EURADOS European Radiation Dosimetry Group

Extremity Dosemeter Intercomparison IC2024ext

Certificate of Participation

for the EURADOS Extremity Dosemeter Intercomparison IC2024ext

Certificate Number:	EURADOS-2020- S050/2024
Number of pages:	3
Date of Issue:	21/03/2025
Participating Insttute:	Tecnorad srl
Dosimetry System:	S050/2024
ReportingNumber:	61

Intercomparison procedure:

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

The Coordinator then returned the dosemeters to the participants and indicated which dosemeters 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 dosemeter 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 - S050/2024

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
S050/2024-01	S050/2024-01	W-80	60°	4.008	3.70	1.08
S050/2024-02	S050/2024-02	W-80	0°	4.642	4.00	1.16
S050/2024-03	S050/2024-03	W-80	0°	52.13	48.0	1.09
S050/2024-05	S050/2024-05	W-80	0°	4.247	4.00	1.06
S050/2024-12	S050/2024-12	N-25	0°	2.686	3.10	0.87
S050/2024-13	S050/2024-13	N-25	0°	2.716	3.10	0.88
S050/2024-18	S050/2024-18	W-80	0°	269.5	240	1.12
S050/2024-19	S050/2024-19	W-80	0°	52.07	48.0	1.08
S050/2024-21	S050/2024-21	Cs-137	0°	5.642	5.60	1.01
S050/2024-22	S050/2024-22	W-80	0°	267.5	240	1.11
S050/2024-27	S050/2024-27	W-80	0°	4.498	4.00	1.12
S050/2024-28	S050/2024-28	W-80	0°	4.505	4.00	1.13
S050/2024-29	S050/2024-29	W-80	60°	3.766	3.70	1.02
S050/2024-30	S050/2024-30	Cs-137	0°	5.973	5.60	1.07

Extremity Dosemeter Intercomparison IC2024ext

Results of Intercomparison: Dosimetry System - S050/2024

Dosemeters irradiation status: Not Irradiated

Dosemeters		Radiation Quality	
Eurados _ID	**Participant's ID**	**Quality**	**Angle**
S050/2024-04	S050/2024-04	Not Irradiated	
S050/2024-06	S050/2024-06	Not Irradiated	
S050/2024-07	S050/2024-07	Not Irradiated	
S050/2024-09	S050/2024-09	Not Irradiated	
S050/2024-11	S050/2024-11	Not Irradiated	
S050/2024-14	S050/2024-14	Not Irradiated	
S050/2024-15	S050/2024-15	Not Irradiated	
S050/2024-16	S050/2024-16	Not Irradiated	
S050/2024-24	S050/2024-24	Not Irradiated	
S050/2024-25	S050/2024-25	Not Irradiated	

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

Gamma radiation:

S-Cs: 662 keV

X-ray radiation:

N-25: 20.3 keV

W-80: 57 keV

Calibration
No. of Certificate 117

HELLENIC REPUBLIC
MINISTRY OF DEVELOPMENT
GENERAL SECRETARIAT FOR RESEARCH AND INNOVATION

Our Ref: CDU/428/2591/06.03.2025

EEAE ΕΛΛΗΝΙΚΗ ΕΠΙΤΡΟΠΗ ΑΤΟΜΙΚΗΣ ΕΝΕΡΓΕΙΑΣ
GREEK ATOMIC ENERGY COMMISSION

IONIZING RADIATION CALIBRATION LABORATORY
Affiliated to the Hellenic Metrology Institute

IRRADIATION CERTIFICATE No: DOS /3090 - 50/24
Number of Pages: 2

The following personnel dosemeters from:	**EURADOS Intercomparison Program IC2024ext System No: S050/2024**

have been irradiated at the ***Ionizing Radiation Calibration Laboratory of Greek Atomic Energy Commission:***

Personal Dosemeters (PD):	**Extremity, Ankle/Wrist Dosemeters**
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 pillar phantom (cylinder diameter 70mm, length 300mm, PMMA walls water filled)
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)*
S050-21	18/07/2024	S-Cs	5.60	4.9
S050-30	18/07/2024	S-Cs	5.60	4.9
S050-05	07/08/2024	W-80	4.00	5.1
S050-28	07/08/2024	W-80	4.00	5.1
S050-02	07/08/2024	W-80	4.00	5.1
S050-27	07/08/2024	W-80	4.00	5.1
S050-03	05/08/2024	W-80	48.0	5.1
S050-19	05/08/2024	W-80	48.0	5.1
S050-18	01/08/2024	W-80	240	5.1
S050-22	01/08/2024	W-80	240	5.1
S050-13	26/07/2024	N-25	3.10	4.9
S050-12	26/07/2024	N-25	3.10	4.9
S050-01	08/08/2024	W-80 (60 º)	3.70	5.3
S050-29	08/08/2024	W-80 (60 º)	3.70	5.3

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

Not Irradiated Dosemeters :
S050-25; S050-06; S050-15; S050-16; S050-07; S050-11;

Head of Dosimetry and Calibration Department

Calibration performed by:
Stamatopoulou E.

Argyro Boziari
06/06/2025 15:13

Argiro Boziari

ΕΣΥΔ 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

RÉPUBLIQUE FRANÇAISE
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ASNR Autorité de sûreté nucléaire et de radioprotection

Test report

N° 2025-S050

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 dosemeters 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 S050

Dosemeter : Personal dosemeters

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

Technical Manager of calibration activities

Signature numérique de ASNR
Date : 2025.03.24 13:34:16 +01'00'

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 $^{90}Sr/Y$ 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 dosemeter: 30 cm. The test point corresponds to the reference point of the dosemeter 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 dosemeter
- Phantom for wrist dosemeter: 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 dosemeter: 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
S050/2024-10	WRIST	Sr-90	0	2,50	5,7	24/07/2024	
S050/2024-20	WRIST	Sr-90	0	2,50	5,7	24/07/2024	
S050/2024-23	WRIST	Sr-90	60	2,20	7,0	31/07/2024	
S050/2024-08	WRIST	Sr-90	60	2,20	7,0	31/07/2024	
S050/2024-26	WRIST	Kr-85	0	3,01	5,9	29/07/2024	
S050/2024-17	WRIST	Kr-85	0	3,01	5,9	29/07/2024	
S050/2024-04	WRIST	-	-				Spare
S050/2024-24	WRIST	-	-				Spare
S050/2024-14	WRIST	-	-				Back ground
S050/2024-09	WRIST	-	-				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 dosemeters 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).