Technical Protocol for an EURAMET Key Comparison of ^{131}I (EURAMET Project #1383)

1. Introduction

This comparison is carried out in order to link both the Italian National Institute of Ionizing Radiation Metrology (INMRI), belonging to ENEA, and POLATOM (Poland) to the BIPM International Reference System (SIR) for the ^{131}I radionuclide.

2. Comparison details

2.1 Pilot laboratory: POLATOM, Poland

Coordinator:
Ryszard BRODA
POLATOM
Address: National Centre for Nuclear Research
Radioisotope Centre POLATOM
Andrzeja Soltana 7, 05-400 Otwock, Poland
Tel : +48 22 2731953
E-mail: ryszard.broda@polatom.pl

2.2 Participants:

NMI	Country	Contact person	Responsible activity measurements	e-mail contact person
ENEA-INMRI	Italy	Marco CAPOGNI	Marco CAPOGNI Aldo FAZIO	marco.capogni@enea.it
POLATOM	Poland	Ryszard BRODA	Tomasz DZIEL Tomasz ZIEMEK	ryszard.broda@polatom.pl

2.3 Data of the ^{131}I master solution

Chemical composition of the solution:	$Na^{131}I$ in carrier solution containing 65 μg NaI + 50 μg $Na_2S_2O_3$ in 1 mL of 1 % HCHO
Approximate activity concentration:	230 kBq g^{-1}
Reference Date:	20th October 2015 12:00 UTC
Container:	BIPM SIR ampoule
Mass:	3.6189 g
Recommended nuclear data:	Decay Data Evaluation project [1] half-life: $T_{1/2}$ = 8.0233 (19) d

2.4 Measurand

The measurand for this exercise is the activity per mass in the master solution.

2.5 Schedule

The exercise shall start in the last week of September when a ^{131}I solution, with the chemical composition and approximate activity concentration reported above, will be prepared at POLATOM. By dilution of this master solution the following sources will be prepared:

- a set of six sources in 20 mL high-performance PerkinElmer glass vials filled-in with 10 mL of Ultima Gold, as liquid scintillator, containing a mass of radioactive material ranging from 9.9 mg to 12.4 mg;
- two glass ampoules, type BIPM SIR, filled-in in order to obtain a volume of 3.6 cc liquid solution;
- one glass ampoule, type P6, filled-in in order to obtain a volume of 4 cc of liquid solution.

The set of six sources and the first of the glass ampoules, type BIPM SIR, shall be measured at POLATOM in the period of two weeks. Three of the six sources above, the same BIPM SIR glass vial measured at POLATOM and the P6 glass vial shall be sent to ENEA-INMRI by 5th October 2015 and then measured. The ^{131}I master solution will be standardised at both ENEA-INMRI and POLATOM by using primary activity measurements techniques, based on $4\pi\beta-\gamma$ coincidence counting, TDCR and/or CIEMAT/NIST method.

POLATOM will send to the BIPM the second glass SIR ampoule by 20th October 2015, with the characteristics described above, in order to link the results achieved in the bilateral comparison to the BIPM SIR.

The following schedule for reporting is proposed:

END of the measurements	01st November 2015
Reporting dead line:	01st December 2015
Draft A sent to participants:	01st February 2016
Draft A acceptance dead line:	01th March 2016
Draft B sent to participants:	01th May 2016
Draft B acceptance dead line:	01th June 2016

2.6 Costs

The costs associated with the shipping of the ^{131}I comparison solutions from POLATOM to the ENEA-INMRI and BIPM are borne by the POLATOM.

2.7 Further information

To guarantee confidentiality, each institute will communicate its own results to the Executive Secretary of the CCRI(II), before the reporting deadline, using the standard reporting form for the BIPM SIR results [2] and describing the methods used for standardisation, the balance of uncertainty, any additional information useful for the comparison, and the final results achieved in own laboratory.

A result from a participant will not be considered complete without an associated uncertainty and will not be included in the comparison report unless it is accompanied by an uncertainty supported by a complete uncertainty budget.

Participants must provide a list and evaluation of the principal components of the uncertainty budget based on the Guide to the Expression of Uncertainty in Measurement, published by the Joint Committee for Guides in Metrology (JCGM) [3]. In addition to the principal components of the uncertainty, common to both participants, each individual institute must add any other components they consider appropriate. Uncertainties are evaluated at a level of one standard deviation and information must be given on the number of effective degrees of freedom, required for a proper estimate of the level of confidence, where this is appropriate.

3. Preparation of the report on the comparison

According to the document "Measurement comparisons in the CIPM MRA" [4], the pilot laboratory, POLATOM, is responsible for the preparation of the Draft-A comparison report, as in the schedule above. For that purpose, the results shall be transmitted to the pilot laboratory immediately after the deadline for reporting results (see 2.5).

If, on examination of the complete set of contributions, the pilot laboratory finds results that appear to be anomalous, the pilot laboratory will invite the corresponding institute to check their result for transcription or arithmetic errors but without indication about the magnitude or sign of the apparent anomaly. If no numerical error is found, the result will stand.

Draft-A is considered as confidential to the participants (POLATOM and ENEA-INMRI) and will include the results, uncertainties, methods, the analysis carried out, the conclusions reached and other details transmitted by the participants, identified by name. In particular, provisional degrees of equivalence for ENEA-INMRI shall also be stated, using the link of POLATOM to the SIR and subject to the BIPM further update of the KCRV for this radionuclide.

The pilot laboratory will circulate the Draft A to all the participants (in this case ENEA) for comments, with a reasonable deadline for reply. The date at which this draft is sent to the participants is taken to be the end date for the comparison and is subsequently referred to as such. If any controversial comments are received by the pilot laboratory, the discussion will continue until a consensus will be reached.

Note that once all participants have been informed of the results, individual results and uncertainties may be changed or removed or the complete comparison abandoned, only with the agreement of all participants and on the basis of some cause that renders the comparison or part of it invalid.

Due to the confidential character of the Draft A, copies will not be given to non-participants and graphs or other parts of the Draft A cannot be used in oral presentations without the specific agreement of all the participants. The results may be the subject of an internal report if they are shown in relative terms and the names of participants hidden. At this stage, a participant may publish experimental techniques or new developments as long as no information or comments are made about the comparison results.

Once the final version of Draft A is approved by the participants, the report is considered as Draft B and shall be sent to the CCRI Executive Secretary who will make a preliminary technical and editorial revision before circulation through the KCWG(II) and the CCRI(II), for comments within a reasonable period of time. At this stage, the results are not considered confidential and can be used to support CMCs and used for presentations and publications with the exception of the proposals for the reference value and degrees of equivalence.

The pilot lab shall take into account the comments received and revise the Draft B, obtaining the agreement of all the participants if necessary. The revised Draft B will be considered as Final Report and shall be sent to the CCRI Executive Secretary for verification purposes, upload into the KCDB and publication in the Metrologia Tech. Suppl. series.

Marco Capogni
ENEA-INMRI

Ryszard Broda - Tomasz Dziel
POLATOM

References

[1] http://www.nucleide.org/DDEP_WG/Nuclides/I-131_tables.pdf
[2] Reference BIPM/RI-SIR-F-02
[3] Evaluation of measurement data – Guide to the expression of uncertainty in measurement (JCGM 100:2008) and supplements.
[4] Measurement comparisons in the CIPM MRA, CIPM-MRA-D-05 (version 1.5)