

Project Title

Pilot study for metrologically underpinning secondary laboratory intercomparisons and to quick-check existing CMC entries

Coordinator, Institute, Country

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Final approved report

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1. Introduction

International Committee for Weights and Measures (CIPM) Mutual Recognition Arrangement (MRA) is a multilateral agreement between National Metrology Institutes (NMI) and Designated Institutes (DI). CIPM MRA provides mutual recognition of calibration and test certificates and national measurement standards. Key and supplementary comparisons are organized within CIPM MRA framework to support member Calibration and Measurement Capabilities (CMC) [1].

Pilot studies are the third category of comparisons normally undertaken to establish measurement parameters for a “new” field or instrument, or as a training exercise. The results of pilot studies alone are not normally considered sufficient support for CMC.

Ambient dose equivalent, $H^*(10)$, is an operational quantity used in ionizing radiation dosimetry for area monitoring. It was introduced by ICRU [2] and adopted by European Union in Council Directives 96/29/EURATOM and 2013/59/EURATOM. A supplementary EURAMET comparison of calibration coefficients for $H^*(10)$ for photon radiation, EURAMET.RI(I)-S18, was organized between 2019 and 2021, with 13 NMIs and DIs [3]. Besides NMI and DI intercomparisons, there is a need for intercomparisons for calibrations by other secondary standard dosimetry laboratories (SSDLs). These intercomparisons (ICs) are usually organized e.g. by EURADOS e.V. with a metrological reference, which is usually provided by an NMI.

This Pilot Study aims to demonstrate the capability for providing a metrological reference, i.e. traceability, to third party ICs, i.e. which are not provided by RMOs but instead e.g. by EURADOS, by an inter-NMI IC using passive area dosimeters and train emerging NMIs or DIs to provide such reference irradiations. Additionally, it will be investigated if these intercomparisons can be used to increase confidence in existing CMCs beside the official EURAMET supplementary comparisons..

The aim of this comparison was to compare ambient dose equivalent, $H^*(10)$, by performing photon irradiations of passive area dosimeters. For this purpose, passive area dosimeters were provided by the dosimeter provider. The dosimeters were shipped to the participants, irradiated, and shipped back to the dosimeter provider. The dosimeter provider processed the dosimeters and reported the doses to the pilot laboratory.

The comparison was performed for 4 radiation qualities (1 mandatory and 3 additional) which are to be established in accordance with ISO 4037-1 [4]. The radiation qualities chosen for the comparison are:

- N-30
- N-150
- S-Cs (mandatory)
- S-Co

The recommended irradiation dose value was, ambient dose equivalent, $H^*(10) = 10$ mSv.

The recommended ambient dose equivalent value and radiation qualities were selected in accordance with the IC2023calib intercomparison by EURADOS [5] to provide a metrological basis for this intercomparison and to compare the results reached by NMIs and DIs with the EURADOS participants (([secondary standard] calibration laboratories).

The comparison was coordinated by PTB as the pilot laboratory. IRSN provided the passive area dosimeters. The results were evaluated by PTB, with support of the project partners and the participants.

This comparison protocol was prepared according to EURAMET guidelines [6].

2. Participants

Eight NMIs and DIs took part in the comparison:

- CEA-LNHB, France
- CMI, Czech Republic
- MIRS/IJS/F-2,O-2 - Metrology Institute of the Republic of Slovenia/Jozef Stefan Institute/Low and Medium Energy Physics F2, Environmental Sciences O2, Slovenia
- PTB, Physikalisch-Technische Bundesanstalt, Germany
- SCK CEN/LNK, Studiecentrum voor Kernenergie, Centre d'Étude de l'énergie Nucléaire / The Laboratory for Nuclear Calibrations, Belgium
- SMU - Slovak Institute of Metrology, Slovakia
- STUK - Säteilyturvakeskus, Finland
- VINS – Vinča Institute of Nuclear Sciences - National Institute of the Republic of Serbia, University of Belgrade, Belgrade, Serbia

3. Transfer device

Passive area dosimeters were provided by the ISO 17025 accredited service of IRSN. The ambient dose equivalent readings are traceable to LDRI of the IRSN and therefore traceable to LNHB primary standards.



Figure 1 Passive RPL dosimeter provided by IRSN. The dimensions are approximately 29.8 mm x 61.5 mm x 8 mm.

4. Linearity and stability of the transfer dosimeters

An accredited passive area dosimeter was used. To keep the effect of dose linearity small, the required ambient dose equivalent range was small. Within the expected dose rate range, the dose rate linearity correction is expected to be negligible.

The stability of the dosimeters is guaranteed by keeping the time between release from the dosimeter provider and read out within the accreditation time frame.

Each participant received 10 dosimeters per radiation quality and 10 transport/background dosimeters. The transport dosimeters were used for subtraction of transport and background dose by IRSN.

5. Irradiation method, irradiation conditions

The comparison was performed for up to four radiation qualities. The mandatory radiation quality was S-Cs. Additional radiation qualities were N-30, N-150 and S-Co. All radiation qualities were realised in accordance with ISO 4037-1 [4]. Recommended ambient dose equivalent per dosimeter was 10 mSv for all radiation qualities.

The dosimeters were irradiated free in air (i.e. not on a phantom).

In accordance with the EURADOS protocol for IC2023calib it was advised:

- for X-ray fields, to irradiate one dosimeter and
- for S-Cs and S-Co two dosimeters per time with an appropriate build-up plate (3 mm PMMA).

The dosimeters should be oriented in such a way that the reference point was at the point of test.

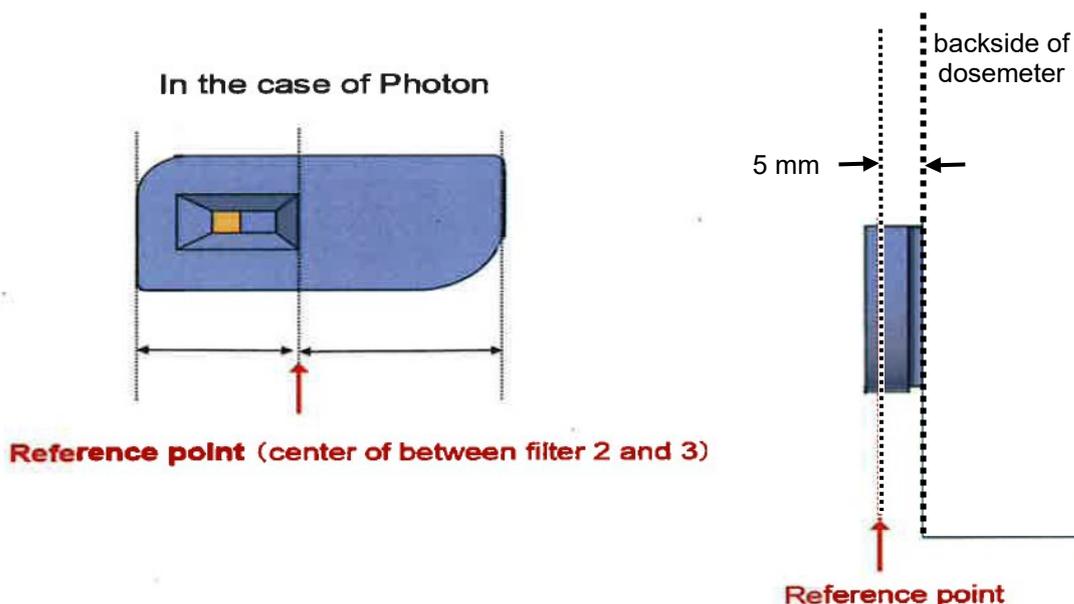


Figure 2 Definition of the reference point for the RPL dosimeters.

6. Necessary data and measurement uncertainty

Each participant prepared a calibration report containing the following data: method of determination of reference $H^*(10)$ values including traceability, air density correction (if applicable), and uncertainties of the conversion coefficients from air Kerma, K_a , to $H^*(10)$ (if applicable), description of the used equipment, description and picture of irradiation setup, irradiated ambient dose equivalent, and the uncertainty budgets for each radiation quality and any corrections used.

The measurement results and uncertainty budgets were reported in an excel form provided by PTB. The uncertainty was determined in accordance with the ISO Guide to the expression of uncertainties in measurements (GUM) [7].

7. Evaluation and communication of the results

All participants sent their irradiation reports to EURAMET TC-IR chair electronically. IRSN performed the evaluation of the dosimeter readings and provided the results to PTB after having finished the measurements and after PTB sent their irradiation report to EURAMET TC-IR chair. Afterwards, all participants sent their irradiation reports electronically to PTB (see flow chart in Figure 3).

Evaluators of the Pilot Study are PTB, with support from GUM, IMBiH, IRB, JSI, STUK and VINS, according to the activity A4.3.1 of the EMPIR project supportBSS.

PTB sent compiled irradiation reports from all comparison participants and results of dosimeter evaluation of IRSN electronically to the evaluators, but not before they have sent their own irradiation reports to the TC-IR chair.

The comparison reference value $C_i(D_H)$ was determined for each radiation quality Q as the average value of the mean response R_Q , i.e. the mean value of the single dosimeter responses (evaluated ambient dose equivalent by IRSN, M , divided by irradiated ambient dose equivalent, $H^*(10)$), calculated for the participants with primary standards for K_a or $H^*(10)$ according to the irradiation protocols. The results of the participants were compared to this comparison reference value as a ratio of participant's calculated response/comparison reference value.

Each radiation quality was evaluated separately.

For each radiation quality, we get n ambient dose equivalent readings per participant from IRSN, i , with subtracted background dose calculated as the mean dose of the transport dosimeters: $M_{i,1...n}$.

The measurement error of these readings is neglected as it is the same for all participants (e.g. due to the energy dependence of the dosimeter) and therefore cancel out during evaluation of CRV and relative deviation D . Only the statistical uncertainty is relevant in this case. It is kept small by using a sufficiently large dose and calculating the mean response per participant of at least 10 dosimeters per radiation quality.

For each radiation quality, from each participant i we get n ambient dose equivalent values $H^*(10)_{i,1...n}$. Together with the irradiated ambient dose equivalent each participant stated their uncertainty u_i for that dose, which is the same for all n dosimeters.

From these values the response $R_{i,j}$ and mean response R_i including standard deviation, $\sigma(R_i)$, is calculated:

$$R_{i,j} = \frac{M_{i,j}}{H^*(10)_{i,j}} \text{ and } R_i = \frac{\sum_{j=1}^n R_{i,j}}{n} \text{ with uncertainty } u_{R_i} = \sqrt{u_i^2 + \sigma(R_i)^2}, \text{ since the}$$

uncertainties of the ambient dose equivalent values stated by the participants for each dosimeter, u_i , are highly correlated. The standard deviation, $\sigma(R_i)$, is taken as a measurement for the uncertainty of the ambient dose equivalent reading provided by IRSN.

The reference value for the radiation quality Q is the mean response of all m participants with primary standards:

$$R_Q = \frac{\sum_{i=1}^m R_i}{m} \text{ with uncertainty } u_{R_Q} = \sqrt{\frac{\sum_{i=1}^m u_{R_i}^2}{m^2}}.$$

From this the relative deviation from the reference value is calculated for each participant by:

$$D_i = \frac{R_i}{R_Q} - 1 \text{ with uncertainty } u_{D_i} = \sqrt{\left(\frac{1}{R_Q} \cdot u_{R_i}\right)^2 + \left(\frac{R_i}{R_Q^2} \cdot u_{R_Q}\right)^2}.$$

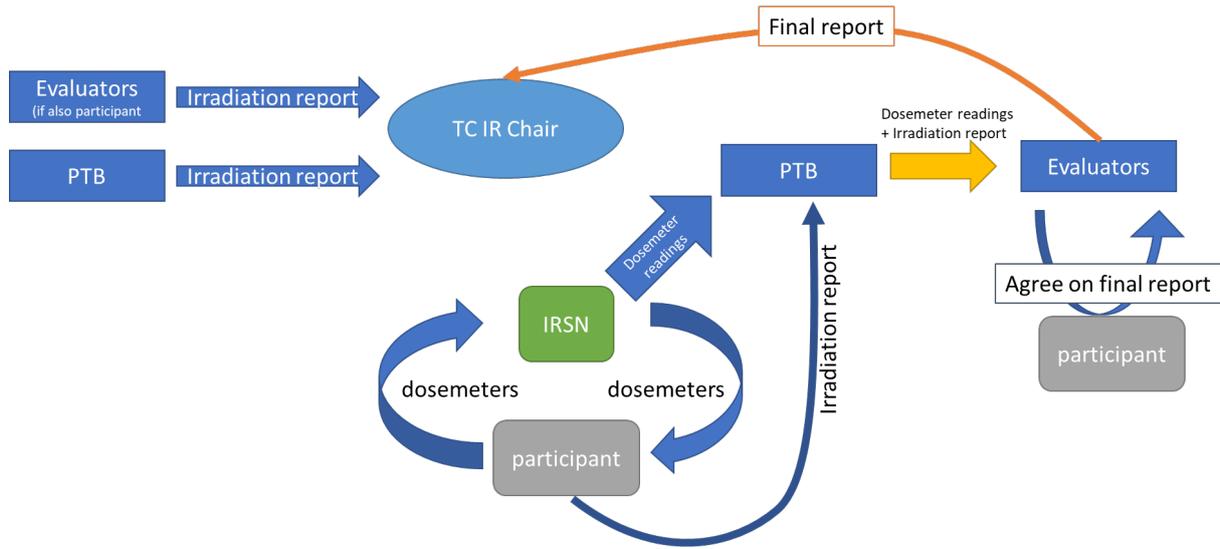


Figure 3 Flow chart depicting the information flow during the pilot study.

Table 1 Traceability as reported by participants

Participant	N-30	N-150	S-Cs	S-Co
CEA	primary standard	primary standard	primary standard	primary standard
CMI	primary standard	primary standard	primary standard	primary standard
JSI	BFKH Budapest, HU	PTB through IAEA	BIPM through IAEA	
PTB	primary standard	primary standard	primary standard	primary standard
SCK CEN	PTB	PTB	PTB	PTB
SMU		PTB through IAEA	Slovak institute of Metrology (primary chamber ND1005/A)	
STUK	PTB	PTB	NPL	NPL
VINS		PTB through IAEA	BIPM through IAEA	BIPM through IAEA

8. Organisation and time schedule

The comparison had 8 participants in total.

The comparison started on 1st October 2023 and the irradiations were scheduled to finish on 21th October 2023. The irradiations were carried out on or as close as possible to 11 October 2023, at least within the time period 01 to 21 October.

9. Results for radiation quality N-30

The results for the intercomparison for N-30 radiation quality are presented in Table 2 and Figure 4.

Table 2 Results N-30. Participants with independent traceability are marked in bold.

Participant	Mean Response R	rel. stated uncertainty of irradiated dose $H^*(10)$ $k = 2$ u_i	calculated rel. uncertainty of mean R $k = 2$ u_{R_i}	rel. Deviation from reference response D_i	Uncertainty of rel. deviation $k = 2$ u_{D_i}
PTB	1,057	3,8%	4,1%	0,008	0,047
CEA	1,060	3,1%	3,2%	0,011	0,039
CMI	1,067	4,7%	4,8%	0,017	0,054
JSI	1,010	5,0%	5,4%	-0,037	0,056
SCK CEN	1,103	4,7%	4,8%	0,052	0,056
STUK	1,020	5,0%	5,3%	-0,027	0,056

The reference response R_Q for N-30 is 1.049 ± 0.023 ($k = 2$).

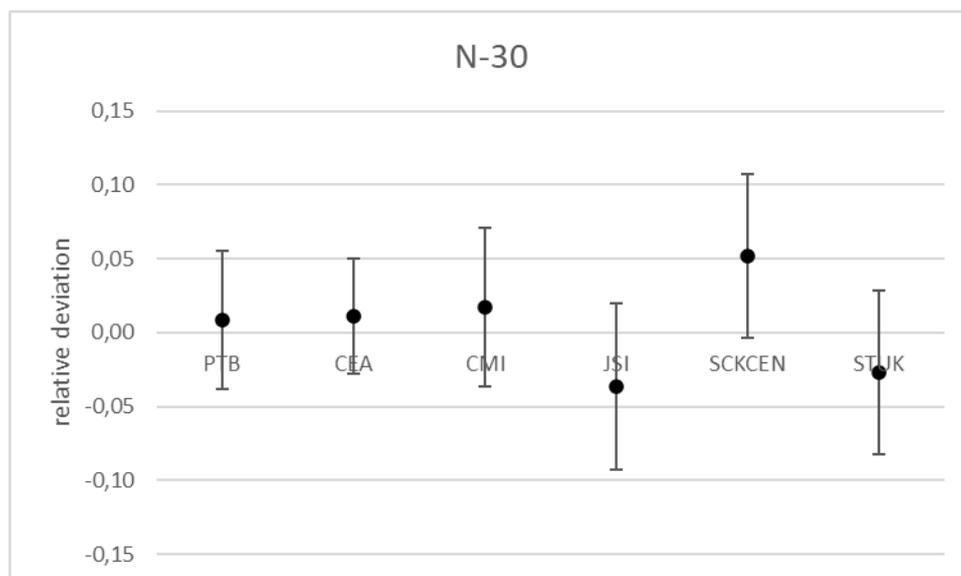


Figure 4 Results N-30

10. Results for radiation quality N-150

The results for the intercomparison for N-150 radiation quality are presented in Table 3 and Figure 5.

Table 3 Results N-150. Participants with independent traceability are marked in bold.

Participant	Mean Response R	rel. stated uncertainty of irradiated dose $H^*(10)$ $k = 2$ u_i	calculated rel. uncertainty of mean R $k = 2$ u_{R_i}	rel. Deviation from reference response D_i	Uncertainty of rel. deviation $k = 2$ u_{D_i}
PTB	0,847	3,8%	3,9%	-0,031	0,052
CEA	0,859	1,2%	1,7%	-0,018	0,040
CMI	0,917	4,7%	4,8%	0,049	0,064
JSI	0,869	4,9%	4,9%	-0,007	0,061
SCK CEN	0,884	4,7%	4,7%	0,011	0,061
SMU	0,870	4,3%	4,3%	-0,005	0,057
STUK	0,843	4,5%	4,7%	-0,035	0,058
VINS	0,857	4,5%	5,0%	-0,020	0,061

The reference response R_Q for N-150 is 0.874 ± 0.033 ($k = 2$).

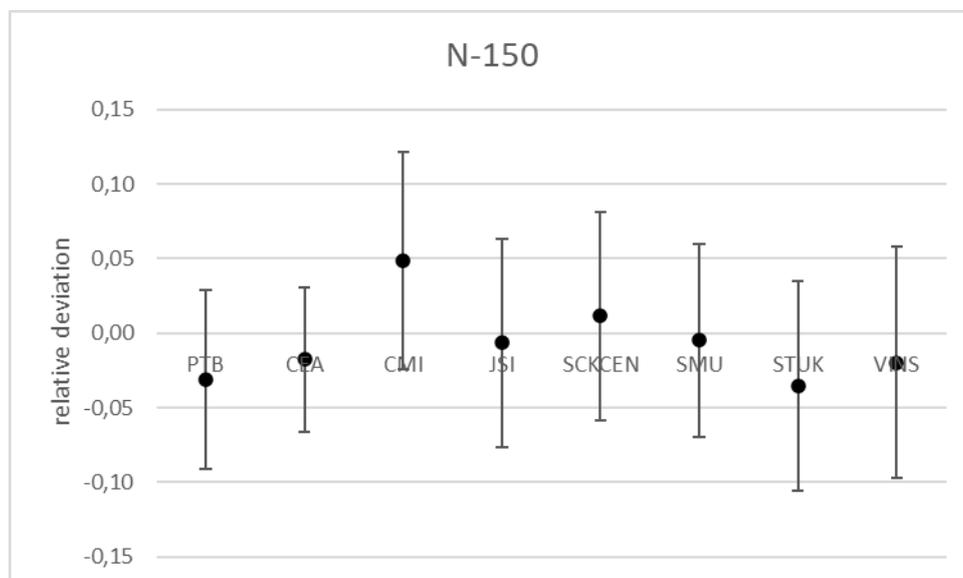


Figure 5 Results N-150

11. Results for radiation quality S-Cs

The results for the intercomparison for S-Cs radiation quality are presented in Table 4 and Figure 6. Two dosimeters of STUK were irradiated with a dose of 16,7 mSv, which was within the linearity range of the dosimeter. Therefore, the dosimeters were included in the evaluation.

Table 4 Results S-Cs. Participants with independent traceability are marked in bold.

Participant	Mean Response R	rel. stated uncertainty of irradiated dose $H^*(10)$ $k = 2$ u_i	calculated rel. uncertainty of mean R $k = 2$ u_{R_i}	rel. Deviation from reference response D_i	Uncertainty of rel. deviation $k = 2$ u_{D_i}
PTB	1,048	2,9%	2,9%	-0,013	0,034
CEA	1,064	4,1%	4,2%	0,002	0,045
CMI	1,081	4,4%	4,5%	0,018	0,049
JSI	1,069	4,3%	4,3%	0,007	0,047
SCK CEN	1,038	4,3%	4,3%	-0,022	0,046
SMU	1,055	4,1%	4,1%	-0,007	0,045
STUK	1,053	4,5%	4,8%	-0,008	0,051
VINS	1,045	4,3%	4,7%	-0,016	0,050

The reference response R_Q for S-Cs is 1.062 ± 0.019 ($k = 2$).

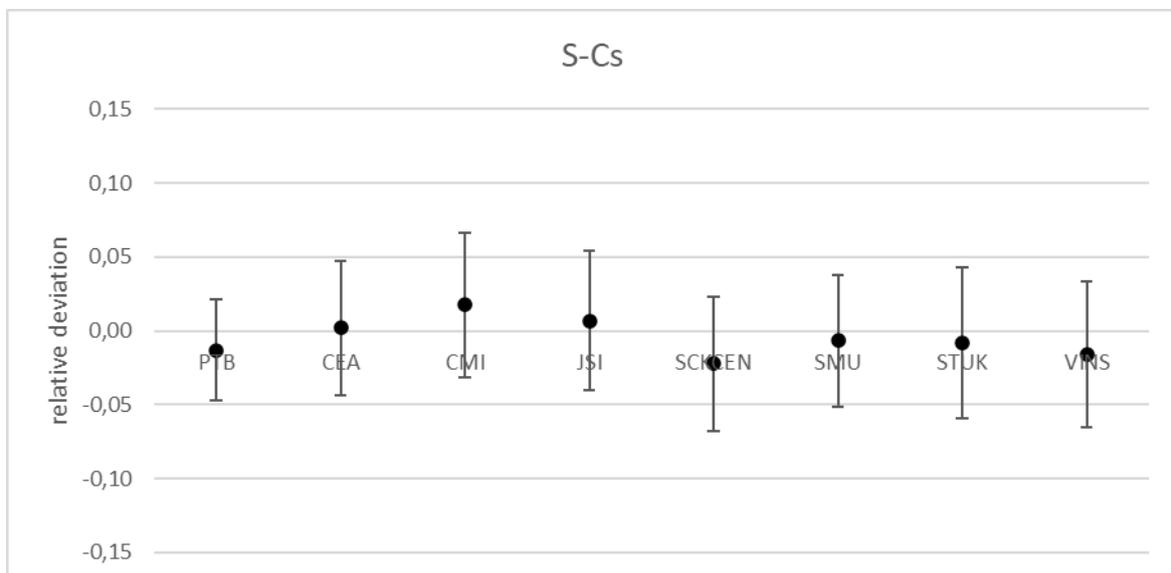


Figure 6 Results S-Cs

11. Results for radiation quality S-Co

The results for the intercomparison for S-Co radiation quality are presented in Table 5 and Figure 6.

Table 5 Results S-Co. Participants with independent traceability are marked in bold.

Participant	Mean Response R	rel. stated uncertainty of irradiated dose $H^*(10)$ $k = 2$ u_i	calculated rel. uncertainty of mean R $k = 2$ u_{R_i}	rel. Deviation from reference response D_i	Uncertainty of rel. deviation $k = 2$ u_{D_i}
PTB	0,980	2,9%	3,1%	-0,005	0,040
CEA	0,981	4,2%	5,0%	-0,004	0,056
CMI	0,993	4,5%	5,3%	0,008	0,059
SCK CEN	0,965	4,5%	5,2%	-0,019	0,057
STUK	0,979	4,5%	5,1%	-0,005	0,057
VINS	0,999	4,3%	4,9%	0,015	0,057

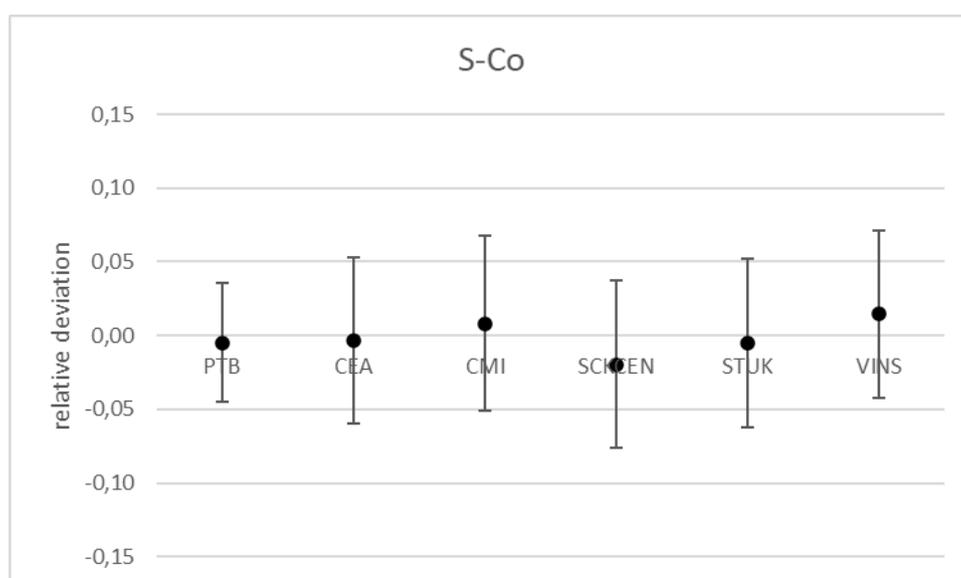


Figure 7 Results S-Co

The reference response R_Q for S-Co is 0.984 ± 0.026 ($k = 2$).

12. Summary

All results agree well within the stated uncertainties and thus, those are supporting the measurement capabilities of the participating laboratories.

For S-Cs and S-Co qualities, no large discrepancies were observed. Those radiation fields are very well established and this kind of comparison with passive area dosimeters provide sufficient quality for intermediate support. However, in X-ray qualities some variation is observed, which might suggest e.g. some variation in the traceability chain or in the set-up of the radiation qualities. Due to the larger

uncertainty induced by using the passive area dosimeters, the discrepancies have only a weak significance.

The results show that all partners can provide reference values for calibration laboratory intercomparison e.g. conducted by EURADOS when the stated uncertainty is considered. In addition, the results can be used to increase the confidence in existing CMCs between official EURAMET supplementary ICs. Results of such intercomparisons cannot be used to substitute high level EURAMET supplementary ICs due to higher associated uncertainties.

13. References

[1] International Committee for Weights and Measures, 2003. Mutual recognition of national measurement standards and of calibration and measurement certificates issued by national metrology institutes

[2] International Commission on Radiation Units and Measurements, 1993. Quantities and Units in Radiation Protection Dosimetry, ICRU Report 51

[3] Miloš Živanović, Oliver Hupe, Hayo Zutz, Amra Šabeta, Stanislav Sandtner and Nikola Kržanović, EURAMET DOSEtrace supplementary comparison in terms of the ambient dose equivalent/rate for photon radiation (EURAMET.RI(I)-S18), Metrologia 60(1A), 2023, 06017, <https://doi.org/10.1088/0026-1394/60/1A/06017>

[4] International Organization for Standardization, 2019. X and gamma reference radiation fields for calibrating dosimeters and doserate meters and for determining their response as a function of photon energy - Part 1: Radiation characteristics and production methods, ISO 4037-1.

[5] EURADOS, Participant Instructions for the IC2023calib EURADOS Calibration intercomparison, <https://www.eurados-intercomparison.org/ic2023calib/documents/IC2023calib%20Instructions.pdf>

[6] EURAMET Guide No. 4, EURAMET Guide on Comparisons, Version 1.0 (05/2016)

[7] BIPM, JCGM 100:2008, Evaluation of measurement data - Guide to the expression of uncertainty in measurement (GUM 1995 with minor corrections)

Appendix A

CEA results

supportBSS A4.3.1 Pilot Study

EURAMET.1593

Participant:	
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Radiation quality	Dosimeter ID	Dose H*(10) in mSv	U _{rel} (k=2)	
N-30	AMB01	9,99	3,1%	
N-30	AMB02	9,99	3,1%	
N-30	AMB03	9,99	3,1%	
N-30	AMB04	9,99	3,1%	
N-30	AMB05	9,99	3,1%	
N-30	AMB06	9,99	3,1%	
N-30	AMB07	9,99	3,1%	
N-30	AMB08	9,99	3,1%	
N-30	AMB09	9,99	3,1%	
N-30	AMB10	9,99	3,1%	
N-30		0	0,00	3,1%
N-30		0	0,00	3,1%
N-30		0	0,00	3,1%
N-30		0	0,00	3,1%
N-30		0	0,00	3,1%
N-30		0	0,00	3,1%
N-150	AMB11	10,07	1,2%	
N-150	AMB12	10,07	1,2%	
N-150	AMB13	10,07	1,2%	
N-150	AMB14	10,07	1,2%	
N-150	AMB15	10,07	1,2%	
N-150	AMB16	10,07	1,2%	
N-150	AMB17	10,07	1,2%	
N-150	AMB18	10,07	1,2%	
N-150	AMB19	10,07	1,2%	
N-150	AMB20	10,07	1,2%	
N-150		0	0,00	1,2%
N-150		0	0,00	1,2%
N-150		0	0,00	1,2%
N-150		0	0,00	1,2%
N-150		0	0,00	1,2%
N-150		0	0,00	1,2%
N-150		0	0,00	1,2%
S-Cs (Cs-137)	AMB21	10,00	4,1%	
S-Cs (Cs-137)	AMB22	10,00	4,1%	
S-Cs (Cs-137)	AMB23	10,00	4,1%	
S-Cs (Cs-137)	AMB24	10,00	4,1%	
S-Cs (Cs-137)	AMB25	10,00	4,1%	
S-Cs (Cs-137)	AMB26	10,00	4,1%	
S-Cs (Cs-137)	AMB27	10,00	4,1%	
S-Cs (Cs-137)	AMB28	10,00	4,1%	
S-Cs (Cs-137)	AMB29	10,00	4,1%	
S-Cs (Cs-137)	AMB30	10,00	4,1%	
S-Cs (Cs-137)	AMB41	0,00	4,1%	
S-Cs (Cs-137)	AMB42	0,00	4,1%	
S-Cs (Cs-137)	AMB43	0,00	4,1%	
S-Cs (Cs-137)	AMB44	0,00	4,1%	
S-Cs (Cs-137)	AMB45	0,00	4,1%	
S-Cs (Cs-137)		0	0,00	4,1%
S-Co (Co-60)	AMB31	10,05	4,2%	
S-Co (Co-60)	AMB32	10,05	4,2%	
S-Co (Co-60)	AMB33	10,05	4,2%	
S-Co (Co-60)	AMB34	10,05	4,2%	
S-Co (Co-60)	AMB35	10,05	4,2%	
S-Co (Co-60)	AMB36	10,05	4,2%	
S-Co (Co-60)	AMB37	10,05	4,2%	
S-Co (Co-60)	AMB38	10,05	4,2%	
S-Co (Co-60)	AMB39	10,05	4,2%	
S-Co (Co-60)	AMB40	10,05	4,2%	
S-Co (Co-60)	AMB46	0,00	4,2%	
S-Co (Co-60)	AMB47	0,00	4,2%	
S-Co (Co-60)	AMB48	0,00	4,2%	
S-Co (Co-60)	AMB49	0,00	4,2%	
S-Co (Co-60)	AMB50	0,00	4,2%	
S-Co (Co-60)		0	0,00	4,2%

Name and signature of the responsible person:	J.Plagnard
Date of the report:	24.10.2023

N-30 H*10 irradiations relative uncertainty contributions all k = 1

Source of uncertainty	$u_{i,A}$	$u_{i,B}$	$u_{i,A}^2 + u_{i,B}^2$	Comment
Air density correction			0	
Source to dosimeter distance		0,001	0,000001	
Conversion coefficient	0,0142		0,000202	
Other sources of uncertainty...	0,0055		3,03E-05	
Combined uncertainty, H*(10)			0,015261	

Name of the person, who filled this form Laboratory name or identification * Date of arrival of the dosimeters Date of dispatch back of the dosimeters Date of irradiations * Names of persons who performed the irradiations (*) Do you want and allow that these names are stated in the certificate? (*) Radiation quality * Facility name or identification * Setting of tube voltage (kV) Setting of tube current (mA) Inherent filtration (mm Be) or inherent filtration (mm Al) Additional filtration (mm Al) First half value layer HVL (mm Al) * Standardized radiation field * H*(10) conversion coefficient (Sv/Gy) * Irradiation distance (mm) * Irradiation time (seconds) * Build-up plate in front of the dosimeters (not recommended for x-ray) Air temperature (°C) Air pressure (hPa=mbar) Air relative humidity (%) Number of dosimeters irradiated at the same time * (1 dosimeter recommended at a time for x-ray) Relative uncertainty of irradiated doses (%) * (relative in % with k = 2, i.e. 95 % confidence) Traceability is to this standards laboratory	Johann Plagnard CEA-LNHB-MD 2023-09-27 2023-10-13 2023-10-11 J.Plagnard-J.Lefèvre yes N-30 N-30 30,0 10,0 0,80 or inherent filtration (mm Al) 3,66 1,16 ISO 4037:2019 characterized radiation field 0,782 500,0 123,1 no 23,2 999,9 44 1 1,5%	Please, fill in all grey cells - if possible. * marked data will be stated in the certificate (otherwise "not stated"). You can also report several dates or a range of dates (it is recommended to perform the irradiations of a radiation quality within a day). (*) marked data will only be stated in the certificate if agreed. A "yes" means these persons have agreed that their names are stated in the certificate. In case of other filter materials, please specify in the comments. In case of different values for your irradiation, please report the average value. In case of different values for your irradiation, please report the average value. Ambient conditions during irradiation. Ambient conditions during irradiation. Ambient conditions during irradiation. In case of different values for your irradiation, please report the most used value. Only % values are allowed (recommended with 1 decimal place).
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Dosemeter number * (dosemeters should be taken by chance and not in order)	Irradiation status	Irradiated dose (mSv) * (recommended with 2 decimal places)
AMB01	irradiated	9,99
AMB02	irradiated	9,99
AMB03	irradiated	9,99
AMB04	irradiated	9,99
AMB05	irradiated	9,99
AMB06	irradiated	9,99
AMB07	irradiated	9,99
AMB08	irradiated	9,99
AMB09	irradiated	9,99
AMB10	irradiated	9,99

Photo of the irradiation setup provided? Test or calibration report number - if a report is provided (*) Do you want and allow that this number is stated in the certificate? (*) Comments Comments Comments	yes no possibility to file the "comment" fields in the "N-30 Uncertainty" tab All uncertainties at k=1 H*(10) conversion coefficient determined using measured spectrum	The photo must be provided in a separate file (it is recommended to make additional photos of all irradiations with dosimeter IDs visible.) The test or calibration report must be provided in a separate file. The report number can only be stated in the certificate if the report is provided.
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Cs-137 H*10 irradiations relative uncertainty contributions all k = 1

Source of uncertainty	$u_{i,A}$	$u_{i,B}$	$u_{i,A}^2 + u_{i,B}^2$	Comment
Air density correction			0	
Source to dosimeter distance		0,00153	2,34E-06	
Conversion coefficient	0,02		0,0004	
Other sources of uncertainty...		0,00425	1,81E-05	
Combined uncertainty, H*(10)			0,020504	

Name of the person, who filled this form: J.Lefèvre
 Laboratory name or identification: * CEA-LNHB-MD
 Date of arrival of the dosimeters: 2023-09-27
 Date of dispatch back of the dosimeters: 2023-10-13
 Date of irradiations: * 2023-10-09

Names of persons who performed the irradiations (*): J. Plagnard-J. Lefèvre

Do you want and allow that these names are stated in the certificate? (*): yes

Radiation quality: * S-Cs (Cs-137)
 Facility name or identification: * CsM12B

Please, fill in all grey cells - if possible.
 * marked data will be stated in the certificate (otherwise "not stated").
 You can also report several dates or a range of dates (it is recommended to perform the irradiations of a radiation quality within a day).
 (*) marked data will only be stated in the certificate if agreed.
 A "yes" means these persons have agreed that their names are stated in the certificate.

H*(10) conversion coefficient (Sv/Gy): * 1,210
 Irradiation distance (mm): * 1000,0
 Irradiation time (seconds): * 4858,8

Build-up plate in front of the dosimeters (recommended for gamma-ray): 3 mm PMMA
 Air temperature (°C): 23,8
 Air pressure (hPa=mbar): 1005
 Air relative humidity (%): 44

Number of dosimeters irradiated at the same time * (2 dosimeter recommended at a time for gamma-ray): 2

Relative uncertainty of irradiated doses (%): * 2,1%
 (relative in % with k = 2, i.e. 95 % confidence)
 Traceability is to this standards laboratory

In case of different values for your irradiation, please report the average value.
 In case of different values for your irradiation, please report the average value.
 Ambient conditions during irradiation.
 Ambient conditions during irradiation.
 Ambient conditions during irradiation.
 In case of different values for your irradiation, please report the most used value.
 Only % values are allowed (recommended with 1 decimal place).

Dosemeter number * (dosemeters should be taken by chance and not in order)	Irradiation status	Irradiated dose (mSv) * (recommended with 2 decimal places)
AMB21	irradiated	10,00
AMB22	irradiated	10,00
AMB23	irradiated	10,00
AMB24	irradiated	10,00
AMB25	irradiated	10,00
AMB26	irradiated	10,00
AMB27	irradiated	10,00
AMB28	irradiated	10,00
AMB29	irradiated	10,00
AMB30	irradiated	10,00
AMB41	not irradiated (background)	
AMB42	not irradiated (background)	
AMB43	not irradiated (background)	
AMB44	not irradiated (background)	
AMB45	not irradiated (background)	

Photo of the irradiation setup provided?: yes

Test or calibration report number - if a report is provided (*):

Do you want and allow that this number is stated in the certificate? (*):

Comments: no possibility to file the "comment" fields in the "Cs-137 Uncertainty" tab
 Comments: All uncertainties at k=1

The photo must be provided in a separate file (it is recommended to make additional photos of all irradiations with dosimeter IDs visible.)
 The test or calibration report must be provided in a separate file. The report number can only be stated in the certificate if the report is provided.

<i>N-150 H*10 irradiations relative uncertainty contributions</i>				
<i>all k = 2</i>				
Source of uncertainty	$u_{i,A}$	$u_{i,B}$	$u_{i,A}^2 + u_{i,B}^2$	Comment
Air density correction			0	
Source to dosimeter distance		0,00153	2,34E-06	
Conversion coefficient	0,02		0,0004	
Other sources of uncertainty...		0,00537	2,88E-05	
Combined uncertainty, H*(10)			0,020765	

Name of the person, who filled this form J.Lefèvre
 Laboratory name or identification * CEA-LNHB-MD
 Date of arrival of the dosimeters 2023-09-27
 Date of dispatch back of the dosimeters 2023-10-13
 Date of irradiations * 2023-10-10

Names of persons who performed the irradiations (*) J. Plagnard-J. Lefèvre

Do you want and allow that these names are stated in the certificate? (*) yes

Radiation quality * S-Co (Co-60)
 Facility name or identification * CoM2C

Please, fill in all grey cells - if possible.
 * marked data will be stated in the certificate (otherwise "not stated").
 You can also report several dates or a range of dates (it is recommended to perform the irradiations of a radiation quality within a day).
 (*) marked data will only be stated in the certificate if agreed.
 A "yes" means these persons have agreed that their names are stated in the certificate.

H *(10) conversion coefficient (Sv/Gy) * 1,160
 Irradiation distance (mm) * 1000,0
 Irradiation time (seconds) * 2864,9
 Build-up plate in front of the dosimeters (recommended for gamma-ray) 3 mm PMMA
 Air temperature (°C) 24,1
 Air pressure (hPa=mbar) 1002
 Air relative humidity (%) 43
 Number of dosimeters irradiated at the same time * 2
 (2 dosimeter recommended at a time for gamma-ray)
 Relative uncertainty of irradiated doses (%) * 2,1%
 (relative in % with k = 2, i.e. 95 % confidence)
 Traceability is to this standards laboratory

In case of different values for your irradiation, please report the average value.
 In case of different values for your irradiation, please report the average value.
 Ambient conditions during irradiation.
 Ambient conditions during irradiation.
 Ambient conditions during irradiation.
 In case of different values for your irradiation, please report the most used value.
 Only % values are allowed (recommended with 1 decimal place).

Dosemeter number * (dosemeters should be taken by chance and not in order)	Irradiation status	Irradiated dose (mSv) * (recommended with 2 decimal places)
AMB31	irradiated	10,05
AMB32	irradiated	10,05
AMB33	irradiated	10,05
AMB34	irradiated	10,05
AMB35	irradiated	10,05
AMB36	irradiated	10,05
AMB37	irradiated	10,05
AMB38	irradiated	10,05
AMB39	irradiated	10,05
AMB40	irradiated	10,05
AMB46	not irradiated (background)	
AMB47	not irradiated (background)	
AMB48	not irradiated (background)	
AMB49	not irradiated (background)	
AMB50	not irradiated (background)	

Photo of the irradiation setup provided? yes

Test or calibration report number - if a report is provided (*)

Do you want and allow that this number is stated in the certificate? (*)

Comments no possibility to file the "comment" fields in the "Co-60 Uncertainty" tab
 Comments All uncertainties at k=1
 Comments

The photo must be provided in a separate file (it is recommended to make additional photos of all irradiations with dosimeter IDs visible.)
 The test or calibration report must be provided in a separate file. The report number can only be stated in the certificate if the report is provided.

CMI results

supportBSS A4.3.1 Pilot Study

EURAMET.1593

Participant:	Czech Metrology Institute
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Radiation quality	Dosemeter ID	Dose H*(10) in mSv	U _{rel} (k=2)
N-30	15	9,97	4,7%
N-30	16	9,95	4,7%
N-30	17	9,93	4,7%
N-30	18	9,91	4,7%
N-30	19	9,89	4,7%
N-30	20	9,90	4,7%
N-30	21	9,99	4,7%
N-30	22	9,98	4,7%
N-30	23	9,98	4,7%
N-30	24	9,97	4,7%
N-30	0	0,00	4,7%
N-30	0	0,00	4,7%
N-30	0	0,00	4,7%
N-30	0	0,00	4,7%
N-30	0	0,00	4,7%
N-30	0	0,00	4,7%
N-150	5	10,05	4,7%
N-150	6	10,03	4,7%
N-150	7	10,05	4,7%
N-150	8	10,04	4,7%
N-150	9	10,07	4,7%
N-150	10	10,05	4,7%
N-150	11	10,06	4,7%
N-150	12	10,02	4,7%
N-150	13	10,04	4,7%
N-150	14	10,04	4,7%
N-150	0	0,00	4,7%
N-150	0	0,00	4,7%
N-150	0	0,00	4,7%
N-150	0	0,00	4,7%
N-150	0	0,00	4,7%
N-150	0	0,00	4,7%
S-Cs (Cs-137)	35	10,02	4,4%
S-Cs (Cs-137)	36	10,02	4,4%
S-Cs (Cs-137)	37	10,02	4,4%
S-Cs (Cs-137)	38	10,02	4,4%
S-Cs (Cs-137)	39	10,02	4,4%
S-Cs (Cs-137)	40	10,02	4,4%
S-Cs (Cs-137)	41	10,02	4,4%
S-Cs (Cs-137)	42	10,02	4,4%
S-Cs (Cs-137)	43	10,02	4,4%
S-Cs (Cs-137)	44	10,02	4,4%
S-Cs (Cs-137)	0	0,00	4,4%
S-Cs (Cs-137)	0	0,00	4,4%
S-Cs (Cs-137)	0	0,00	4,4%
S-Cs (Cs-137)	0	0,00	4,4%
S-Cs (Cs-137)	0	0,00	4,4%
S-Co (Co-60)	25	10,00	4,5%
S-Co (Co-60)	26	10,00	4,5%
S-Co (Co-60)	27	10,00	4,5%
S-Co (Co-60)	28	10,00	4,5%
S-Co (Co-60)	29	10,00	4,5%
S-Co (Co-60)	30	10,00	4,5%
S-Co (Co-60)	31	10,00	4,5%
S-Co (Co-60)	32	10,00	4,5%
S-Co (Co-60)	33	10,00	4,5%
S-Co (Co-60)	34	10,00	4,5%
S-Co (Co-60)	0	0,00	4,5%
S-Co (Co-60)	0	0,00	4,5%
S-Co (Co-60)	0	0,00	4,5%
S-Co (Co-60)	0	0,00	4,5%
S-Co (Co-60)	0	0,00	4,5%

Name and signature of the responsible person:	Vladimír SOCHOR
Date of the report:	7th November 2023

N-30 H*10 irradiations relative uncertainty contributions all $k = 1$

Source of uncertainty	$u_{i,A}$	$u_{i,B}$	$u_{i,A}^2 + u_{i,B}^2$	Comment
Air density correction	0,0002	0,0012	1,48E-06	
Source to dosimeter distance		0,0015	2,25E-06	
Conversion coefficient		0,02	0,0004	
Other sources of uncertainty...	0,007	0,0095	0,000139	
Combined uncertainty, $H^*(10)$			0,023302	

Name of the person, who filled this form: Vladimir SOCHOR
 Laboratory name or identification: *
 Date of arrival of the dosimeters: 26th September 2023
 Date of dispatch back of the dosimeters: 17th October 2023
 Date of irradiations: * 14th October 2023

Names of persons who performed the irradiations (*): Vladimir SOCHOR

Do you want and allow that these names are stated in the certificate? (*):

Radiation quality: * N-30

Facility name or identification: *
 Setting of tube voltage (kV): 28,5
 Setting of tube current (mA): 40,0
 Inherent filtration (mm Be) or inherent filtration (mm Al): 1,00
 Additional filtration (mm Al):
 First half value layer HVL (mm Al): *
 Standardized radiation field: ISO 4037:2019 characterized radiation field
 $H^*(10)$ conversion coefficient (Sv/Gy): * 0,814
 Irradiation distance (mm): * 1352,0
 Irradiation time (seconds): * 352,6

Build-up plate in front of the dosimeters (not recommended for x-ray): no
 Air temperature (°C): 22,3-22,5
 Air pressure (hPa=mbar): 97,7
 Air relative humidity (%): 30

Number of dosimeters irradiated at the same time (*): 1
 (1 dosimeter recommended at a time for x-ray)

Relative uncertainty of irradiated doses (%): * 2,3%
 (relative in % with $k = 2$, i.e. 95 % confidence)
 Traceability is to this standards laboratory

Please, fill in all grey cells - if possible.
 * marked data will be stated in the certificate (otherwise "not stated").

You can also report several dates or a range of dates (it is recommended to perform the irradiations of a radiation quality within a day).

(*): marked data will only be stated in the certificate if agreed.

A "yes" means these persons have agreed that their names are stated in the certificate.

In case of other filter materials, please specify in the comments.

In case of different values for your irradiation, please report the average value.

In case of different values for your irradiation, please report the average value.

Ambient conditions during irradiation.

Ambient conditions during irradiation.

Ambient conditions during irradiation.

In case of different values for your irradiation, please report the most used value.

Only % values are allowed (recommended with 1 decimal place).

Dosemeter number * (dosemeters should be taken by chance and not in order)	Irradiation status	Irradiated dose (mSv) * (recommended with 2 decimal places)
15	irradiated	9,97
16	irradiated	9,95
17	irradiated	9,93
18	irradiated	9,91
19	irradiated	9,89
20	irradiated	9,90
21	irradiated	9,99
22	irradiated	9,98
23	irradiated	9,98
24	irradiated	9,97

Photo of the irradiation setup provided? no

Test or calibration report number - if a report is provided (*):

Do you want and allow that this number is stated in the certificate? (*):

Comments
 Comments
 Comments

The photo must be provided in a separate file (it is recommended to make additional photos of all irradiations with dosimeter IDs visible.)

The test or calibration report must be provided in a separate file. The report number can only be stated in the certificate if the report is provided.

N-150 H*10 irradiations relative uncertainty contributions all k = 1				
Source of uncertainty	$u_{i,A}$	$u_{i,B}$	$u_{i,A}^2 + u_{i,B}^2$	Comment
Air density correction	0,0002	0,0012	1,48E-06	
Source to dosimeter distance		0,0015	2,25E-06	
Conversion coefficient		0,02	0,0004	
Other sources of uncertainty...	0,0058	0,011	0,000155	
Combined uncertainty, H*(10)			0,02363	

Name of the person, who filled this form	Vladimir SOCHOR	Please, fill in all grey cells - if possible.
Laboratory name or identification *		* marked data will be stated in the certificate (otherwise "not stated").
Date of arrival of the dosimeters	26th September 2023	
Date of dispatch back of the dosimeters	17th October 2023	
Date of irradiations *	13th October 2023	You can also report several dates or a range of dates (it is recommended to perform the irradiations of a radiation quality within a day).
Names of persons who performed the irradiations (*)	Vladimir SOCHOR	(*) marked data will only be stated in the certificate if agreed.
Do you want and allow that these names are stated in the certificate? (*)		A "yes" means these persons have agreed that their names are stated in the certificate.
Radiation quality *	N-150	
Facility name or identification *		
Setting of tube voltage (kV)	148,3	
Setting of tube current (mA)	14,0	
Inherent filtration (mm Be) or inherent filtration (mm Al)	1,00	
Additional filtration (mm Al)		In case of other filter materials, please specify in the comments.
First half value layer HVL (mm Al) *		
Standardized radiation field	ISO 4037:2019 characterized radiation field	
H*(10) conversion coefficient (Sv/Gy) *	1,578	
Irradiation distance (mm) *	1352,0	In case of different values for your irradiation, please report the average value.
Irradiation time (seconds) *	247,0	In case of different values for your irradiation, please report the average value.
Build-up plate in front of the dosimeters (not recommended for x-ray)	no	
Air temperature (°C)	22,4	Ambient conditions during irradiation.
Air pressure (hPa=mbar)	98,1-98,2	Ambient conditions during irradiation.
Air relative humidity (%)	31	Ambient conditions during irradiation.
Number of dosimeters irradiated at the same time * (1 dosimeter recommended at a time for x-ray)	1	In case of different values for your irradiation, please report the most used value.
Relative uncertainty of irradiated doses (%) * (relative in % with $k = 2$, i.e. 95 % confidence)	2,4%	Only % values are allowed (recommended with 1 decimal place).
Traceability is to this standards laboratory		

Dosemeter number * (dosimeters should be taken by chance and not in order)	Irradiation status	Irradiated dose (mSv) * (recommended with 2 decimal places)
--	--------------------	---

5	irradiated	10,05
6	irradiated	10,03
7	irradiated	10,05
8	irradiated	10,04
9	irradiated	10,07
10	irradiated	10,05
11	irradiated	10,06
12	irradiated	10,02
13	irradiated	10,04
14	irradiated	10,04

Photo of the irradiation setup provided?	yes	The photo must be provided in a separate file (it is recommended to make additional photos of all irradiations with dosimeter IDs visible.)
Test or calibration report number - if a report is provided (*)		The test or calibration report must be provided in a separate file. The report number can only be stated in the certificate if the report is provided.
Do you want and allow that this number is stated in the certificate? (*)		
Comments	Only one photo of dosimeter no. 11 has been taken	
Comments		
Comments		

Cs-137 H*10 irradiations relative uncertainty contributions all k = 1

Source of uncertainty	$u_{i,A}$	$u_{i,B}$	$u_{i,A}^2 + u_{i,B}^2$	Comment
Air density correction	0,0002	0,0012	1,48E-06	
Source to dosimeter distance		0,0006	3,6E-07	
Conversion coefficient		0,02	0,0004	
Other sources of uncertainty...	0,003	0,0088	8,64E-05	
Combined uncertainty, H*(10)			0,022097	

Name of the person, who filled this form: Vladimir SOCHOR
 Laboratory name or identification *
 Date of arrival of the dosimeters: 26th September 2023
 Date of dispatch back of the dosimeters: 17th October 2023
 Date of irradiations * 12th October 2023

Names of persons who performed the irradiations (*) Tomáš TESAR

Do you want and allow that these names are stated in the certificate? (*)

Radiation quality * S-Cs (Cs-137)
 Facility name or identification *

Please, fill in all grey cells - if possible.
 * marked data will be stated in the certificate (otherwise "not stated").
 You can also report several dates or a range of dates (It is recommended to perform the irradiations of a radiation quality within a day).
 (*) marked data will only be stated in the certificate if agreed.
 A "yes" means these persons have agreed that their names are stated in the certificate.

H*(10) conversion coefficient (Sv/Gy) * 1,210
 Irradiation distance (mm) * 3342,0
 Irradiation time (seconds) * 369,0

Build-up plate in front of the dosimeters (recommended for gamma-ray) 3 mm PMMA
 Air temperature (°C) 22,6
 Air pressure (hPa=mbar) 98,6
 Air relative humidity (%) 33

Number of dosimeters irradiated at the same time * 2
 (2 dosimeter recommended at a time for gamma-ray)

Relative uncertainty of irradiated doses (%) * 2,2%
 (relative in % with k = 2, i.e. 95 % confidence)
 Traceability is to this standards laboratory

In case of different values for your irradiation, please report the average value.
 In case of different values for your irradiation, please report the average value.
 Ambient conditions during irradiation.
 Ambient conditions during irradiation.
 Ambient conditions during irradiation.
 In case of different values for your irradiation, please report the most used value.
 Only % values are allowed (recommended with 1 decimal place).

Dosemeter number * (dosemeters should be taken by chance and not in order)	Irradiation status	Irradiated dose (mSv) * (recommended with 2 decimal places)
35	irradiated	10,02
36	irradiated	10,02
37	irradiated	10,02
38	irradiated	10,02
39	irradiated	10,02
40	irradiated	10,02
41	irradiated	10,02
42	irradiated	10,02
43	irradiated	10,02
44	irradiated	10,02

Photo of the irradiation setup provided? no
 The photo must be provided in a separate file (It is recommended to make additional photos of all irradiations with dosimeter IDs visible.)

Test or calibration report number - if a report is provided (*)
 Do you want and allow that this number is stated in the certificate? (*)

Comments
 Comments
 Comments

The test or calibration report must be provided in a separate file. The report number can only be stated in the certificate if the report is provided.

N-150 H*10 irradiations relative uncertainty contributions all k = 2

Source of uncertainty	$u_{i,A}$	$u_{i,B}$	$u_{i,A}^2 + u_{i,B}^2$	Comment
Air density correction	0,0002	0,0012	1,48E-06	
Source to dosimeter distance		0,0015	2,25E-06	
Conversion coefficient		0,02	0,0004	
Other sources of uncertainty...	0,0046	0,0087	9,69E-05	
Combined uncertainty, H*(10)			0,022374	

Name of the person, who filled this form	Vladimír SOCHOR	Please, fill in all grey cells - if possible. * marked data will be stated in the certificate (otherwise "not stated"). You can also report several dates or a range of dates (it is recommended to perform the irradiations of a radiation quality within a day). (*) marked data will only be stated in the certificate if agreed. A "yes" means these persons have agreed that their names are stated in the certificate.
Laboratory name or identification *		
Date of arrival of the dosimeters	26th September 2023	
Date of dispatch back of the dosimeters	17th October 2023	
Date of irradiations *	13th October 2023	
Names of persons who performed the irradiations (*)	Tomáš TESAR	
Do you want and allow that these names are stated in the certificate? (*)		
Radiation quality *	S-Co (Co-60)	
Facility name or identification *		

H*(10) conversion coefficient (Sv/Gy) *	1,160	In case of different values for your irradiation, please report the average value. In case of different values for your irradiation, please report the average value.
Irradiation distance (mm) *	1375,0	
Irradiation time (seconds) *	1077,0	Ambient conditions during irradiation. Ambient conditions during irradiation. Ambient conditions during irradiation.
Build-up plate in front of the dosimeters (recommended for gamma-ray)		
Air temperature (°C)	22,4	
Air pressure (hPa=mbar)	98,2	
Air relative humidity (%)	33	
Number of dosimeters irradiated at the same time * (2 dosimeter recommended at a time for gamma-ray)	2	In case of different values for your irradiation, please report the most used value.
Relative uncertainty of irradiated doses (%) * (relative in % with k = 2, i.e. 95 % confidence)	2,2%	Only % values are allowed (recommended with 1 decimal place).
Traceability is to this standards laboratory		

Dosemeter number * (dosemeters should be taken by chance and not in order)	Irradiation status	Irradiated dose (mSv) * (recommended with 2 decimal places)
25	irradiated	10,00
26	irradiated	10,00
27	irradiated	10,00
28	irradiated	10,00
29	irradiated	10,00
30	irradiated	10,00
31	irradiated	10,00
32	irradiated	10,00
33	irradiated	10,00
34	irradiated	10,00

Photo of the irradiation setup provided?	yes	The photo must be provided in a separate file (it is recommended to make additional photos of all irradiations with dosimeter IDs visible.)
Test or calibration report number - if a report is provided (*)		The test or calibration report must be provided in a separate file. The report number can only be stated in the certificate if the report is provided.
Do you want and allow that this number is stated in the certificate? (*)		
Comments	Only one photo of dosimeters no. 25 and 26 has been taken	
Comments		
Comments		

N-150 H*10 irradiations relative uncertainty contributions all k = 1

Source of uncertainty	$u_{i,A}$	$u_{i,B}$	$u_{i,A}^2 + u_{i,B}^2$	Comment
Air density correction		0,003673	1,35E-05	
Source to dosimeter distance		0,002887	8,33E-06	
Conversion coefficient		0,02	0,0004	
Other sources of uncertainty...	0,0131802	0,000287	0,000174	
Combined uncertainty, H*(10)			0,024405	

Name of the person, who filled this form	Boštjan Črnič	Please, fill in all grey cells - if possible.
Laboratory name or identification *	Jožef Stefan Institute, Laboratory for dosimetry standards	* marked data will be stated in the certificate (otherwise "not stated").
Date of arrival of the dosimeters	2023-09-22	
Date of dispatch back of the dosimeters	2023-10-20	
Date of irradiations *	2023-10-10	You can also report several dates or a range of dates (it is recommended to perform the irradiations of a radiation quality within a day).
Names of persons who performed the irradiations (*)	Boštjan Črnič	(*) marked data will only be stated in the certificate if agreed.
Do you want and allow that these names are stated in the certificate? (*)	yes	A "yes" means these persons have agreed that their names are stated in the certificate.
Radiation quality *	N-150	
Facility name or identification *	NDS	
Setting of tube voltage (kV)	150,0	
Setting of tube current (mA)	5,0	
Inherent filtration (mm Be)	3,00	
or inherent filtration (mm Al)		
Additional filtration (mm Al)	3,6 mm Al / 2,5 mm Sn	In case of other filter materials, please specify in the comments.
First half value layer HVL (mm Al) *	2,409 mm Cu	
Standardized radiation field *	ISO 4037:2019 matched radiation field	
H*(10) conversion coefficient (Sv/Gy) *	1,580	
Irradiation distance (mm) *	1000,0	In case of different values for your irradiation, please report the average value.
Irradiation time (seconds) *	370,0	In case of different values for your irradiation, please report the average value.
Build-up plate in front of the dosimeters (not recommended for x-ray)	no	
Air temperature (°C)	22	Ambient conditions during irradiation.
Air pressure (hPa=mbar)	988	Ambient conditions during irradiation.
Air relative humidity (%)	65	Ambient conditions during irradiation.
Number of dosimeters irradiated at the same time * (1 dosimeter recommended at a time for x-ray)	1	In case of different values for your irradiation, please report the most used value.
Relative uncertainty of irradiated doses (%) * (relative in % with k = 2, i.e. 95 % confidence)	2,4%	Only % values are allowed (recommended with 1 decimal place).
Traceability is to this standards laboratory	IAEA SSDL Seibersdorf, AT	

Dosemeter number * (dosimeters should be taken by chance and not in order)	Irradiation status	Irradiated dose (mSv) * (recommended with 2 decimal places)
AMB 003 (48747732)	irradiated	10,01
AMB 009 (48747738)	irradiated	10,01
AMB 012 (48747741)	irradiated	10,01
AMB 015 (48747744)	irradiated	10,01
AMB 024 (48747753)	irradiated	10,01
AMB 027 (48747756)	irradiated	10,01
AMB 033 (48747762)	irradiated	10,01
AMB 037 (48747766)	irradiated	10,01
AMB 041 (48747770)	irradiated	10,01
AMB 049 (48747778)	irradiated	10,01

Photo of the irradiation setup provided?	yes	The photo must be provided in a separate file (it is recommended to make additional photos of all irradiations with dosimeter IDs visible.)
Test or calibration report number - if a report is provided (*)	PO 99/23	The test or calibration report must be provided in a separate file. The report number can only be stated in the certificate if the report is provided.
Do you want and allow that this number is stated in the certificate? (*)	yes	
Comments	Actual uncertainty of irradiations was 2,4% (k=1) but we report our accreditation limit 2,5% (k=1).	
Comments		
Comments		

Cs-137 H*10 irradiations relative uncertainty contributions all k = 1

Source of uncertainty	$u_{i,A}$	$u_{i,B}$	$u_{i,A}^2 + u_{i,B}^2$	Comment
Air density correction		0,003673	1,35E-05	
Source to dosimeter distance		0,002887	8,33E-06	
Conversion coefficient		0,02	0,0004	
Other sources of uncertainty...	0,00643951	0,000287	4,15E-05	
Combined uncertainty, H*(10)			0,021526	

Name of the person, who filled this form	Boštjan Čmič	Please, fill in all grey cells - if possible.
Laboratory name or identification *	Jožef Stefan Institute, Laboratory for dosimetry standards	* marked data will be stated in the certificate (otherwise "not stated").
Date of arrival of the dosimeters	2023-09-22	
Date of dispatch back of the dosimeters	2023-10-20	
Date of irradiations *	2023-10-11	You can also report several dates or a range of dates (it is recommended to perform the irradiations of a radiation quality within a day).
Names of persons who performed the irradiations (*)	Boštjan Čmič	(*) marked data will only be stated in the certificate if agreed.
Do you want and allow that these names are stated in the certificate? (*)	yes	A "yes" means these persons have agreed that their names are stated in the certificate.
Radiation quality *	S-Cs (Cs-137)	
Facility name or identification *	NDS	

H*(10) conversion coefficient (Sv/Gy) *	1,210	
Irradiation distance (mm) *	1000,0	In case of different values for your irradiation, please report the average value.
Irradiation time (seconds) *	1130,3	In case of different values for your irradiation, please report the average value.
Build-up plate in front of the dosimeters (recommended for gamma-ray)	3 mm PMMA	
Air temperature (°C)	22	Ambient conditions during irradiation.
Air pressure (hPa=mbar)	990	Ambient conditions during irradiation.
Air relative humidity (%)	67	Ambient conditions during irradiation.
Number of dosimeters irradiated at the same time * (2 dosimeter recommended at a time for gamma-ray)	1	In case of different values for your irradiation, please report the most used value.
Relative uncertainty of irradiated doses (%) * (relative in % with k = 2, i.e. 95 % confidence)	2,2%	Only % values are allowed (recommended with 1 decimal place).
Traceability is to this standards laboratory	IAEA SSDL Seibersdorf, AT	

Dosemeter number * (dosemeters should be taken by chance and not in order)	Irradiation status	Irradiated dose (mSv) * (recommended with 2 decimal places)
AMB 005 (48747734)	irradiated	10,00
AMB 008 (48747737)	irradiated	10,00
AMB 013 (48747742)	irradiated	10,00
AMB 017 (48747746)	irradiated	10,00
AMB 025 (48747754)	irradiated	10,00
AMB 029 (48747758)	irradiated	10,00
AMB 034 (48747763)	irradiated	10,00
AMB 036 (48747765)	irradiated	10,00
AMB 042 (48747771)	irradiated	10,00
AMB 046 (48747775)	irradiated	10,00

Photo of the irradiation setup provided?	yes	The photo must be provided in a separate file (it is recommended to make additional photos of all irradiations with dosimeter IDs visible.)
Test or calibration report number - if a report is provided (*)	PO 99/23	The test or calibration report must be provided in a separate file. The report number can only be stated in the certificate if the report is provided.
Do you want and allow that this number is stated in the certificate? (*)	yes	
Comments	Actual uncertainty of irradiations was 2,2% (k=1) but we report our accreditation limit 2,5% (k=1).	
Comments		
Comments		

PTB

supportBSS A4.3.1 Pilot Study

EURAMET.1593

Participant:	Physikalisch-Technische Bundesanstalt (PTB)
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Radiation quality	Dosimeter ID	Dose H*(10) in mSv	U _{rel} (k=1)	
N-30	AMB 001	10,02	1,9%	
N-30	AMB 002	10,00	1,9%	
N-30	AMB 003	10,03	1,9%	
N-30	AMB 004	10,01	1,9%	
N-30	AMB 005	10,02	1,9%	
N-30	AMB 006	10,04	1,9%	
N-30	AMB 007	10,04	1,9%	
N-30	AMB 008	10,02	1,9%	
N-30	AMB 009	10,01	1,9%	
N-30	AMB 010	10,02	1,9%	
N-30	AMB 041	0,00	1,9%	
N-30	AMB 042	0,00	1,9%	
N-30		0	0,00	1,9%
N-30		0	0,00	1,9%
N-30		0	0,00	1,9%
N-30		0	0,00	1,9%
N-150	AMB 011	10,01	1,9%	
N-150	AMB 012	10,01	1,9%	
N-150	AMB 013	10,01	1,9%	
N-150	AMB 014	10,01	1,9%	
N-150	AMB 015	10,01	1,9%	
N-150	AMB 016	10,01	1,9%	
N-150	AMB 017	10,01	1,9%	
N-150	AMB 018	10,01	1,9%	
N-150	AMB 019	10,01	1,9%	
N-150	AMB 020	10,01	1,9%	
N-150	AMB 043	0,00	1,9%	
N-150	AMB 044	0,00	1,9%	
N-150		0	0,00	1,9%
N-150		0	0,00	1,9%
N-150		0	0,00	1,9%
N-150		0	0,00	1,9%
S-Cs (Cs-137)	AMB 021	9,99	1,4%	
S-Cs (Cs-137)	AMB 022	9,99	1,4%	
S-Cs (Cs-137)	AMB 023	9,99	1,4%	
S-Cs (Cs-137)	AMB 024	9,99	1,4%	
S-Cs (Cs-137)	AMB 025	10,00	1,4%	
S-Cs (Cs-137)	AMB 026	10,00	1,4%	
S-Cs (Cs-137)	AMB 027	10,00	1,4%	
S-Cs (Cs-137)	AMB 028	10,00	1,4%	
S-Cs (Cs-137)	AMB 029	10,00	1,4%	
S-Cs (Cs-137)	AMB 030	10,00	1,4%	
S-Cs (Cs-137)	AMB 045	0,00	1,4%	
S-Cs (Cs-137)	AMB 046	0,00	1,4%	
S-Cs (Cs-137)	AMB 047	0,00	1,4%	
S-Cs (Cs-137)		0	0,00	1,4%
S-Cs (Cs-137)		0	0,00	1,4%
S-Cs (Cs-137)		0	0,00	1,4%
S-Co (Co-60)	AMB 031	10,00	1,4%	
S-Co (Co-60)	AMB 032	10,00	1,4%	
S-Co (Co-60)	AMB 033	10,00	1,4%	
S-Co (Co-60)	AMB 034	10,00	1,4%	
S-Co (Co-60)	AMB 035	10,00	1,4%	
S-Co (Co-60)	AMB 036	10,00	1,4%	
S-Co (Co-60)	AMB 037	10,00	1,4%	
S-Co (Co-60)	AMB 038	10,00	1,4%	
S-Co (Co-60)	AMB 039	10,00	1,4%	
S-Co (Co-60)	AMB 040	10,00	1,4%	
S-Co (Co-60)	AMB 048	0,00	1,4%	
S-Co (Co-60)	AMB 049	0,00	1,4%	
S-Co (Co-60)	AMB 050	0,00	1,4%	
S-Co (Co-60)		0	0,00	1,4%
S-Co (Co-60)		0	0,00	1,4%
S-Co (Co-60)		0	0,00	1,4%

Name and signature of the responsible person:	
Date of the report:	13.10.2023

N-30 H*10 irradiations relative uncertainty contributions all k = 2

Source of uncertainty	$u_{i,A}$	$u_{i,B}$	$u_{i,A}^2 + u_{i,B}^2$	Comment
Air density correction			0	
Source to dosimeter distance		0,27%	7,29E-06	
Conversion coefficient		1%	0,0001	
Other sources of uncertainty...		1,60%	0,000256	
Combined uncertainty, H*(10)			0,01906	

Name of the person, who filled this form	Dr. Hayo Zutz	Please, fill in all grey cells - if possible.
Laboratory name or identification *	Physikalisch-Technische Bundesanstalt Braunschweig	* marked data will be stated in the certificate (otherwise "not stated").
Date of arrival of the dosimeters	2023-09-22	
Date of dispatch back of the dosimeters	2323-10-16	
Date of irradiations *	2023-10-10	You can also report several dates or a range of dates (it is recommended to perform the irradiations of a radiation quality within a day).
Names of persons who performed the irradiations (*)	Simone Janßen	(*) marked data will only be stated in the certificate if agreed.
Do you want and allow that these names are stated in the certificate? (*)	no	A "yes" means these persons have agreed that their names are stated in the certificate.
Radiation quality *	N-30	
Facility name or identification *	120kV-Bestrahlungsanlage	
Setting of tube voltage (kV)	30,0	
Setting of tube current (mA)	38,0	
Inherent filtration (mm Be)	1,00	
or inherent filtration (mm Al)		
Additional filtration (mm Al)	4,00	In case of other filter materials, please specify in the comments.
First half value layer HVL (mm Al) *	1,16	
Standardized radiation field *	ISO 4037:2019 characterized radiation field	
H*(10) conversion coefficient (Sv/Gy) *	0,815	
Irradiation distance (mm) *	1500,0	In case of different values for your irradiation, please report the average value.
Irradiation time (seconds) *	304,5	In case of different values for your irradiation, please report the average value.
Build-up plate in front of the dosimeters (not recommended for x-ray)	no	
Air temperature (°C)	21	Ambient conditions during irradiation.
Air pressure (hPa=mbar)	1010	Ambient conditions during irradiation.
Air relative humidity (%)	52	Ambient conditions during irradiation.
Number of dosimeters irradiated at the same time *	1	In case of different values for your irradiation, please report the most used value.
(1 dosimeter recommended at a time for x-ray)		
Relative uncertainty of irradiated doses (%) *	1,9%	Only % values are allowed (recommended with 1 decimal place).
(relative in % with k = 2, i.e. 95 % confidence)		
Traceability is to this standards laboratory		

Dosemeter number * (dosimeters should be taken by chance and not in order)	Irradiation status	Irradiated dose (mSv) * (recommended with 2 decimal places)
AMB 001	irradiated	10,02
AMB 002	irradiated	10,00
AMB 003	irradiated	10,03
AMB 004	irradiated	10,01
AMB 005	irradiated	10,02
AMB 006	irradiated	10,04
AMB 007	irradiated	10,04
AMB 008	irradiated	10,02
AMB 009	irradiated	10,01
AMB 010	irradiated	10,02
AMB 041	not irradiated (background)	
AMB 042	not irradiated (background)	

Photo of the irradiation setup provided?		The photo must be provided in a separate file (it is recommended to make additional photos of all irradiations with dosimeter IDs visible.)
Test or calibration report number - if a report is provided (*)		The test or calibration report must be provided in a separate file. The report number can only be stated in the certificate if the report is provided.
Do you want and allow that this number is stated in the certificate? (*)		
Comments		
Comments		
Comments		

N-150 H*10 irradiations relative uncertainty contributions all $k = 2$

Source of uncertainty	$u_{i,A}$	$u_{i,B}$	$u_{i,A}^2 + u_{i,B}^2$	Comment
Air density correction		0	0	
Source to dosimeter distance		0,27%	7,29E-06	
Conversion coefficient		1%	0,0001	
Other sources of uncertainty...		1,60%	0,000256	
Combined uncertainty, $H^*(10)$			0,01906	

Name of the person, who filled this form	Dr. Hayo Zutz	Please, fill in all grey cells - if possible.
Laboratory name or identification *	Physikalisch-Technische Bundesanstalt Braunschweig	* marked data will be stated in the certificate (otherwise "not stated").
Date of arrival of the dosimeters	2023-09-22	
Date of dispatch back of the dosimeters	2323-10-16	
Date of irradiations *	2023-10-10	You can also report several dates or a range of dates (it is recommended to perform the irradiations of a radiation quality within a day).
Names of persons who performed the irradiations (*)	Simone Janßen	(*) marked data will only be stated in the certificate if agreed.
Do you want and allow that these names are stated in the certificate? (*)		A "yes" means these persons have agreed that their names are stated in the certificate.
Radiation quality *	N-150	
Facility name or identification *	400kV-Bestrahlungsanlage	
Setting of tube voltage (kV)	150,0	
Setting of tube current (mA)	16,5	
Inherent filtration (mm Be) or inherent filtration (mm Al)	7,00	
Additional filtration (mm Al)	4 + 2,5 mm Sn	In case of other filter materials, please specify in the comments.
First half value layer HVL (mm Al) *	16,49	
Standardized radiation field *	ISO 4037:2019 characterized radiation field	
$H^*(10)$ conversion coefficient (Sv/Gy) *	1,580	
Irradiation distance (mm) *	1500,0	In case of different values for your irradiation, please report the average value.
Irradiation time (seconds) *	250,3	In case of different values for your irradiation, please report the average value.
Build-up plate in front of the dosimeters (not recommended for x-ray)	no	
Air temperature (°C)	21	Ambient conditions during irradiation.
Air pressure (hPa=mbar)	1009	Ambient conditions during irradiation.
Air relative humidity (%)		Ambient conditions during irradiation.
Number of dosimeters irradiated at the same time * (1 dosimeter recommended at a time for x-ray)	1	In case of different values for your irradiation, please report the most used value.
Relative uncertainty of irradiated doses (%) * (relative in % with $k = 2$, i.e. 95 % confidence)	1,9%	Only % values are allowed (recommended with 1 decimal place).
Traceability is to this standards laboratory		

Dosemeter number * (dosemeters should be taken by chance and not in order)	Irradiation status	Irradiated dose (mSv) * (recommended with 2 decimal places)
AMB 011	irradiated	10,01
AMB 012	irradiated	10,01
AMB 013	irradiated	10,01
AMB 014	irradiated	10,01
AMB 015	irradiated	10,01
AMB 016	irradiated	10,01
AMB 017	irradiated	10,01
AMB 018	irradiated	10,01
AMB 019	irradiated	10,01
AMB 020	irradiated	10,01
AMB 043	not irradiated (background)	
AMB 044	not irradiated (background)	

Photo of the irradiation setup provided?		The photo must be provided in a separate file (it is recommended to make additional photos of all irradiations with dosimeter IDs visible.)
Test or calibration report number - if a report is provided (*)		The test or calibration report must be provided in a separate file. The report number can only be stated in the certificate if the report is provided.
Do you want and allow that this number is stated in the certificate? (*)		
Comments		
Comments		
Comments		

Cs-137 H*10 irradiations relative uncertainty contributions all k = 2

Source of uncertainty	$u_{i,A}$	$u_{i,B}$	$u_{i,A}^2 + u_{i,B}^2$	Comment
Air density correction	0	0	0	
Source to dosimeter distance		0,27%	7,29E-06	
Conversion coefficient		1%	0,0001	
Other sources of uncertainty...		1,00%	0,0001	
Combined uncertainty, H*(10)			0,014398	

Name of the person, who filled this form Please, fill in all grey cells - if possible.

Laboratory name or identification * * marked data will be stated in the certificate (otherwise "not stated").

Date of arrival of the dosimeters

Date of dispatch back of the dosimeters

Date of irradiations * You can also report several dates or a range of dates (it is recommended to perform the irradiations of a radiation quality within a day).

Names of persons who performed the irradiations (* (*) marked data will only be stated in the certificate if agreed.

Do you want and allow that these names are stated in the certificate? (* A "yes" means these persons have agreed that their names are stated in the certificate.

Radiation quality *

Facility name or identification *

H*(10) conversion coefficient (Sv/Gy) *

Irradiation distance (mm) * In case of different values for your irradiation, please report the average value.

Irradiation time (seconds) * In case of different values for your irradiation, please report the average value.

Build-up plate in front of the dosimeters (recommended for gamma-ray)

Air temperature (°C) Ambient conditions during irradiation.

Air pressure (hPa=mbar) Ambient conditions during irradiation.

Air relative humidity (%) Ambient conditions during irradiation.

Number of dosimeters irradiated at the same time * In case of different values for your irradiation, please report the most used value.

(2 dosimeter recommended at a time for gamma-ray)

Relative uncertainty of irradiated doses (%) * Only % values are allowed (recommended with 1 decimal place).

(relative in % with k = 2, i.e. 95 % confidence)

Traceability is to this standards laboratory

Dosimeter number * (dosimeters should be taken by chance and not in order)	Irradiation status	Irradiated dose (mSv) * (recommended with 2 decimal places)
AMB 021	irradiated	9,99
AMB 022	irradiated	9,99
AMB 023	irradiated	9,99
AMB 024	irradiated	9,99
AMB 025	irradiated	10,00
AMB 026	irradiated	10,00
AMB 027	irradiated	10,00
AMB 028	irradiated	10,00
AMB 029	irradiated	10,00
AMB 030	irradiated	10,00
AMB 045	not irradiated (background)	
AMB 046	not irradiated (background)	
AMB 047	not irradiated (background)	

Photo of the irradiation setup provided? The photo must be provided in a separate file (it is recommended to make additional photos of all irradiations with dosimeter IDs visible.)

Test or calibration report number - if a report is provided (* The test or calibration report must be provided in a separate file. The report number can only be stated in the certificate if the report is provided.

Do you want and allow that this number is stated in the certificate? (*

Comments

Comments

Comments

N-150 H*10 irradiations relative uncertainty contributions all k = 2

Source of uncertainty	$u_{i,A}$	$u_{i,B}$	$u_{i,A}^2 + u_{i,B}^2$	Comment
Air density correction		0	0	
Source to dosimeter distance		0,27%	7,29E-06	
Conversion coefficient		1%	0,0001	
Other sources of uncertainty...		1,00%	0,0001	
Combined uncertainty, H*(10)			0,014398	

Name of the person, who filled this form Please, fill in all grey cells - if possible.

Laboratory name or identification * * marked data will be stated in the certificate (otherwise "not stated").

Date of arrival of the dosimeters

Date of dispatch back of the dosimeters

Date of irradiations * You can also report several dates or a range of dates (it is recommended to perform the irradiations of a radiation quality within a day).

Names of persons who performed the irradiations (* (*) marked data will only be stated in the certificate if agreed.

Do you want and allow that these names are stated in the certificate? (* A "yes" means these persons have agreed that their names are stated in the certificate.

Radiation quality *

Facility name or identification *

H*(10) conversion coefficient (Sv/Gy) *

Irradiation distance (mm) * In case of different values for your irradiation, please report the average value.

Irradiation time (seconds) * In case of different values for your irradiation, please report the average value.

Build-up plate in front of the dosimeters (recommended for gamma-ray)

Air temperature (°C) Ambient conditions during irradiation.

Air pressure (hPa=mbar) Ambient conditions during irradiation.

Air relative humidity (%) Ambient conditions during irradiation.

Number of dosimeters irradiated at the same time * In case of different values for your irradiation, please report the most used value.

(2 dosimeter recommended at a time for gamma-ray)

Relative uncertainty of irradiated doses (%) * Only % values are allowed (recommended with 1 decimal place).

(relative in % with k = 2, i.e. 95 % confidence)

Traceability is to this standards laboratory

Dosimeter number * (dosimeters should be taken by chance and not in order)	Irradiation status	Irradiated dose (mSv) * (recommended with 2 decimal places)
AMB 031	irradiated	10,00
AMB 032	irradiated	10,00
AMB 033	irradiated	10,00
AMB 034	irradiated	10,00
AMB 035	irradiated	10,00
AMB 036	irradiated	10,00
AMB 037	irradiated	10,00
AMB 038	irradiated	10,00
AMB 039	irradiated	10,00
AMB 040	irradiated	10,00
AMB 048	not irradiated (background)	
AMB 049	not irradiated (background)	
AMB 050	not irradiated (background)	

Photo of the irradiation setup provided? The photo must be provided in a separate file (it is recommended to make additional photos of all irradiations with dosimeter IDs visible.)

Test or calibration report number - if a report is provided (*) The test or calibration report must be provided in a separate file. The report number can only be stated in the certificate if the report is provided.

Do you want and allow that this number is stated in the certificate? (*)

Comments

Comments

Comments

SCK CEN

supportBSS A4.3.1 Pilot Study

EURAMET.1593

Participant:	SCK CEN/LNK, Belgium
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Radiation quality	Dosemeter ID	Dose H*(10) in mSv	U _{rel} (k=2)
N-30	925	10,00	2,3%
N-30	917	10,00	2,3%
N-30	883	10,00	2,3%
N-30	884	10,00	2,3%
N-30	886	10,00	2,3%
N-30	907	10,00	2,3%
N-30	888	10,00	2,3%
N-30	914	10,00	2,3%
N-30	891	10,00	2,3%
N-30	894	10,00	2,3%
N-30	930	?	2,3%
N-30	885	0,00	2,3%
N-30	904	0,00	2,3%
N-30	909	0,00	2,3%
N-30	922	0,00	2,3%
N-30	910	0,00	2,3%
N-150	893	9,80	2,3%
N-150	895	9,80	2,3%
N-150	912	9,80	2,3%
N-150	892	9,80	2,3%
N-150	908	9,80	2,3%
N-150	931	9,80	2,3%
N-150	918	9,80	2,3%
N-150	924	9,80	2,3%
N-150	913	9,80	2,3%
N-150	887	9,80	2,3%
N-150	902	0,00	2,3%
N-150	927	0,00	2,3%
N-150	911	0,00	2,3%
N-150	898	0,00	2,3%
N-150	0	0,00	2,3%
N-150	0	0,00	2,3%
S-Cs (Cs-137)	905	10,00	2,1%
S-Cs (Cs-137)	920	10,00	2,1%
S-Cs (Cs-137)	899	10,00	2,1%
S-Cs (Cs-137)	919	10,00	2,1%
S-Cs (Cs-137)	900	10,00	2,1%
S-Cs (Cs-137)	915	10,00	2,1%
S-Cs (Cs-137)	928	10,00	2,1%
S-Cs (Cs-137)	929	10,00	2,1%
S-Cs (Cs-137)	890	10,00	2,1%
S-Cs (Cs-137)	889	10,00	2,1%
S-Cs (Cs-137)	0	0,00	2,1%
S-Cs (Cs-137)	0	0,00	2,1%
S-Cs (Cs-137)	0	0,00	2,1%
S-Cs (Cs-137)	0	0,00	2,1%
S-Cs (Cs-137)	0	0,00	2,1%
S-Cs (Cs-137)	0	0,00	2,1%
S-Co (Co-60)	903	10,00	2,3%
S-Co (Co-60)	923	10,00	2,3%
S-Co (Co-60)	916	10,00	2,3%
S-Co (Co-60)	926	10,00	2,3%
S-Co (Co-60)	896	10,00	2,3%
S-Co (Co-60)	906	10,00	2,3%
S-Co (Co-60)	932	10,00	2,3%
S-Co (Co-60)	901	10,00	2,3%
S-Co (Co-60)	921	10,00	2,3%
S-Co (Co-60)	897	10,00	2,3%
S-Co (Co-60)	0	0,00	2,3%
S-Co (Co-60)	0	0,00	2,3%
S-Co (Co-60)	0	0,00	2,3%
S-Co (Co-60)	0	0,00	2,3%
S-Co (Co-60)	0	0,00	2,3%
S-Co (Co-60)	0	0,00	2,3%
S-Co (Co-60)	0	0,00	2,3%
S-Co (Co-60)	0	0,00	2,3%
S-Co (Co-60)	0	0,00	2,3%

Name and signature of the responsible person:	
Date of the report:	11.10.2023

N-30 H*10 irradiations relative uncertainty contributions all k = 2

Source of uncertainty	$u_{i,A}$	$u_{i,B}$	$u_{i,A}^2 + u_{i,B}^2$	Comment
Air density correction	0,00%	0,26%	6,89E-06	
Source to dosimeter distance	0,20%	0,00%	3,92E-06	
Conversion coefficient	0,00%	2,00%	0,0004	
Other sources of uncertainty...	0,00%	1,17%	0,000137	
Combined uncertainty, H*(10)			0,02341	

Name of the person, who filled this form: Liviu-Cristian Mihailescu
 Laboratory name or identification: SCK CEN / LNK
 Date of arrival of the dosimeters: 2023-10-01
 Date of dispatch back of the dosimeters: 2023-10-12
 Date of irradiations: 2023-10-10

Names of persons who performed the irradiations (*): Bart Marlein

Do you want and allow that these names are stated in the certificate? (*): yes

Radiation quality: N-30
 Facility name or identification: Xstrahl 100 kV X-ray tube
 Setting of tube voltage (kV): 30,0
 Setting of tube current (mA): 16,0
 Inherent filtration (mm Be) or inherent filtration (mm Al): 1,00 / 0,17
 Additional filtration (mm Al): 4,00
 First half value layer HVL (mm Al): 1,14
 Standardized radiation field: ISO 4037:2019 characterized radiation field
 H*(10) conversion coefficient (Sv/Gy): 0,785
 Irradiation distance (mm): 1000,0
 Irradiation time (seconds): 346,0

Build-up plate in front of the dosimeters (not recommended for x-ray): no
 Air temperature (°C): 19-22
 Air pressure (hPa=mbar): 1014-1017
 Air relative humidity (%): 55-56

Number of dosimeters irradiated at the same time (*):
 (1 dosimeter recommended at a time for x-ray)

Relative uncertainty of irradiated doses (%): 2,3%
 (relative in % with k = 2, i.e. 95 % confidence)

Traceability is to this standards laboratory: PTB(D)

Please, fill in all grey cells - if possible.
 * marked data will be stated in the certificate (otherwise "not stated").

You can also report several dates or a range of dates (it is recommended to perform the irradiations of a radiation quality within a day).

(*) marked data will only be stated in the certificate if agreed.

A "yes" means these persons have agreed that their names are stated in the certificate.

In case of other filter materials, please specify in the comments.

In case of different values for your irradiation, please report the average value.

In case of different values for your irradiation, please report the average value.

Ambient conditions during irradiation.

Ambient conditions during irradiation.

Ambient conditions during irradiation.

In case of different values for your irradiation, please report the most used value.

Only % values are allowed (recommended with 1 decimal place).

Dosemeter number * (dosemeters should be taken by chance and not in order)	Irradiation status	Irradiated dose (mSv) * (recommended with 2 decimal places)
925	irradiated	10,00
917	irradiated	10,00
883	irradiated	10,00
884	irradiated	10,00
886	irradiated	10,00
907	irradiated	10,00
888	irradiated	10,00
914	irradiated	10,00
891	irradiated	10,00
894	irradiated	10,00
930	wrong irradiated	?
885	not irradiated (background)	0,00
904	not irradiated (background)	0,00
909	not irradiated (background)	0,00
922	not irradiated (background)	0,00
910	not irradiated (background)	0,00

Photo of the irradiation setup provided? yes

Test or calibration report number - if a report is provided (*): LNK2023-496

Do you want and allow that this number is stated in the certificate? (*): yes

Comments: additional filtration=4mmAl
 Comments: 1st HVL=1.14 mmAl and second HVL=1.30 mmAl
 Comments: H*(10)=10.0 mSv +/-0.5 mSv (k=2)

The photo must be provided in a separate file (It is recommended to make additional photos of all irradiations with dosimeter IDs visible.)

The test or calibration report must be provided in a separate file. The report number can only be stated in the certificate if the report is provided.

***N-150 H*10 irradiations relative uncertainty contributions
all k = 2***

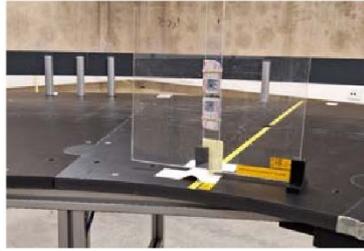
Source of uncertainty	$u_{i,A}$	$u_{i,B}$	$u_{i,A}^2 + u_{i,B}^2$	Comment
Air density correction	0,00%	0,26%	6,89E-06	
Source to dosimeter distance	0,20%	0,00%	3,92E-06	
Conversion coefficient	0,00%	2,00%	0,0004	
Other sources of uncertainty...	0,00%	1,17%	0,000137	
Combined uncertainty, $H^*(10)$			0,02341	

Name of the person, who filled this form	Liviu-Cristian Mihailescu	Please, fill in all grey cells - if possible.
Laboratory name or identification *	SCK CEN / LNK	* marked data will be stated in the certificate (otherwise "not stated").
Date of arrival of the dosimeters	2023-10-01	
Date of dispatch back of the dosimeters	2023-10-12	
Date of irradiations *	2023-10-10	You can also report several dates or a range of dates (it is recommended to perform the irradiations of a radiation quality within a day).
Names of persons who performed the irradiations (*)	Bart Marlein	(*) marked data will only be stated in the certificate if agreed.
Do you want and allow that these names are stated in the certificate? (*)	yes	A "yes" means these persons have agreed that their names are stated in the certificate.
Radiation quality *	N-150	
Facility name or identification *	Xstrahl 320 kV X-ray tube	
Setting of tube voltage (kV)	150,0	
Setting of tube current (mA)	10,0	
Inherent filtration (mm Be)	4,00	
or inherent filtration (mm Al)	0,20	
Additional filtration (mm Al)	3,80	In case of other filter materials, please specify in the comments.
First half value layer HVL (mm Al) *	2,34	
Standardized radiation field *	ISO 4037:2019 characterized radiation field	
H*(10) conversion coefficient (Sv/Gy) *	1,588	
Irradiation distance (mm) *	1000,0	In case of different values for your irradiation, please report the average value.
Irradiation time (seconds) *	171,0	In case of different values for your irradiation, please report the average value.
Build-up plate in front of the dosimeters (not recommended for x-ray)	no	
Air temperature (°C)	19-22	Ambient conditions during irradiation.
Air pressure (hPa=mbar)	1014-1017	Ambient conditions during irradiation.
Air relative humidity (%)	55-56	Ambient conditions during irradiation.
Number of dosimeters irradiated at the same time * (1 dosimeter recommended at a time for x-ray)	1	In case of different values for your irradiation, please report the most used value.
Relative uncertainty of irradiated doses (%) * (relative in % with $k = 2$, i.e. 95 % confidence)	2,3%	Only % values are allowed (recommended with 1 decimal place).
Traceability is to this standards laboratory	PTB(D)	

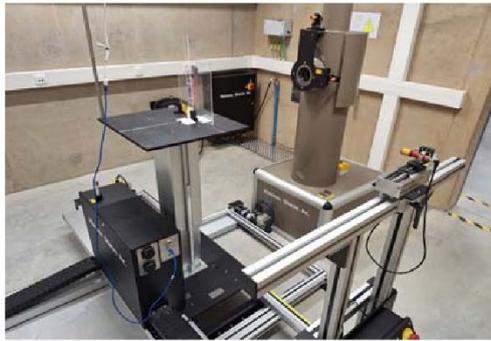
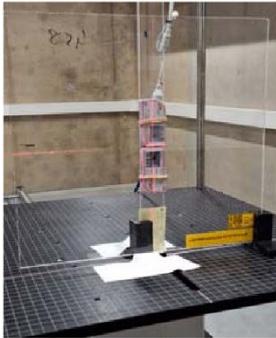
Dosemeter number *	Irradiation status	Irradiated dose (mSv) *
(dosemeters should be taken by chance and not in order)		(recommended with 2 decimal places)
893	irradiated	9,80
895	irradiated	9,80
912	irradiated	9,80
892	irradiated	9,80
908	irradiated	9,80
931	irradiated	9,80
918	irradiated	9,80
924	irradiated	9,80
913	irradiated	9,80
887	irradiated	9,80
902	not irradiated (background)	0,00
927	not irradiated (background)	0,00
911	not irradiated (background)	0,00
898	not irradiated (background)	0,00

Photo of the irradiation setup provided?	yes	The photo must be provided in a separate file (it is recommended to make additional photos of all irradiations with dosimeter IDs visible.)
Test or calibration report number - if a report is provided (*)	LNK2023-496	The test or calibration report must be provided in a separate file. The report number can only be stated in the certificate if the report is provided.
Do you want and allow that this number is stated in the certificate? (*)	yes	
Comments	additional filtration=3.8mmAl +2.5mm Sn	
Comments	1st HVL=2.34 mmCu and second HVL=2.45mmCu	
Comments	H*(10)=9.8 mSv +/-0.5 mSv (k=2)	

Co-60



Cs-137



N-150



N-30



**Cs-137 H*10 irradiations relative uncertainty contributions
all $k = 2$**

Source of uncertainty	$u_{i,A}$	$u_{i,B}$	$u_{i,A}^2 + u_{i,B}^2$	Comment
Air density correction	0,00%	0,26%	6,89E-06	
Source to dosimeter distance	0,20%	0,00%	3,92E-06	
Conversion coefficient	0,00%	2,00%	0,0004	
Other sources of uncertainty...	0,00%	0,66%	4,42E-05	
Combined uncertainty, $H^*(10)$			0,021331	

Name of the person, who filled this form **Liviu-Cristian Mihailescu** Please, fill in all grey cells - if possible.

Laboratory name or identification * **SCK CEN / LNK** * marked data will be stated in the certificate (otherwise "not stated").

Date of arrival of the dosimeters **2023-10-01**

Date of dispatch back of the dosimeters **2023-10-12**

Date of irradiations * **2023-10-10** You can also report several dates or a range of dates (it is recommended to perform the irradiations of a radiation quality within a day).

Names of persons who performed the irradiations (*) **Bart Marlein** (*) marked data will only be stated in the certificate if agreed.

Do you want and allow that these names are stated in the certificate? (*) **yes** A "yes" means these persons have agreed that their names are stated in the certificate.

Radiation quality * **S-Co (Co-60)**

Facility name or identification * **DS-20 panoramic Hopewell irradiator source P2**

$H^{*}(10)$ conversion coefficient (Sv/Gy) * **2,000**

Irradiation distance (mm) * **1000,0** In case of different values for your irradiation, please report the average value.

Irradiation time (seconds) * **213,0** In case of different values for your irradiation, please report the average value.

Build-up plate in front of the dosimeters (recommended for gamma-ray) **3 mm PMMA**

Air temperature (°C) **19-22** Ambient conditions during irradiation.

Air pressure (hPa=mbar) **1014-1017** Ambient conditions during irradiation.

Air relative humidity (%) **55-56** Ambient conditions during irradiation.

Number of dosimeters irradiated at the same time * **2** In case of different values for your irradiation, please report the most used value.

(2 dosimeter recommended at a time for gamma-ray)

Relative uncertainty of irradiated doses (%) * **2,3%** Only % values are allowed (recommended with 1 decimal place).

(relative in % with $k = 2$, i.e. 95 % confidence)

Traceability is to this standards laboratory **PTB (D)**

Dosimeter number * (dosimeters should be taken by chance and not in order)	Irradiation status	Irradiated dose (mSv) * (recommended with 2 decimal places)
903	irradiated	10,00
923	irradiated	10,00
916	irradiated	10,00
926	irradiated	10,00
896	irradiated	10,00
906	irradiated	10,00
932	irradiated	10,00
901	irradiated	10,00
921	irradiated	10,00
897	irradiated	10,00

Photo of the irradiation setup provided? **yes** The photo must be provided in a separate file (it is recommended to make additional photos of all irradiations with dosimeter IDs visible.)

Test or calibration report number - if a report is provided (*) **LNK2023-496** The test or calibration report must be provided in a separate file. The report number can only be stated in the certificate if the report is provided.

Do you want and allow that this number is stated in the certificate? (*) **yes**

Comments **$H^{*}(10)=10.0$ mSv ± 0.5 mSv ($k=2$)**

Comments **irradiated in groups of 2, in the consecutive order.**

Comments **serial number starts with 48747+ 3 digits from the table above**

N-150 H*10 irradiations relative uncertainty contributions all k = 1

Source of uncertainty	$u_{i,A}$	$u_{i,B}$	$u_{i,A}^2 + u_{i,B}^2$	Comment
Air density correction	0	0	0	
Source to dosimeter distance	0	0,002	0,000004	
Conversion coefficient	0	0,02	0,0004	
Other sources of uncertainty...	0,007	0,001	0,00005	
Combined uncertainty, H*(10)			0,021307	

Name of the person, who filled this form Laboratory name or identification * Date of arrival of the dosimeters Date of dispatch back of the dosimeters Date of irradiations * Names of persons who performed the irradiations (*) Do you want and allow that these names are stated in the certificate? (*) Radiation quality * Facility name or identification * Setting of tube voltage (kV) Setting of tube current (mA) Inherent filtration (mm Be) or inherent filtration (mm Al) Additional filtration (mm Al) First half value layer HVL (mm Al) * Standardized radiation field * H*(10) conversion coefficient (Sv/Gy) * Irradiation distance (mm) * Irradiation time (seconds) * Build-up plate in front of the dosimeters (not recommended for x-ray) Air temperature (°C) Air pressure (hPa=mbar) Air relative humidity (%) Number of dosimeters irradiated at the same time * (1 dosimeter recommended at a time for x-ray) Relative uncertainty of irradiated doses (%) * (relative in % with k = 2, i.e. 95 % confidence) Traceability is to this standards laboratory	Stanislav Sandtner Slovak Institute of Metrology (SMU) 2023-09-25 2023-10-18 2023-10-11 Katarina Buzinkayova no N-150 Slovak Institute of Metrology (SMU) 150,0 1,0 - 0,25 3,75 2,40 ISO 4037:2019 matched radiation field 1,580 1000,0 1750,0 no 23,11 998,3 57,32 1 2,1% IAEA	Please, fill in all grey cells - If possible. * marked data will be stated in the certificate (otherwise "not stated"). You can also report several dates or a range of dates (it is recommended to perform the irradiations of a radiation quality within a day). (*) marked data will only be stated in the certificate if agreed. A "yes" means these persons have agreed that their names are stated in the certificate. In case of other filter materials, please specify in the comments. In case of different values for your irradiation, please report the average value. In case of different values for your irradiation, please report the average value. Ambient conditions during irradiation. Ambient conditions during irradiation. Ambient conditions during irradiation. In case of different values for your irradiation, please report the most used value. Only % values are allowed (recommended with 1 decimal place).
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Dosemeter number * (dosemeters should be taken by chance and not in order)	Irradiation status	Irradiated dose (mSv) * (recommended with 2 decimal places)
48747953	irradiated	9,99
48747967	irradiated	9,99
48747940	irradiated	9,99
48747963	irradiated	9,99
48747958	irradiated	9,99
48747939	irradiated	9,99
48747947	irradiated	9,99
48747971	irradiated	9,99
48747955	irradiated	9,99
48747964	irradiated	9,99
48747965	not irradiated (background)	
48747946	not irradiated (background)	
48747961	not irradiated (background)	
48747944	not irradiated (background)	
48747942	not irradiated (background)	
48747959	not irradiated (background)	

Photo of the irradiation setup provided? Test or calibration report number - if a report is provided (*) Do you want and allow that this number is stated in the certificate? (*)	yes yes yes	The photo must be provided in a separate file (it is recommended to make additional photos of all irradiations with dosimeter IDs visible.) The test or calibration report must be provided in a separate file. The report number can only be stated in the certificate if the report is provided. Comments irradiated dose is smaller, because we can only set timer at accuracy of ten seconds (real irradiation time should be 1751 seconds) Comments First half value layer is in the mm Cu, not in the mm Al Comments
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Cs-137 H*10 irradiations relative uncertainty contributions all k = 1

Source of uncertainty	$u_{i,A}$	$u_{i,B}$	$u_{i,A}^2 + u_{i,B}^2$	Comment
Air density correction	0	0	0	
Source to dosimeter distance		0,00003	9E-10	
Conversion coefficient		0,02	0,0004	
Other sources of uncertainty...	0,004381404	0,00122	2,069E-05	
Combined uncertainty, H*(10)			0,0205106	

Name of the person, who filled this form: Stanislav Sandtner
 Laboratory name or identification: Slovak Institute of Metrology (SMU)
 Date of arrival of the dosimeters: 2023-09-25
 Date of dispatch back of the dosimeters: 2023-10-18
 Date of irradiations: 2023-10-11

Names of persons who performed the irradiations (*): Stanislav Sandtner

Do you want and allow that these names are stated in the certificate? (*): yes

Radiation quality: S-Cs (Cs-137)
 Facility name or identification: Slovak Institute of Metrology (SMU)

Please, fill in all grey cells - if possible.
 * marked data will be stated in the certificate (otherwise "not stated").
 You can also report several dates or a range of dates (it is recommended to perform the irradiations of a radiation quality within a day).
 (*) marked data will only be stated in the certificate if agreed.
 A "yes" means these persons have agreed that their names are stated in the certificate.

H*(10) conversion coefficient (Sv/Gy): 1,210
 Irradiation distance (mm): 4000,0
 Irradiation time (seconds): 1589,0

Build-up plate in front of the dosimeters (recommended for gamma-ray): 3 mm PMMA

Air temperature (°C): 22,4
 Air pressure (hPa=mbar): 996,3
 Air relative humidity (%): 54,04

Number of dosimeters irradiated at the same time (2 dosimeter recommended at a time for gamma-ray): 1

Relative uncertainty of irradiated doses (%): 2,1%
(relative in % with k = 2, i.e. 95 % confidence)

Traceability is to this standards laboratory: Slovak institute of Metrology (primary chamber ND1005/A)

In case of different values for your irradiation, please report the average value.
 In case of different values for your irradiation, please report the average value.
 Ambient conditions during irradiation.
 Ambient conditions during irradiation.
 Ambient conditions during irradiation.
 In case of different values for your irradiation, please report the most used value.
 Only % values are allowed (recommended with 1 decimal place).

Dosemeter number (dosemeters should be taken by chance and not in order)	Irradiation status	Irradiated dose (mSv) (recommended with 2 decimal places)
48747968	irradiated	10,00
48747960	irradiated	10,00
48747943	irradiated	10,00
48747957	irradiated	10,00
48747966	irradiated	10,00
48747954	irradiated	10,00
48747938	irradiated	10,00
48747962	irradiated	10,00
48747956	irradiated	10,00
48747941	irradiated	10,00
48747965	not irradiated (background)	
48747946	not irradiated (background)	
48747961	not irradiated (background)	
48747944	not irradiated (background)	
48747942	not irradiated (background)	
48747959	not irradiated (background)	

Photo of the irradiation setup provided? yes

Test or calibration report number - if a report is provided (*):

Do you want and allow that this number is stated in the certificate? (*): yes

Comments: we used 1 dosimeter a time to reduce the uncertainty (dosimeter was at the center of the beam)

The photo must be provided in a separate file (it is recommended to make additional photos of all irradiations with dosimeter IDs visible.)
 The test or calibration report must be provided in a separate file. The report number can only be stated in the certificate if the report is provided.

N-30 H*10 irradiations relative uncertainty contributions all k = 2

Source of uncertainty	$u_{i,A}$	$u_{i,B}$	$u_{i,A}^2 + u_{i,B}^2$	Comment
Air density correction		0,0024	5,76E-06	
Source to dosimeter distance		0,0012	1,44E-06	
Conversion coefficient		0,04	0,0016	
Other sources of uncertainty...	0,001	0,03	0,000901	
Combined uncertainty, H*(10)			0,050082	

Name of the person, who filled this form: Jussi Huikari
 Laboratory name or identification: STUK
 Date of arrival of the dosimeters:
 Date of dispatch back of the dosimeters: 2023-10-16
 Date of irradiations: 2023-10-11

Names of persons who performed the irradiations (*): Panu Pousi

Do you want and allow that these names are stated in the certificate? (*): yes

Radiation quality: N-30
 Facility name or identification: STUK
 Setting of tube voltage (kV): 30,0
 Setting of tube current (mA): 31,0
 Inherent filtration (mm Be) or inherent filtration (mm Al): 3,00
 Additional filtration (mm Al): 4,00
 First half value layer HVL (mm Al): 1,22
 Standardized radiation field: ISO 4037:2019 characterized radiation field
 H*(10) conversion coefficient (Sv/Gy): 0,829
 Irradiation distance (mm): 2000,0
 Irradiation time (seconds): 676,0

Build-up plate in front of the dosimeters (not recommended for x-ray): no
 Air temperature (°C): 20
 Air pressure (hPa=mbar): 98,8
 Air relative humidity (%): 50

Number of dosimeters irradiated at the same time (*): 1
 (1 dosimeter recommended at a time for x-ray)
 Relative uncertainty of irradiated doses (%): 5,0%
 (relative in % with k = 2, i.e. 95 % confidence)
 Traceability is to this standards laboratory: PTB

Please, fill in all grey cells - if possible.
 * marked data will be stated in the certificate (otherwise "not stated").

You can also report several dates or a range of dates (it is recommended to perform the irradiations of a radiation quality within a day).

(*) marked data will only be stated in the certificate if agreed.

A "yes" means these persons have agreed that their names are stated in the certificate.

In case of other filter materials, please specify in the comments.

In case of different values for your irradiation, please report the average value.

In case of different values for your irradiation, please report the average value.

Ambient conditions during irradiation.

Ambient conditions during irradiation.

Ambient conditions during irradiation.

In case of different values for your irradiation, please report the most used value.

Only % values are allowed (recommended with 1 decimal place).

Dosemeter number * (dosemeters should be taken by chance and not in order)	Irradiation status	Irradiated dose (mSv) * (recommended with 2 decimal places)
48748000	irradiated	10,00
48748011	irradiated	10,00
48748009	irradiated	10,00
48747999	irradiated	10,00
48747994	irradiated	10,00
48747995	irradiated	10,00
48747996	irradiated	10,00
48747997	irradiated	10,00
48747998	irradiated	10,00
48748024	irradiated	10,00

Photo of the irradiation setup provided?

Test or calibration report number - if a report is provided (*): S/52/23

Do you want and allow that this number is stated in the certificate? (*): yes

Comments:
 Comments:
 Comments:

The photo must be provided in a separate file (it is recommended to make additional photos of all irradiations with dosimeter IDs visible.)

The test or calibration report must be provided in a separate file. The report number can only be stated in the certificate if the report is provided.

N-150 H*10 irradiations relative uncertainty contributions all k = 2

Source of uncertainty	$u_{i,A}$	$u_{i,B}$	$u_{i,A}^2 + u_{i,B}^2$	Comment
Air density correction		0,004	0,000016	
Source to dosimeter distance		0,0024	5,76E-06	
Conversion coefficient		0,04	0,0016	
Other sources of uncertainty...	0,001	0,019	0,000362	
Combined uncertainty, H*(10)			0,044539	

Name of the person, who filled this form Laboratory name or identification * STUK Date of arrival of the dosimeters Date of dispatch back of the dosimeters Date of irradiations * 11. - 12.10.2023 Names of persons who performed the irradiations (*) Panu Pousi, Jussi Huikari Do you want and allow that these names are stated in the certificate? (*) yes Radiation quality * N-150 Facility name or identification * STUK Setting of tube voltage (kV) 150,0 Setting of tube current (mA) 5,0 Inherent filtration (mm Be) 7,00 or inherent filtration (mm Al) Additional filtration (mm Al) 3,90 First half value layer HVL (mm Al) * 2,39 mmCu Standardized radiation field * ISO 4037:2019 matched radiation field H*(10) conversion coefficient (Sv/Gy) * 1,580 Irradiation distance (mm) * 2000,0 Irradiation time (seconds) * 1539,8 Build-up plate in front of the dosimeters (not recommended for x-ray) no Air temperature (°C) 20 Air pressure (hPa=mbar) 98,9 Air relative humidity (%) 50 Number of dosimeters irradiated at the same time * 1 (1 dosimeter recommended at a time for x-ray) Relative uncertainty of irradiated doses (%) * 4,5% (relative in % with k = 2, i.e. 95 % confidence) Traceability is to this standards laboratory PTB	Please, fill in all grey cells - if possible. * marked data will be stated in the certificate (otherwise "not stated"). You can also report several dates or a range of dates (it is recommended to perform the irradiations of a radiation quality within a day). (*) marked data will only be stated in the certificate if agreed. A "yes" means these persons have agreed that their names are stated in the certificate. In case of other filter materials, please specify in the comments. In case of different values for your irradiation, please report the average value. In case of different values for your irradiation, please report the average value. Ambient conditions during irradiation. Ambient conditions during irradiation. Ambient conditions during irradiation. In case of different values for your irradiation, please report the most used value. Only % values are allowed (recommended with 1 decimal place).
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Dosemeter number * (dosemeters should be taken by chance and not in order)	Irradiation status	Irradiated dose (mSv) * (recommended with 2 decimal places)
48748013	irradiated	10,00
48748012	irradiated	10,00
48748010	irradiated	10,00
48748002	irradiated	10,00
48748001	irradiated	10,00
48748003	irradiated	10,00
48748025	irradiated	10,00
48748026	irradiated	10,00
48748027	irradiated	10,00
48748028	irradiated	10,00

Photo of the irradiation setup provided? Test or calibration report number - if a report is provided (*) S/52/23 Do you want and allow that this number is stated in the certificate? (*) yes Comments filtration: 3.9 mmSi + 2.5 mmSn Comments Comments	The photo must be provided in a separate file (it is recommended to make additional photos of all irradiations with dosimeter IDs visible.) The test or calibration report must be provided in a separate file. The report number can only be stated in the certificate if the report is provided.
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Cs-137 H*10 irradiations relative uncertainty contributions all k = 2

Source of uncertainty	$u_{i,A}$	$u_{i,B}$	$u_{i,A}^2 + u_{i,B}^2$	Comment
Air density correction		0	0	
Source to dosimeter distance		0,0024	5,76E-06	
Conversion coefficient		0,04	0,0016	
Other sources of uncertainty...	0,001	0,02	0,000401	
Combined uncertainty, H*(10)			0,044797	

Name of the person, who filled this form	Jussi Huikari	Please, fill in all grey cells - if possible.
Laboratory name or identification *	STUK	* marked data will be stated in the certificate (otherwise "not stated").
Date of arrival of the dosimeters		
Date of dispatch back of the dosimeters	2023-10-16	
Date of irradiations *	2023-10-11	You can also report several dates or a range of dates (it is recommended to perform the irradiations of a radiation quality within a day).
Names of persons who performed the irradiations (*)	Jan Morelius	(*) marked data will only be stated in the certificate if agreed.
Do you want and allow that these names are stated in the certificate? (*)	yes	A "yes" means these persons have agreed that their names are stated in the certificate.
Radiation quality *	S-Cs (Cs-137)	
Facility name or identification *	STUK	

H *(10) conversion coefficient (Sv/Gy) *	1,210	In case of different values for your irradiation, please report the average value.
Irradiation distance (mm) *	1530,0	In case of different values for your irradiation, please report the average value.
Irradiation time (seconds) *	720,0	In case of different values for your irradiation, please report the average value.
Build-up plate in front of the dosimeters (recommended for gamma-ray)	3 mm PMMA	
Air temperature (°C)	20	Ambient conditions during irradiation.
Air pressure (hPa=mbar)	98,9	Ambient conditions during irradiation.
Air relative humidity (%)	50	Ambient conditions during irradiation.
Number of dosimeters irradiated at the same time * (2 dosimeter recommended at a time for gamma-ray)	2	In case of different values for your irradiation, please report the most used value.
Relative uncertainty of irradiated doses (%) * (relative in % with k = 2, i.e. 95 % confidence)	4,5%	Only % values are allowed (recommended with 1 decimal place).
Traceability is to this standards laboratory	NPL	

Dosimeter number * (dosimeters should be taken by chance and not in order)	Irradiation status	Irradiated dose (mSv) * (recommended with 2 decimal places)
48748031	irradiated	10,00
48748029	irradiated	10,00
48748030	irradiated	10,00
48748032	irradiated	10,00
48748034	irradiated	10,00
48748033	irradiated	10,00
48747985	irradiated	10,00
48747986	irradiated	10,00
48747987	irradiated	10,00
48747988	irradiated	10,00
48748004	wrong irradiated	16,72
48748005	wrong irradiated	16,72

Photo of the irradiation setup provided?		The photo must be provided in a separate file (it is recommended to make additional photos of all irradiations with dosimeter IDs visible.)
Test or calibration report number - if a report is provided (*)	S/52/23	The test or calibration report must be provided in a separate file. The report number can only be stated in the certificate if the report is provided.
Do you want and allow that this number is stated in the certificate? (*)	yes	
Comments		
Comments		
Comments		

N-150 H*10 irradiations relative uncertainty contributions all k = 2

Source of uncertainty	$u_{i,A}$	$u_{i,B}$	$u_{i,A}^2 + u_{i,B}^2$	Comment
Air density correction		0,001	0,000001	
Source to dosimeter distance		0,0006	3,6E-07	
Conversion coefficient		0,02	0,0004	
Other sources of uncertainty...	0,0043	0,0091	0,000101	
Combined uncertainty, H*(10)			0,02242	

Name of the person, who filled this form	Milos Zivanovic	Please, fill in all grey cells - if possible.
Laboratory name or identification *	Vinca Institute of Nuclear Sciences - National Institute	* marked data will be stated in the certificate (otherwise "not stated").
Date of arrival of the dosimeters	9.10.2023.	
Date of dispatch back of the dosimeters	13.10.2023.	
Date of irradiations *	11.10.2023.	You can also report several dates or a range of dates (it is recommended to perform the irradiations of a radiation quality within a day).
Names of persons who performed the irradiations (*)	Nikola Krzanovic, Milos Zivanovic	(*) marked data will only be stated in the certificate if agreed.
Do you want and allow that these names are stated in the certificate? (*)	yes	A "yes" means these persons have agreed that their names are stated in the certificate.
Radiation quality *	N-150	
Facility name or identification *	Secondary Standards Dosimetry Laboratory of Vinca Institute	
Setting of tube voltage (kV)	150,0	
Setting of tube current (mA)	20,0	
Inherent filtration (mm Be) or inherent filtration (mm Al)	4,00	
Additional filtration (mm Al)	2.5 mm Sn	In case of other filter materials, please specify in the comments.
First half value layer HVL (mm Al) *	2,46	
Standardized radiation field	ISO 4037:2019 matched radiation field	
H*(10) conversion coefficient (Sv/Gy) *	1,580	
Irradiation distance (mm) *	2000,0	In case of different values for your irradiation, please report the average value.
Irradiation time (seconds) *	318,1	In case of different values for your irradiation, please report the average value.
Build-up plate in front of the dosimeters (not recommended for x-ray)	no	
Air temperature (°C)	22,7	Ambient conditions during irradiation.
Air pressure (hPa=mbar)	1014	Ambient conditions during irradiation.
Air relative humidity (%)	55	Ambient conditions during irradiation.
Number of dosimeters irradiated at the same time * (1 dosimeter recommended at a time for x-ray)	1	In case of different values for your irradiation, please report the most used value.
Relative uncertainty of irradiated doses (%) * (relative in % with k = 2, i.e. 95 % confidence)	2,2%	Only % values are allowed (recommended with 1 decimal place).
Traceability is to this standards laboratory	PTB through IAEA	

Dosemeter number * (dosemeters should be taken by chance and not in order)	Irradiation status	Irradiated dose (mSv) * (recommended with 2 decimal places)
AMB 040	irradiated	10,04
AMB 011	irradiated	10,04
AMB 037	irradiated	10,04
AMB 017	irradiated	10,04
AMB 046	irradiated	10,04
AMB 032	irradiated	10,04
AMB 007	irradiated	10,04
AMB 006	irradiated	10,04
AMB 042	irradiated	10,04
AMB 012	irradiated	10,04

Photo of the irradiation setup provided?	yes	The photo must be provided in a separate file (it is recommended to make additional photos of all irradiations with dosimeter IDs visible.)
Test or calibration report number - if a report is provided (*)	898	The test or calibration report must be provided in a separate file. The report number can only be stated in the certificate if the report is provided.
Do you want and allow that this number is stated in the certificate? (*)	yes	
Comments	additional filtration is in mm Sn	
Comments		
Comments		

Cs-137 H*10 irradiations relative uncertainty contributions all k = 2

Source of uncertainty	$u_{i,A}$	$u_{i,B}$	$u_{i,A}^2 + u_{i,B}^2$	Comment
Air density correction		0,001	0,000001	
Source to dosimeter distance		0,0004	1,6E-07	
Conversion coefficient		0,02	0,0004	
Other sources of uncertainty...	0,0045	0,0058	5,39E-05	
Combined uncertainty, H*(10)			0,021332	

Name of the person, who filled this form: Milos Zivanovic
 Laboratory name or identification: Vinca Institute of Nuclear Sciences - National Institute
 Date of arrival of the dosimeters: 9.10.2023.
 Date of dispatch back of the dosimeters: 13.10.2023.
 Date of irradiations: 10.10. - 11.10.2023.
 Names of persons who performed the irradiations (*): Milos Zivanovic, Nikola Krzanovic
 Do you want and allow that these names are stated in the certificate? (*): yes
 Radiation quality: S-Cs (Cs-137)
 Facility name or identification: Secondary Standards Dosimetry Laboratory of Vinca Institute

Please, fill in all grey cells - if possible.
 * marked data will be stated in the certificate (otherwise "not stated").
 You can also report several dates or a range of dates (it is recommended to perform the irradiations of a radiation quality within a day).
 (*) marked data will only be stated in the certificate if agreed.
 A "yes" means these persons have agreed that their names are stated in the certificate.

H*(10) conversion coefficient (Sv/Gy): 1,210
 Irradiation distance (mm): 1500,0
 Irradiation time (seconds): 7581,0
 Build-up plate in front of the dosimeters (recommended for gamma-ray): 3 mm PMMA
 Air temperature (°C): 21
 Air pressure (hPa=mbar): 1010
 Air relative humidity (%): 57
 Number of dosimeters irradiated at the same time (2 dosimeter recommended at a time for gamma-ray): 2
 Relative uncertainty of irradiated doses (%): 2,1%
 Traceability is to this standards laboratory: BIPM through IAEA

In case of different values for your irradiation, please report the average value.
 In case of different values for your irradiation, please report the average value.
 Ambient conditions during irradiation.
 Ambient conditions during irradiation.
 Ambient conditions during irradiation.
 In case of different values for your irradiation, please report the most used value.
 Only % values are allowed (recommended with 1 decimal place).

Dosimeter number (dosimeters should be taken by chance and not in order)	Irradiation status	Irradiated dose (mSv) (recommended with 2 decimal places)
AMB 001	irradiated	10,00
AMB 016	irradiated	10,00
AMB 029	irradiated	10,00
AMB 048	irradiated	10,00
AMB 010	irradiated	10,00
AMB 033	irradiated	10,00
AMB 038	irradiated	10,00
AMB 045	irradiated	10,00
AMB 009	irradiated	10,00
AMB 013	irradiated	10,00

Photo of the irradiation setup provided? yes
 Test or calibration report number - if a report is provided (*): 898
 Do you want and allow that this number is stated in the certificate? (*): yes
 Comments
 Comments
 Comments

The photo must be provided in a separate file (it is recommended to make additional photos of all irradiations with dosimeter IDs visible.)
 The test or calibration report must be provided in a separate file. The report number can only be stated in the certificate if the report is provided.

N-150 H*10 irradiations relative uncertainty contributions all k = 2

Source of uncertainty	$u_{i,A}$	$u_{i,B}$	$u_{i,A}^2 + u_{i,B}^2$	Comment
Air density correction		0,001	0,000001	
Source to dosimeter distance		0,0004	1,6E-07	
Conversion coefficient		0,02	0,0004	
Other sources of uncertainty...	0,0045	0,0058	5,39E-05	
Combined uncertainty, H*(10)			0,021332	

Name of the person, who filled this form: Milos Zivanovic

Laboratory name or identification: Vinca Institute of Nuclear Sciences - National Institute

Date of arrival of the dosimeters: 9.10.2023.

Date of dispatch back of the dosimeters: 13.10.2023.

Date of irradiations: 10.10.2023.

Names of persons who performed the irradiations (*): Nikola Krzanovic, Milos Zivanovic

Do you want and allow that these names are stated in the certificate? (*): yes

Radiation quality: S-Co (Co-60)

Facility name or identification: Secondary Standards Dosimetry Laboratory of Vinca Institute

Please, fill in all grey cells - if possible.
(*) marked data will be stated in the certificate (otherwise "not stated").
You can also report several dates or a range of dates (it is recommended to perform the irradiations of a radiation quality within a day).
(*) marked data will only be stated in the certificate if agreed.
A "yes" means these persons have agreed that their names are stated in the certificate.

H*(10) conversion coefficient (Sv/Gy): 1,160

Irradiation distance (mm): 3000,0

Irradiation time (seconds): 616,0

Build-up plate in front of the dosimeters (recommended for gamma-ray): 3 mm PMMA

Air temperature (°C): 20,9

Air pressure (hPa=mbar): 1010

Air relative humidity (%): 55

Number of dosimeters irradiated at the same time (2 dosimeter recommended at a time for gamma-ray): 2

Relative uncertainty of irradiated doses (%): 2,1% (relative in % with k = 2, i.e. 95 % confidence)

Traceability is to this standards laboratory: BIPM through IAEA

In case of different values for your irradiation, please report the average value.
In case of different values for your irradiation, please report the average value.
Ambient conditions during irradiation.
Ambient conditions during irradiation.
Ambient conditions during irradiation.
In case of different values for your irradiation, please report the most used value.
Only % values are allowed (recommended with 1 decimal place).

Dosimeter number (dosimeters should be taken by chance and not in order)	Irradiation status	Irradiated dose (mSv) (recommended with 2 decimal places)
AMB 021	irradiated	9,99
AMB 022	irradiated	9,99
AMB 023	irradiated	9,99
AMB 024	irradiated	9,99
AMB 025	irradiated	9,99
AMB 026	irradiated	9,99
AMB 027	irradiated	9,99
AMB 028	irradiated	9,99
AMB 004	irradiated	9,99
AMB 015	irradiated	9,99

Photo of the irradiation setup provided? yes

Test or calibration report number - if a report is provided (*): 898

Do you want and allow that this number is stated in the certificate? (*): yes

Comments

Comments

Comments

The photo must be provided in a separate file (it is recommended to make additional photos of all irradiations with dosimeter IDs visible.)
The test or calibration report must be provided in a separate file. The report number can only be stated in the certificate if the report is provided.