

# Ispra Site WBC Laboratory Participation in the 2011 Thyroid Counting Intercomparison organised by the IRSN

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## 1. INTRODUCTION

The Joint Research Centre (JRC) located in Ispra, is one of the research sites belonging to the European Commission, Directorate General JRC. It was created in the late '50s, in order to lead the European research in the field of nuclear industry.

the Whole Body Counter (WBC) Laboratory is part of the Radioprotection Sector within the Nuclear Decommissioning Unit and performs monitoring of radioactive contamination within the human body.

## 2. MATERIAL AND METHOD

The JRC Ispra WBC laboratory is equipped with HPGe semiconductor detectors used to investigate internal contamination inside specific organs (Thyroid, lungs). For background and calibration measurements an anthropomorphic Livermore phantom is used.

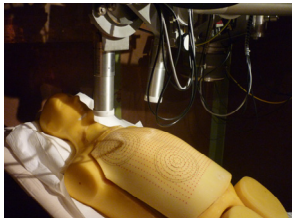


Figure 1: Twin couple HPGe with Livermore Phantom

Equipment Characteristics	
Diameter	5,1cm
Energy resolution (FWHM)	1,25keV at 661,66keV 0,549keV at 29keV
Energy range:	10keV - 800keV
Electronic chain:	NIM modules
Phantom:	Livermore Phantom
Analysis software:	Genie 2000

Tab. 1: Laboratory equipment

## 3. INTERCOMPARISON PROGRAMME

In 2004 the IRSN (Institut de Radioprotection et de Sûreté Nucléaire) was established as an organising institution for the triennial intercomparison programme of anthroporadiometric measurements in the field of Whole Body, Lungs and Thyroid Counting.

In 2011 the JRC Ispra WBC Laboratory took part, for the first time, in the IRSN Thyroid Counting Intercomparison programme.

The objective of these exercises is to prove the laboratory's measurement procedure in order to:

- 1) guarantee the laboratory's measurement quality
- 2) apply for laboratory accreditation

The procedures of each system are evaluated by acceptance criteria defined in the standard NF ISO 12790-1.

## 4. THYROID COUNTING INTERCOMPARISON 2011

The first exercise planned was a thyroid geometry intercomparison and 18 laboratories out of a total of 34 installations participated.

The JRC Ispra WBC took part in this thyroid intercomparison even though it was not a requirement of Italian legislation.

3 different high and low energy sources were provided by the IRSN in order to perform the activity measurements.

The uncertainty of the JRC Ispra WBC results were expressed using the following equation:



Figure 2: Thyroid source

$$u(A) = A \sqrt{\left(\frac{u_{area}}{area}\right)^2 + \left(\frac{u_{GEO}}{100}\right)^2 + \left(\frac{u_{\gamma}}{\gamma}\right)^2 + \left(\frac{u_{\epsilon}}{\epsilon}\right)^2 + \left(\frac{u_k}{k}\right)^2}$$

where:

- $u_{area}$  = uncertainty of the net peak area
- $u_{GEO}$  = uncertainty due to the repositioning for measurement
- $u_{\gamma}$  = uncertainty of the branching ratio
- $u_{\epsilon}$  = uncertainty of the efficiency
- $u_k$  = uncertainty of the decay correction factor
- $\gamma$  = branching ratio
- $\epsilon$  = efficiency
- $k$  = decay correction factor

## 5. INTERCOMPARISON 2011 MEASUREMENTS RESULTS

SOURCE CODE	RADIONUCLIDE	ACTIVITY [Bq]	UNCERTAINTY [Bq]
S23495	129I	95,85	27,66
S23496	133Ba	33,52	10,04
S24475	133Ba	378,63	107,00

Tab. 2: The results of the JRC Ispra WBC laboratory with measurement uncertainty

SOURCE CODE	RADIONUCLIDE	ACTIVITY [Bq]	ERROR [Bq]*
S23495	129I	97,00	6,00
S23496	133Ba	41,00	1,00
S24475	133Ba	393,00	11,00

Tab. 3: Nominal activity values of the sources provided by IRSN with the error

(\* the activity error by IRSN is not the same quantity as the measurement uncertainty)

The graphic expression of results of all participating laboratories with the uncertainties in the comparison with the nominal values provided by IRSN:

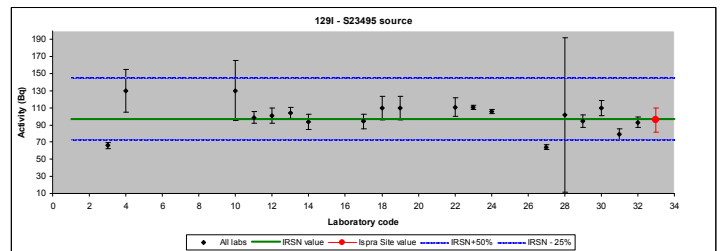


Figure 3: Results for the S23495 source

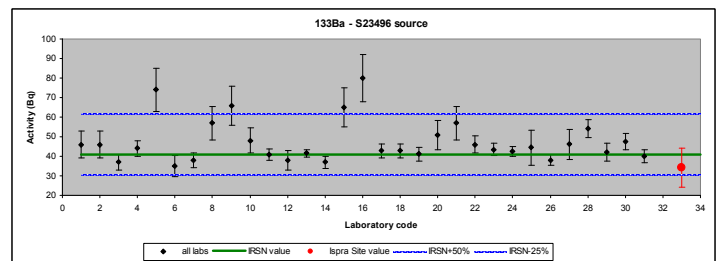


Figure 4: Results for the S23496 source

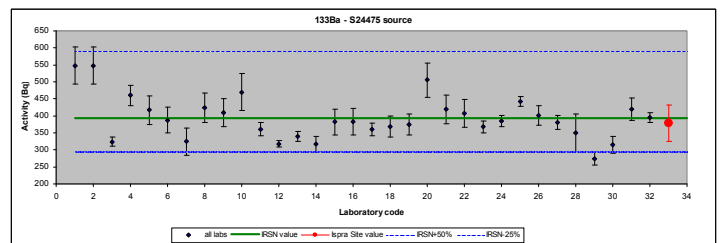


Figure 5: Results for the S24475 source

## 6. CONCLUSION

■ The JRC Ispra WBC Laboratory succeeded in the Thyroid Intercomparison 2011 with very good results reaching the required values for all 3 sources.

■ The calculated uncertainty also includes the factor for repositioning uncertainty as the JRC Ispra laboratory is not equipped with a laser positioning system. The other laboratories had this system. This factor significantly increases the uncertainty value.

■ The participation in Intercomparison programmes is becoming a requirement for any laboratory in order to apply for accreditation as stated in ISO/IEC 17025:2005.

