

The EIVIC2020 Project “European In-vivo Counting Intercomparison Exercise 2020-2021“

EC Contract ENER/2019/NUCL/SI2.811157

Didier Franck (IRSN, France)

Webinar EURADOS, 04/12/2023

- ✓ **Background of the project**
- ✓ **Objectives and principal tasks**
- ✓ **Organisation put in place**

Background of the Project (and a bit of history ...)

- **In 2018**, publication by the European Commission (EC) of its Radiation Protection Series **Technical Recommendations for Monitoring Individuals for Occupational Intakes of Radionuclides as RP 188²**
- This guidance document covers, in-vivo monitoring, dose assessment, quality assurance, and intercomparisons and intercalibrations:
 - **In-vivo monitoring techniques are one of the methods used to monitor and assess possible intakes of radionuclides** at workplaces within a monitoring programme (workers liable to receive significant internal exposure)
 - **Whole body counters are an essential part of emergency preparedness and response plans**, as they may allow a fast measurement of the radioactivity potentially incorporated in the bodies of emergency workers during an emergency.
 - **For quality assurance** of the measurement results, it is **essential that the laboratories performing whole body counting regularly participate in suitable interlaboratory comparisons.**

² Radiation Protection N° 188, Technical Recommendations for Monitoring Individuals for Occupational Intakes of Radionuclides, Luxembourg, Publications Office of the European Union, 2018, ISBN 978-92- 79-86304-2

EC Call (ENER/D3/2019-158)

Objectives :

- (i) To assess the implementation of the individual monitoring requirements in EU Member States based on in-vivo measurements**
- (ii) To receive an overview of the performance of in-vivo measurements using whole body counters »**



- Given the experience in this domain and a projet already thought in the frame of WG7 of EURADOS to organise in vivo intercomparison, application (Eurados, BfS, IRSN): 13/06/2019
- Acceptation: 26/08/2019

Specific features

- Project duration: 2 years (obsolete because of the COVID Crisis)
- Participation in the interlaboratory comparison on whole body counting ensuring an appropriate geographical coverage in the EU and beyond:
 - At least one lab per EC member state (in case there is one) and can be extended for some countries
 - Open also to labs from other European countries
- Development of a technical Data Base of participating whole body counters, including general information and technical characteristics of the in vivo facilities in Europe
- Organisation of a workshop to present results and exchange experience with participants

Structure of the EIVIC project and their Interdependencies

WP 0: Project management

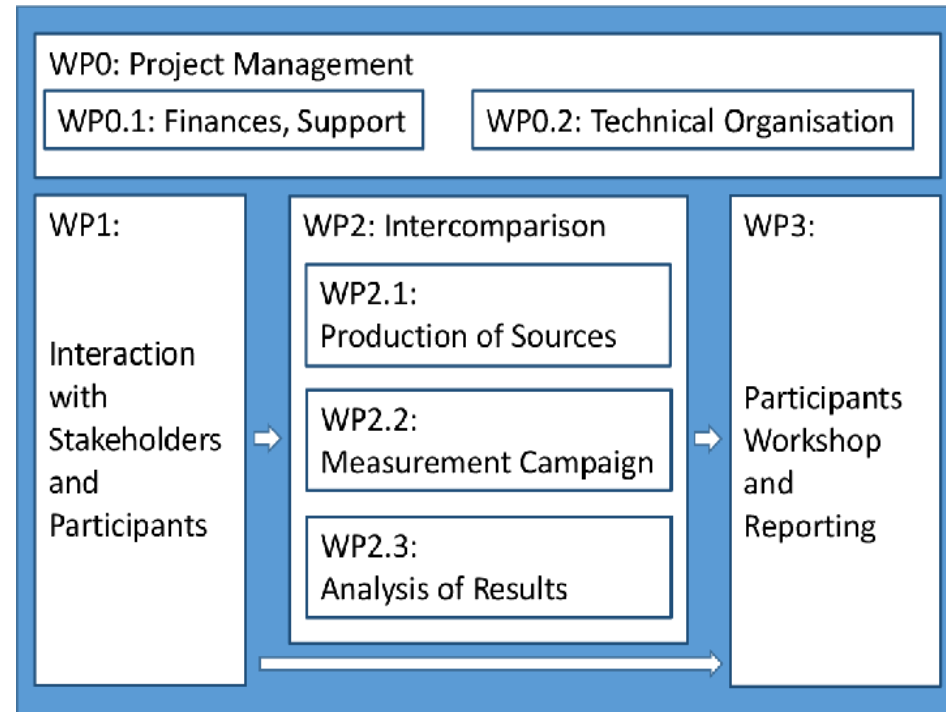
- WP 0.1: Technical organisation
- WP 0.2: Finances, support

WP 1: Interaction with stakeholders and participants

WP 2: Intercomparaison

- WP 2.1: Production of sources
- WP 2.2: Measurement campaign
- WP 2.3: Analysis or results

WP 3: Participants' workshop and reporting



The EIVIC Team

Name	Organisation	Role
Tiffany BEAUMONT	IRSN	leader WP 2.3
Werner BUCHHOLZ	BfS	leader WP 2.2
Didier FRANCK	IRSN	project leader, leader WP 0.2, WP 3
Kerstin HÜRKAMP	EURADOS	administrative manager
Maria Antonia LOPEZ	EURADOS	leader WP 1, WP 3
Oliver MEISENBERG	BfS	deputy project leader, leader WP 2.1
Juan Francisco NAVARRO AMARO	EURADOS	scientific associate
Begona PEREZ LOPEZ	EURADOS	scientific associate
Filip VANHAVERE	EURADOS	EURADOS chairperson

WP1 – Interaction with Stakeholders and Participants

María Antonia Lopez, Juan Francisco Navarro
and Amaro Begona Perez Lopez, EURADOS ; Oliver Meisenberg and Werner
Buchholz, BfS,

- **Establishment of contacts** with stake holders and European laboratories performing whole body counting (María Antonia Lopez, EURADOS)
- **Constitution of list of participants** and sending of official letters to participants (María Antonia Lopez, EURADOS)
- **Organisation of virtual meetings** with participants (Oliver Meisenberg, BfS)

European Radiation Dosimetry Group 

European Radiation Dosimetry Group e.V. • Postfach 11 29 • D-85758 Neuherberg

Your reference:
Your letter dated:
Our letter dated:
Our reference: EURADOS/2020/02/DF
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Fax number:
E-Mail: didier.franch@irsn.fr
Date: 17.01.2020

Invitation Letter to participate in EIVC2020 - "Organisation of a European Interlaboratory Comparison on Whole Body Counting"

Dear Sir/Madam,

EIVC2020 is a European Commission Project (EC, DG-ENER) to be developed on 2020-2021 (ref ENER/2019/NUCL/SI2.611157). Its aim is to organize the 2020 European Intercomparison of Whole Body Counters for the measurement of gamma emitters in total body.

The exercise is being coordinated by EURADOS (European Radiation Dosimetry Group, www.eurados.org, Chair Werner Rühm, Kerstin Hürkamp) together with IRSN-France (Chair Didier Franck; Tiffany Beaumont), BfS-Germany (Oliver Meisenberg, Werner Buchholz), counting with the collaboration of CIEMAT-Spain (M.A. López, J.F. Navarro, B. Pérez) and KIT-Germany (B. Breustedt).

Two brick phantom units simulating the internal contamination of an adult male will be transported or sent to the different in vivo laboratories all around Europe between autumn 2020 and summer 2021.

Please send your answer confirming/refusing participation by e-mail to EIVC2020@eurados.org before 15 February 2020.

Further information regarding the protocol of measurements, information to be provided by your facility and the dates proposed (roadmap of the exercise) will be distributed later.

Sincerely,

Didier Franck Ph.D.
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EURADOS e.V. is registered in the Register of Associations (Vereinsregister) München, registry number VR 207962Z.
Certified to be of non-profit character (Finanzamt Braunschweig, modification from 2008-03-02).
Bank Account Unicredit Bank AG, D-60311 München - IBAN: DE96 2505 0000 0001 5399 15 19 - BIC: HYVEDE33XXX
Jan 2017

Participants

Institution	City	Country	V/S*
Seibersdorf Labor GmbH	Seibersdorf	Austria	V
LKH University Hospital Graz	Graz	Austria	V
SCKCEN Belgian Nuclear Research Centre	Mol	Belgium	V
Kozloduy Nuclear Power Plant	Kozloduy	Bulgaria	S
University of Zagreb School of Medicine	Zagreb	Croatia	V
SÚRO National Radiation Protection Institute	Prague	Czech Republic	V
SIS National Institute of Radiation Protection	Herlev	Denmark	V
EC Joint Research Centre	Ispra	European Commission (Italy)	V
STUK Finnish Radiation and Nuclear Safety Authority	Helsinki	Finland	S
SPRA French Defense Radiation Protection Service	Clamart	France	V
ORANO	La Hague	France	cancelled
CEA French Alternative Energies and Atomic Energy Commission	Saclay	France	S
FZJ Research Centre Jülich	Jülich	Germany	V
LIA Institute for Work Design	Düsseldorf	Germany	V
University Hospital Leipzig	Leipzig	Germany	V
MTA Hungarian Academy of Sciences	Budapest	Hungary	S
National Public Health Centre	Budapest	Hungary	V
IAEA	Vienna	IAEA (Austria)	V
SOGIN	Caorso	Italy	V
ENEA	Rome	Italy	S
Radiation Protection Centre	Vilnius	Lithuania	S
NRG Nuclear Research and Consultancy Group	Petten	Netherlands	V
IFE Institute of Energy and Technology	Kjeller	Norway	V
National Centre for Nuclear Research	Otwock	Poland	S
IFIN-HH National Institute of Physics and Nuclear Engineering	Magurele	Romania	cancelled
Mochovce Nuclear Power Plant	Mochovce	Slovakia	S
JAVYS Nuclear and Decommissioning Company	Bratislava	Slovakia	V
Tecnatom	Madrid	Spain	S
FOI Swedish Defence Research Agency	Umeå	Sweden	S
University of Lund	Malmö	Sweden	V
Ringhals Nuclear Power Plant	Väröbacka	Sweden	V
Forsmark Nuclear Power Plant	Forsmark	Sweden	S
Barsebäck Nuclear Power Plant	Löddeköpinge	Sweden	V
Bundesamt für Bevölkerungsschutz	Spiez	Switzerland	V

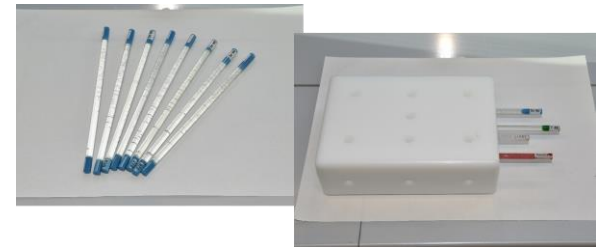
- 35 laboratories were contacted from 21 countries (+ European Commission and IAEA) and were officially registered
- Several laboratories conducted measurements with more than one whole-body counter, so that 41 results were received



Production of Sources and Phantoms

Oliver Meisenberg and Werner Buchholz, BfS (WP 2.1)

- **Objectives:** to simulate measurements that are relevant for the occupational monitoring programmes of individuals exposed to intakes of gamma emitters at the workplace.
- 4 measurement tasks with a brick phantom of different sizes (P4/70 kg and P5/90 kg) and loaded with various radionuclides were defined:
 - “Victor” (standard nuclides),
“Emergency”, “Medicine”, “Calibration
- Production and qualification of the sources at BfS



Measurement Tasks

- **Task 1: ^{60}Co , ^{133}Ba and ^{137}Cs . Phantom size P4/70 kg (called Victor)**
 - Radionuclides frequently used in proficiency tests of whole-body counters because their gamma-ray emissions cover a wide range of energy (80 to 1332 keV) and do not interfere with each other
- **Task 2: ^{134}Cs and ^{137}Cs . Phantom size P5/90 kg (called Emergency)**
 - Relevant for the monitoring of members of the population after nuclear accidents.
 - A metrological challenge when measured with NaI(Tl) detectors: correction of the peak area of ^{137}Cs at 662 keV taking into account the overlapping contribution of the 605 keV emission of ^{134}Cs

Measurement Tasks

- **Task 3: ^{68}Ge (with its daughter nuclide ^{68}Ga in secular equilibrium) and ^{88}Y . Phantom size P4/70 kg (called Medicine)**
 - Featuring common radionuclides in nuclear medical diagnostics.
 - The sets of sources were replaced in the middle of the campaign by new sources in the attended tour as well as for the shipment because of the short half-lives of these radionuclides. 2 subtasks created (Tasks 3.1 and 3.2)
 - Difficulties to handle which led to errors in the circuit resulting to several some errors on the circuit
- **Task 4: ^{133}Ba and ^{152}Eu . Phantom size P4 and P5 (called Calibration)**
 - Featuring a large variety of gamma-ray emissions over a wide range of energies (80 to 1408 keV)
 - Measuring the phantoms of this task enables the participating laboratories to establish an efficiency calibration based on the reported reference activities.
- During all measurement tasks, the phantoms were also prepared with ^{40}K rods in order to simulate the natural radiation background of human bodies.

WP2.2 – Measurement Campaign

Werner Buchholz and Oliver Meisenberg, BfS, Juan Francisco Navarro Amaro and Begonia Perez Lopez, EURADOS

- **Organisation of the circuit for labs:** shipment or attended transport
- **Realisation of the measurement campaign with attended transport (Werner Buchholz, BfS) in red**
- **Organisation of shipments (Werner Buchholz, BfS and Juan Francisco Navarro Amaro, EURADOS) in blue**



WP2.3 – Collection and Analysis of Results

Tiffany Beaumont and Didier Franck, IRSN ; Oliver Meisenberg BfS

- **Collection of technical informations and results** centralisation by BfS (BfS Cloud) of the data provided by the participating laboratories (Oliver Meisenberg)
- **Development of a data base** for technical information (Didier Franck and Oliver Meisenberg)
- **Data evaluation of results**
According to ISO standards ISO 28 218 and ISO 13 528 (Tiffany Beaumont)

EURADOS
IRSN
Institut de Radioprotection
et de Sûreté Nucléaire

EIVIC
Organisation of a European Interlaboratory comparison
on Whole-Body counting

Informations

Laboratory Name

Facility Name

Adresse

Person in charge of
the laboratory

E-mail

Phone number

Fax

Laboratory Facility Routine measurement Energy Calibration Efficiency Calibr

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Date of measurement
MM/DD/YYYY

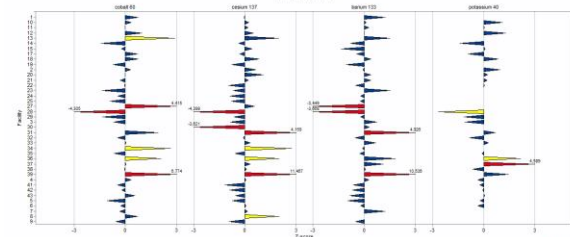
Data entry

Radionuclides detected	Energy used to quantify (keV)	Activity (Bq)	Total uncertainty at +/- 2 (Bq)

Summary of calibration

Radionuclides	Activity (Bq)	Total uncertainty (Bq)	Counting time (s)	LD

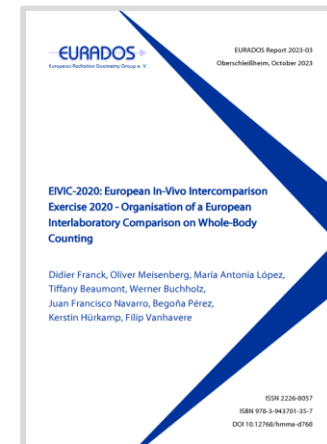
Config. 1 - Victor 70 kg Config. 2 - Accident 90 kg



WP3 – Reporting and Dissemination

Maria Antonia Lopez and Kerstin Hürkamp, EURADOS ; Tiffany Beaumont and Didier Franck, IRSN ; Oliver Meisenberg, BfS

- **Reporting project status to EC** (Inception reports, Internal Reports, Final report)
- **Organisation of a Participants Workshop** CIEMAT Madrid, 9 June 2022 and **a Webinar** (Maria Antonia Lopez and Kerstin Hürkamp, EURADOS)
- **Meeting of the Group of Experts referred to in Article 31 of the Euratom Treaty** (Tiffany Beaumont, Oliver Meisenberg) Luxembourg 29-30 Nov. 2023
- **Publications and communications on the Project**
 - Publishable Reports (EURADOS and RP Report)
 - Journal(s)/conference(s):
 - Lopez et al., ERPW2022 ; Franck et al, Radiat Environ Biophys submitted, Beaumont et al., IRPA (2024)



<https://eurados.sckcen.be/news-overview/eurados-report-2023-03-published-eivic-2020-european-vivo-intercomparison-exercise-2020-organisation-european-interlaboratory-comparison-whole-body-counting>