.55E-02	2.34E+09	1.32E-01	3.09E+08
9.55E-02	1.08E-01	1.66E+09	1.23E-01	2.04E+08
1.08E-01	1.23E-01	2.37E+09	1.30E-01	3.08E+08
1.23E-01	1.40E-01	2.20E+09	1.29E-01	2.85E+08
1.40E-01	1.58E-01	2.81E+09	1.21E-01	3.40E+08
1.58E-01	2.01E-01	2.61E+09	2.41E-01	6.28E+08
2.01E-01	2.22E-01	3.62E+09	9.94E-02	3.60E+08
2.22E-01	2.47E-01	3.90E+09	1.07E-01	4.16E+08
2.47E-01	2.74E-01	5.24E+09	1.04E-01	5.44E+08
2.74E-01	3.05E-01	4.59E+09	1.07E-01	4.92E+08
3.05E-01	3.38E-01	6.37E+09	1.03E-01	6.54E+08
3.38E-01	3.78E-01	5.83E+09	1.12E-01	6.52E+08
3.78E-01	4.21E-01	7.67E+09	1.08E-01	8.26E+08
4.21E-01	4.66E-01	8.91E+09	1.02E-01	9.05E+08
4.66E-01	5.18E-01	8.20E+09	1.06E-01	8.67E+08
5.18E-01	6.01E-01	1.06E+10	1.49E-01	1.58E+09
6.01E-01	6.71E-01	9.71E+09	1.10E-01	1.07E+09
6.71E-01	7.41E-01	1.23E+10	9.92E-02	1.22E+09
7.41E-01	8.25E-01	1.21E+10	1.07E-01	1.30E+09
8.25E-01	9.16E-01	1.34E+10	1.05E-01	1.40E+09
9.16E-01	1.02E+00	1.20E+10	1.08E-01	1.29E+09
1.02E+00	1.13E+00	1.03E+10	1.02E-01	1.05E+09
1.13E+00	1.26E+00	1.48E+10	1.09E-01	1.61E+09
1.26E+00	1.42E+00	1.30E+10	1.20E-01	1.55E+09

1.42E+00	1.61E+00	1.09E+10	1.26E-01	1.37E+09
1.61E+00	1.85E+00	8.28E+09	1.39E-01	1.15E+09
1.85E+00	2.09E+00	1.03E+10	1.22E-01	1.26E+09
2.09E+00	2.38E+00	1.05E+10	1.30E-01	1.37E+09
2.38E+00	2.69E+00	4.57E+09	1.22E-01	5.59E+08
2.69E+00	3.07E+00	5.37E+09	1.32E-01	7.09E+08
3.07E+00	3.48E+00	6.76E+09	1.25E-01	8.47E+08
3.48E+00	3.96E+00	3.24E+09	1.29E-01	4.19E+08
3.96E+00	4.73E+00	2.09E+09	1.78E-01	3.72E+08
4.73E+00	5.31E+00	2.85E+09	1.16E-01	3.30E+08
5.31E+00	5.88E+00	1.59E+09	1.02E-01	1.62E+08
5.88E+00	6.43E+00	6.11E+08	8.94E-02	5.46E+07
6.43E+00	6.98E+00	7.54E+08	8.21E-02	6.19E+07
6.98E+00	7.52E+00	9.18E+08	7.45E-02	6.84E+07
7.52E+00	8.04E+00	8.21E+08	6.69E-02	5.49E+07
8.04E+00	8.56E+00	6.32E+08	6.27E-02	3.96E+07
8.56E+00	9.07E+00	0.00E+00	5.79E-02	0.00E+00
9.07E+00	9.57E+00	0.00E+00	5.37E-02	0.00E+00
9.57E+00	1.06E+01	0.00E+00	1.02E-01	0.00E+00
1.06E+01	1.16E+01	0.00E+00	9.02E-02	0.00E+00
1.16E+01	1.45E+01	0.00E+00	2.23E-01	0.00E+00

Table 20: Neutron fluence at position 8 for a burst change in temperature of 68.6 °C.

E_i	E_{i+1}	Fluence per lethargy	lethargy	Fluence
1.58E-09	2.51E-09	4.32E+05	4.63E-01	2.00E+05
2.51E-09	3.98E-09	3.23E+06	4.61E-01	1.49E+06
3.98E-09	6.31E-09	2.32E+07	4.61E-01	1.07E+07
6.31E-09	1.00E-08	1.13E+08	4.60E-01	5.20E+07
1.00E-08	1.58E-08	4.28E+08	4.57E-01	1.96E+08
1.58E-08	2.51E-08	9.92E+08	4.63E-01	4.59E+08
2.51E-08	3.98E-08	1.86E+09	4.61E-01	8.59E+08
3.98E-08	6.31E-08	2.71E+09	4.61E-01	1.25E+09
6.31E-08	1.00E-07	3.00E+09	4.60E-01	1.38E+09
1.00E-07	1.58E-07	3.10E+09	4.57E-01	1.42E+09
1.58E-07	2.51E-07	2.64E+09	4.63E-01	1.22E+09
2.51E-07	3.98E-07	1.72E+09	4.61E-01	7.93E+08
3.98E-07	6.31E-07	1.17E+09	4.61E-01	5.39E+08
6.31E-07	1.00E-06	1.13E+09	4.60E-01	5.21E+08
1.00E-06	1.00E-02	1.19E+09	9.21E+00	1.10E+10
1.00E-02	5.04E-02	1.74E+09	1.62E+00	2.82E+09
5.04E-02	5.72E-02	2.25E+09	1.27E-01	2.85E+08
5.72E-02	6.51E-02	1.69E+09	1.29E-01	2.19E+08
6.51E-02	7.39E-02	2.29E+09	1.27E-01	2.90E+08
7.39E-02	8.37E-02	2.18E+09	1.25E-01	2.72E+08
8.37E-02	9.55E-02	2.49E+09	1.32E-01	3.29E+08
9.55E-02	1.08E-01	1.78E+09	1.23E-01	2.19E+08
1.08E-01	1.23E-01	2.54E+09	1.30E-01	3.30E+08
1.23E-01	1.40E-01	2.36E+09	1.29E-01	3.06E+08
1.40E-01	1.58E-01	3.02E+09	1.21E-01	3.65E+08
1.58E-01	2.01E-01	2.80E+09	2.41E-01	6.75E+08
2.01E-01	2.22E-01	3.88E+09	9.94E-02	3.86E+08
2.22E-01	2.47E-01	4.18E+09	1.07E-01	4.46E+08
2.47E-01	2.74E-01	5.61E+09	1.04E-01	5.82E+08
2.74E-01	3.05E-01	4.92E+09	1.07E-01	5.27E+08
3.05E-01	3.38E-01	6.81E+09	1.03E-01	7.00E+08
3.38E-01	3.78E-01	6.22E+09	1.12E-01	6.96E+08
3.78E-01	4.21E-01	8.18E+09	1.08E-01	8.81E+08
4.21E-01	4.66E-01	9.49E+09	1.02E-01	9.64E+08
4.66E-01	5.18E-01	8.73E+09	1.06E-01	9.24E+08
5.18E-01	6.01E-01	1.13E+10	1.49E-01	1.68E+09
6.01E-01	6.71E-01	1.02E+10	1.10E-01	1.12E+09
6.71E-01	7.41E-01	1.29E+10	9.92E-02	1.28E+09
7.41E-01	8.25E-01	1.28E+10	1.07E-01	1.37E+09
8.25E-01	9.16E-01	1.40E+10	1.05E-01	1.47E+09
9.16E-01	1.02E+00	1.24E+10	1.08E-01	1.33E+09
1.02E+00	1.13E+00	1.06E+10	1.02E-01	1.09E+09
1.13E+00	1.26E+00	1.53E+10	1.09E-01	1.67E+09
1.26E+00	1.42E+00	1.35E+10	1.20E-01	1.61E+09

1.42E+00	1.61E+00	1.11E+10	1.26E-01	1.39E+09
1.61E+00	1.85E+00	8.42E+09	1.39E-01	1.17E+09
1.85E+00	2.09E+00	1.05E+10	1.22E-01	1.28E+09
2.09E+00	2.38E+00	1.07E+10	1.30E-01	1.39E+09
2.38E+00	2.69E+00	4.53E+09	1.22E-01	5.55E+08
2.69E+00	3.07E+00	5.33E+09	1.32E-01	7.04E+08
3.07E+00	3.48E+00	6.71E+09	1.25E-01	8.41E+08
3.48E+00	3.96E+00	3.20E+09	1.29E-01	4.14E+08
3.96E+00	4.73E+00	2.07E+09	1.78E-01	3.67E+08
4.73E+00	5.31E+00	2.81E+09	1.16E-01	3.25E+08
5.31E+00	5.88E+00	1.57E+09	1.02E-01	1.60E+08
5.88E+00	6.43E+00	6.03E+08	8.94E-02	5.39E+07
6.43E+00	6.98E+00	7.44E+08	8.21E-02	6.11E+07
6.98E+00	7.52E+00	9.06E+08	7.45E-02	6.75E+07
7.52E+00	8.04E+00	8.11E+08	6.69E-02	5.42E+07
8.04E+00	8.56E+00	6.24E+08	6.27E-02	3.91E+07
8.56E+00	9.07E+00	0.00E+00	5.79E-02	0.00E+00
9.07E+00	9.57E+00	0.00E+00	5.37E-02	0.00E+00
9.57E+00	1.06E+01	0.00E+00	1.02E-01	0.00E+00
1.06E+01	1.16E+01	0.00E+00	9.02E-02	0.00E+00
1.16E+01	1.45E+01	0.00E+00	2.23E-01	0.00E+00

Table 21: Neutron fluence at position 9 for a burst change in temperature of 68.6 °C.

E_i	E_{i+1}	Fluence per lethargy	lethargy	Fluence
1.58E-09	2.51E-09	4.49E+05	4.63E-01	2.08E+05
2.51E-09	3.98E-09	3.38E+06	4.61E-01	1.56E+06
3.98E-09	6.31E-09	2.43E+07	4.61E-01	1.12E+07
6.31E-09	1.00E-08	1.18E+08	4.60E-01	5.45E+07
1.00E-08	1.58E-08	4.48E+08	4.57E-01	2.05E+08
1.58E-08	2.51E-08	1.03E+09	4.63E-01	4.79E+08
2.51E-08	3.98E-08	1.94E+09	4.61E-01	8.96E+08
3.98E-08	6.31E-08	2.82E+09	4.61E-01	1.30E+09
6.31E-08	1.00E-07	3.13E+09	4.60E-01	1.44E+09
1.00E-07	1.58E-07	3.24E+09	4.57E-01	1.48E+09
1.58E-07	2.51E-07	2.74E+09	4.63E-01	1.27E+09
2.51E-07	3.98E-07	1.80E+09	4.61E-01	8.28E+08
3.98E-07	6.31E-07	1.23E+09	4.61E-01	5.65E+08
6.31E-07	1.00E-06	1.19E+09	4.60E-01	5.48E+08
1.00E-06	1.00E-02	1.26E+09	9.21E+00	1.16E+10
1.00E-02	5.04E-02	1.83E+09	1.62E+00	2.96E+09
5.04E-02	5.72E-02	2.33E+09	1.27E-01	2.95E+08
5.72E-02	6.51E-02	1.75E+09	1.29E-01	2.27E+08
6.51E-02	7.39E-02	2.38E+09	1.27E-01	3.02E+08
7.39E-02	8.37E-02	2.27E+09	1.25E-01	2.83E+08
8.37E-02	9.55E-02	2.58E+09	1.32E-01	3.40E+08
9.55E-02	1.08E-01	1.82E+09	1.23E-01	2.24E+08
1.08E-01	1.23E-01	2.61E+09	1.30E-01	3.39E+08
1.23E-01	1.40E-01	2.43E+09	1.29E-01	3.14E+08
1.40E-01	1.58E-01	3.08E+09	1.21E-01	3.73E+08
1.58E-01	2.01E-01	2.86E+09	2.41E-01	6.89E+08
2.01E-01	2.22E-01	3.96E+09	9.94E-02	3.94E+08
2.22E-01	2.47E-01	4.25E+09	1.07E-01	4.53E+08
2.47E-01	2.74E-01	5.71E+09	1.04E-01	5.92E+08
2.74E-01	3.05E-01	4.99E+09	1.07E-01	5.35E+08
3.05E-01	3.38E-01	6.93E+09	1.03E-01	7.12E+08
3.38E-01	3.78E-01	6.30E+09	1.12E-01	7.05E+08
3.78E-01	4.21E-01	8.27E+09	1.08E-01	8.91E+08
4.21E-01	4.66E-01	9.61E+09	1.02E-01	9.76E+08
4.66E-01	5.18E-01	8.84E+09	1.06E-01	9.35E+08
5.18E-01	6.01E-01	1.14E+10	1.49E-01	1.69E+09
6.01E-01	6.71E-01	1.03E+10	1.10E-01	1.13E+09
6.71E-01	7.41E-01	1.30E+10	9.92E-02	1.29E+09
7.41E-01	8.25E-01	1.29E+10	1.07E-01	1.38E+09
8.25E-01	9.16E-01	1.40E+10	1.05E-01	1.47E+09
9.16E-01	1.02E+00	1.25E+10	1.08E-01	1.34E+09
1.02E+00	1.13E+00	1.06E+10	1.02E-01	1.09E+09
1.13E+00	1.26E+00	1.53E+10	1.09E-01	1.67E+09
1.26E+00	1.42E+00	1.35E+10	1.20E-01	1.61E+09

1.42E+00	1.61E+00	1.11E+10	1.26E-01	1.39E+09
1.61E+00	1.85E+00	8.35E+09	1.39E-01	1.16E+09
1.85E+00	2.09E+00	1.04E+10	1.22E-01	1.27E+09
2.09E+00	2.38E+00	1.06E+10	1.30E-01	1.38E+09
2.38E+00	2.69E+00	4.47E+09	1.22E-01	5.47E+08
2.69E+00	3.07E+00	5.24E+09	1.32E-01	6.93E+08
3.07E+00	3.48E+00	6.61E+09	1.25E-01	8.28E+08
3.48E+00	3.96E+00	3.14E+09	1.29E-01	4.06E+08
3.96E+00	4.73E+00	2.02E+09	1.78E-01	3.59E+08
4.73E+00	5.31E+00	2.75E+09	1.16E-01	3.18E+08
5.31E+00	5.88E+00	1.53E+09	1.02E-01	1.56E+08
5.88E+00	6.43E+00	5.86E+08	8.94E-02	5.24E+07
6.43E+00	6.98E+00	7.24E+08	8.21E-02	5.94E+07
6.98E+00	7.52E+00	8.80E+08	7.45E-02	6.56E+07
7.52E+00	8.04E+00	7.88E+08	6.69E-02	5.27E+07
8.04E+00	8.56E+00	6.06E+08	6.27E-02	3.80E+07
8.56E+00	9.07E+00	0.00E+00	5.79E-02	0.00E+00
9.07E+00	9.57E+00	0.00E+00	5.37E-02	0.00E+00
9.57E+00	1.06E+01	0.00E+00	1.02E-01	0.00E+00
1.06E+01	1.16E+01	0.00E+00	9.02E-02	0.00E+00
1.16E+01	1.45E+01	0.00E+00	2.23E-01	0.00E+00