

Extremity Dosemeter Intercomparison IC2024ext

Certificate of Participation

for the EURADOS Extremity Dosimeter Intercomparison IC2024ext

Certificate Number: EURADOS-2020- S052/2024

Number of pages: 3

Date of Issue: 21/03/2025

Participating Institute: Tecnorad srl

Dosimetry System: S052/2024

Reporting Number: 68

Intercomparison procedure: The EURADOS Intercomparison 2024 for extremity dosimeters was managed and coordinated on behalf of EURADOS by the WG2 Intercomparison Organization Group (OG). The OG established the irradiation plan and announced the intercomparison, including the range limits of the doses and radiation qualities, in March 2024.

Participants were asked to indicate the details of the dosimeter reference point on the online application form. After completing the application procedures, they sent their dosimeters—following the provided instructions—to the Coordinator (May 2024). The Coordinator verified the correct labeling of the dosimeters and transferred the dosimeters, along with the instructions, to the corresponding laboratories for beta and gamma irradiations. The dosimeters were irradiated according to the irradiation plan between May 2024 and July 2024.

The Coordinator then returned the dosimeters to the participants and indicated which dosimeters had not been irradiated. The participants were instructed to follow normal routine procedures as far as possible. The participants then sent the results of the dosimeter readings to the Coordinator (May 2021). After receipt of the participants' results, the Coordinator sent the irradiation data to the participants.

Number of participants: 65 institutes from 30 countries participated in IC2024ext with a total of 78 systems.

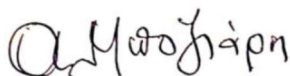
Coordinators: Argiro Boziari, Panagiotis Askounis, Eirini Trifylli (Greek Atomic Energy Commission, Patriarxou Grigoriou and Neapoleos 15341, Agia Paraskevi, Greece)

Intercomparison results: See the table on pages 2 to 4 of this certificate.

Irradiation data: See the attached certificate DOS/2512-Sxxx/2024 for gamma irradiations and No: 2025 – Sxxx for beta irradiations.

Participant results: See the table on page 2 of the certificate

On behalf of the intercomparison
Organization Group:



Argiro Boziari

On behalf of the intercomparison



Filip Vanhavere
Chairperson

Extremity Dosemeter Intercomparison IC2024ext

Results of Intercomparison: Dosimetry System - S052/2024

Dosemeters irradiation status: Irradiated

Dosemeters		Radiation Quality		Dose Values H _p (0.07)		
Eurados_ID	Participant's ID	Quality	Angle	Participant's Value (mSv)	Reference Value (mSv)	Ratio
S052/2024-02	S052/2024-02	W-80	60°	3.541	3.50	1.01
S052/2024-04	S052/2024-04	Sr-90	0°	3.493	2.50	1.40
S052/2024-05	S052/2024-05	W-80	0°	303.3	285	1.06
S052/2024-06	S052/2024-06	W-80	0°	51.07	50.0	1.02
S052/2024-07	S052/2024-07	W-80	0°	4.734	4.70	1.01
S052/2024-08	S052/2024-08	W-80	60°	3.506	3.50	1.00
S052/2024-10	S052/2024-10	Sr-90	0°	2.908	2.50	1.16
S052/2024-12	S052/2024-12	N-25	0°	2.209	2.70	0.82
S052/2024-13	S052/2024-13	W-80	0°	51.71	50.0	1.03
S052/2024-15	S052/2024-15	N-25	0°	2.538	2.70	0.94
S052/2024-16	S052/2024-16	W-80	0°	4.774	4.70	1.02
S052/2024-18	S052/2024-18	Cs-137	0°	4.63	4.80	0.96
S052/2024-19	S052/2024-19	W-80	0°	4.85	4.70	1.03
S052/2024-22	S052/2024-22	W-80	0°	4.874	4.70	1.04
S052/2024-23	S052/2024-23	W-80	0°	305.7	285	1.07
S052/2024-24	S052/2024-24	Kr-85	0°	1.891	3.01	0.63
S052/2024-25	S052/2024-25	Sr-90	60°	1.607	2.20	0.73
S052/2024-27	S052/2024-27	Sr-90	60°	1.902	2.20	0.86
S052/2024-29	S052/2024-29	Kr-85	0°	1.569	3.01	0.52
S052/2024-30	S052/2024-30	Cs-137	0°	4.576	4.80	0.95

Extremity Dosemeter Intercomparison IC2024ext

Results of Intercomparison: Dosimetry System - S052/2024

Dosemeters irradiation status: Not Irradiated

Dosemeters		Radiation Quality	
Eurados_ID	Participant's ID	Quality	Angle
S052/2024-01	S052/2024-01	Not Irradiated	
S052/2024-03	S052/2024-03	Not Irradiated	
S052/2024-09	S052/2024-09	Not Irradiated	
S052/2024-11	S052/2024-11	Not Irradiated	
S052/2024-14	S052/2024-14	Not Irradiated	
S052/2024-17	S052/2024-17	Not Irradiated	
S052/2024-20	S052/2024-20	Not Irradiated	
S052/2024-21	S052/2024-21	Not Irradiated	
S052/2024-26	S052/2024-26	Not Irradiated	
S052/2024-28	S052/2024-28	Not Irradiated	

Radiation Qualities and average photon energy (according to ISO 4037-1, ISO 6980-1):

Gamma radiation:

S-Cs: 662 keV

X-ray radiation:

N-25: 20.3 keV

W-80: 57 keV

Beta radiation:

Kr-85: 0.69 MeV (Emax)

Sr-90/Y-90: 2.3 MeV (Emax)



HELLENIC REPUBLIC
MINISTRY OF DEVELOPMENT
GENERAL SECRETARIAT FOR RESEARCH AND INNOVATION



Our Ref: CDU/428/2591/06.03.2025



IONIZING RADIATION CALIBRATION LABORATORY
Affiliated to the Hellenic Metrology Institute

IRRADIATION CERTIFICATE No: **DOS /3090 - 52/25**

Number of Pages: **2**

The following personnel dosimeters from: **EURADOS Intercomparison Program IC2025ext
System No: S052/2024**
have been irradiated at the ***Ionizing Radiation Calibration Laboratory of Greek Atomic Energy Commission:***

Personal Dosimeters (PD):	Extremity, Fingertip Dosimeters
System Identification:	-
Detector type/Material:	-
Irradiation Dates:	See table (page 2)

The Kair reference values have been obtained using the reference/transfer ionization chamber PTW W-32002-LS01 (S/N:69) and the electrometer PTW UNIDOS 10002 (S/N:20314). The LS01 chamber was calibrated in PTB for S-Cs, ISO –Narrow Series during 22-26/09/2022 (PTB, Cal. Cert. No PTB-6.3-4111433). Both FC65-G chamber and electrometer were calibrated at BIPM for S-Co on 12/02/2024 (BIPM, Cal. Cert. No 6). The irradiation conditions are in accordance to ISO 4037/1-2-3-4.
The uncertainties refer to 95 % confidence level.

Irradiation conditions

Phantom:	ISO rod phantom (cylinder diameter 19 mm, length 300 mm, PMMA)
Source to PD Distance:	100-200 cm, depending on required Kair rate
Kair Rate:	S-Cs: 0.438 mGy/min (at 100 cm) W-80: 2.63 mGy/min (at 200 cm) W-80: 5.35 mGy/min (at 150 cm) N-25: 0.619 mGy/ min (at 150 cm)
Field Size:	S-Cs: Circular with diameter of 55.6 cm (at 200 cm) x-rays: Circular with diameter 26.8 cm (at 200 cm)
Build up PMMA:	S-Cs: (0.3 x 30x30) cm ³
Reference point of PD:	Frontal surface of phantom

Environmental conditions during irradiations:

Temperature	Pressure	Relative Humidity
19.0-20.0 °C	985.0-990.0 hPa	10 %

Photon and X-rays Irradiation Data

# Dosemeter	Date	Quality	H _p (0.07) mSv	U % (1)
S052-18	15/05/2024	S-Cs	4.80	4.9
S052-30	15/05/2024	S-Cs	4.80	4.9
S052-07	16/05/2024	W-80	4.70	5.1
S052-16	16/05/2024	W-80	4.70	5.1
S052-19	16/05/2024	W-80	4.70	5.1
S052-22	16/05/2024	W-80	4.70	5.1
S052-13	20/05/2024	W-80	50.0	5.1
S052-06	20/05/2024	W-80	50.0	5.1
S052-05	04/07/2024	W-80	285	5.1
S052-23	04/07/2024	W-80	285	5.1
S052-12	26/06/2024	N-25	2.70	4.9
S052-15	26/06/2024	N-25	2.70	4.9
S052-02	15/07/2024	W-80 (60°)	3.50	5.3
S052-08	15/07/2024	W-80 (60°)	3.50	5.3

¹U= uncertainty 95% confidence level (k=2)

Not Irradiated Dosimeters :

S052-17; S052-01; S052-14; S052-11; S052-21; S052-20;

**Head of Dosimetry and Calibration
Department**

Calibration performed by:
Stamatopoulou E.

Argyro Boziari
06/06/2025 16:01

Argiro Boziari

 Calibration No. of Certificate 117	This certificate is issued in according with the requirements of ISO 17025. It provides traceability of measurements to recognized national standards laboratories. The IRCL/EEAE is a member of the IAEA/WHO Secondary Standard Dosimetry Laboratory Network. This certificate may not be reproduced other than in full, except with the prior written approval of the IRCL/EEAE
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Test report

N° 2025-S052

Direction de la recherche et
de l'expertise en
santé/SDOS/LDRI
BP 17
92262 Fontenay-aux-Roses
CEDEX France
Tél : 01.58.35.90.54

Subject : EURADOS comparison exercise 2024 (IC2024ext) - Beta irradiation of personal extremity dosimeters in terms of personal dose equivalent $H_p(0.07)$

Ordered by : EURADOS Working Group 2 “Harmonisation of individual Monitoring”

Participant : EURADOS comparison dosimeter system
Identification S052

Dosemeter : Personal dosimeters

This report includes 3 pages
Date of issue: 24th March 2025

Technical Manager of calibration activities



Signature
numérique de
ASNR
Date : 2025.03.24
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L. VAN-RYCKEGHEM

1. METHOD

The irradiations are performed in terms of personal dose equivalent, $H_p(0.07)$ according to the Standard ISO 6980 [1-3]. The unity of this quantity is mSv.

The calibration equipment is a « beta Secondary Standard 2 » manufactured by ISOTRAK/PTB [4]. The radioactive sources used during this comparison exercise are $^{90}\text{Sr}/\text{Y}$ and ^{85}Kr . The traceability of these standards is established by the national standard laboratory, PTB (Physikalisch-Technische Bundesanstalt).

The reference quantity is established in terms of personal dose equivalent, $H_p(0.07)$, calculated by the BBS2 program [4] including the irradiation conditions (T, P, H). The angular conversion coefficients used in the program are those recommended by ISO Standard 6980-3 [3].

2. RADIATION FIELD AND IRRADIATION SET-UP

Each dosimeter irradiated is placed in the front face of the phantom according to the ISO-6980 standard. The phantom is positioned perpendicularly to the incident beta radiation field. Dosimeters are fixed on the phantom within ± 50 mm from the centre of the axis of the radiation field.

The irradiation configuration is as follows:

- Distance source - test point of the dosimeter: 30 cm. The test point corresponds to the reference point of the dosimeter defined by the participant;
- Diameter of the field and homogeneity: 15 cm in diameter with a homogeneity factor of 1;
- Rotation axis: the rotation axis is parallel to the axis of the phantom and goes through the reference point of the dosimeter
- Phantom for wrist dosimeter: ISO pillar phantom is a water-filled hollow cylinder with PMMA walls and an outer diameter of 73mm and 300 mm in length;
- Phantom for ring dosimeter: ISO rod phantom is cylindrical PMMA phantom with a diameter of 19 mm and 300 mm in length.

3. IRRADIATION RESULTS

The results are included in the following table:

Bagde	Type	Source	Angle(°)	Dose (mSv)	Uncertainty % (k=2)	Date	Comments
S052/2024-10	RING	Sr-90	0	2,50	5,7	22/07/2024	
S052/2024-04	RING	Sr-90	0	2,50	5,7	22/07/2024	
S052/2024-27	RING	Sr-90	60	2,20	7,0	30/07/2024	
S052/2024-25	RING	Sr-90	60	2,20	7,0	30/07/2024	
S052/2024-24	RING	Kr-85	0	3,01	5,9	25/07/2024	
S052/2024-29	RING	Kr-85	0	3,01	5,9	25/07/2024	
S052/2024-28	RING	-	-				Spare
S052/2024-03	RING	-	-				Spare
S052/2024-26	RING	-	-				Back ground
S052/2024-09	RING	-	-				Back ground

Uncertainty:

According to the Guide to the expression of uncertainty in measurement [5], the budget uncertainty is calculated as the quadratic combination of each contribution of uncertainty with the uncertainty due to the determination of the reference quantity given by the BSS2 program. The expanded uncertainties for personal dose equivalent are calculated with a coverage factor of two.

4. REFERENCES

[1] ISO-6980-1. Reference beta-particle radiation - part 1: Methods of production (2023).

[2] ISO 6980-2. Reference beta particle radiation - part 2: Calibration fundamentals related to basic quantities characterizing the radiation fields (2023).

[3] ISO-6980-3. Reference beta particle radiation - part 3: Calibration of area and personal dosimeters and the determination of their response as a function of beta radiation energy and angle of incidence (2023).

[4] AEA Technology - ISOTRAK - Operation Manual Beta Secondary Standard 2 BBS2 (2000).

[5] JCGM 100:2008 - Evaluation of measurement data - Guide to the expression of uncertainty in measurement (2008).