Progress report on radioactivity standardization

(May 1999 to April 2001)

Y. HINO
Radioactivity and Neutron Section, Quantum Radiation Division
National Institute of Advanced Industrial Science and Technology (AIST*)
e-mail: y.hino@aist.go.jp http://www.aist.go.jp/
(*Electrotechnical laboratory (ETL) was re-organized to AIST from 1st April 2001)

1. International comparisons and SIR contributions.

1.1 Regional key-comparison of radioactivity.

The Technical Committee on Ionizing Radiation (TCRI) was organized in the regional metrology organization of Asia-Pacific Metrology Programme (APMP) in 1998 to promote regional key comparisons. In total, 6 working groups were organized, and TCRI/WG6 was for radioactivity. In 1999, the first regional key-comparison was carried out with ^{166m}Ho radioactivity measurement, and in 2000, additional comparisons were performed with ^{58}Co and ^{88}Y. The radioactive sources were prepared and delivered by AIST(ETL) and were also sent to SIR in order to link these regional comparisons to the BIPM key comparison reference values. Table 1 shows the list of participated laboratories and their methods, and present results of ^{166m}Ho, ^{58}Co and ^{88}Y are shown in figures 1, 2 and 3, respectively.

The arithmetic mean of ^{166m}Ho was in good agreement with the SIR reference value, but some disagreements were found in ^{58}Co and ^{88}Y, as shown in figures 1 to 3. Although there existed some disagreements, it was successfully demonstrated that regional comparisons could be well linked to other international key comparisons through SIR. Further details of these results have been reported in the ICRM'2001 meeting.

Table 1 Participated laboratories and their method.

.	APMP-RI-K1-99	APMP-RI-K3-00	
.	Ho-166m	Co-58	Y-88
AIST* (National Institute of Advanced Industrial Science and Technology, Japan)	4πβ-γ	4πβ-γ	4πβ-γ
ANSTO* (Australian Nuclear Science and Technology Organization, Australia)	--	-- .	I.C.
BARC*(Bhabha Atomic Research Centre, India)	--.	4πβ-γ	4πβ-γ
CIAE(China Institute of Atomic Energy, China)	4πβ-γ	4πβ-γ	4πβ-γ
CNEA(Comisión Nacional de Energia Atomica, Argentina)	4πβ-γ	4πβ-γ	Ge
INER* (Institute of Nuclear Energy Research, Taiwan)	4πβ-γ	4πβ-γ	4πβ-γ

KRISS* (Korea Research Institute of Standard and Science, Korea)	4πβ-γ	4πβ-γ	4πβ-γ
LNMRI (Laboratório Nacional de Metrologia das Radiações Ionizantes , Brazil)	4πβ-γ	4πβ-γ	4πβ-γ
MINT* (Malaysian Institute for Nuclear Technology Research, Malaysia)	Ge	Ge	Ge
NIM* (National Institute of Metrology, China)	Ge	Ge	Ge
NINT (Northwest Institute of Nuclear Technology, China)	4πβ-γ	4πβ-γ	4πβ-γ
NPIC (South-West Radioactive Metrology Station of Nuclear Power Industry, China)	--	4πβ(LC)-γ	4πβ(LC)-γ
OAEP* (Office of Atomic Energy for Peace, Thailand)	I.C.	I.C.	I.C.
P3KRBiN* (Pusat Penelitian & Pengembangan Keselamatan Radiasi & Biomedika Nuklir , Indonesia)	Ge	Ge	Ge

* =APMP member laboratories.

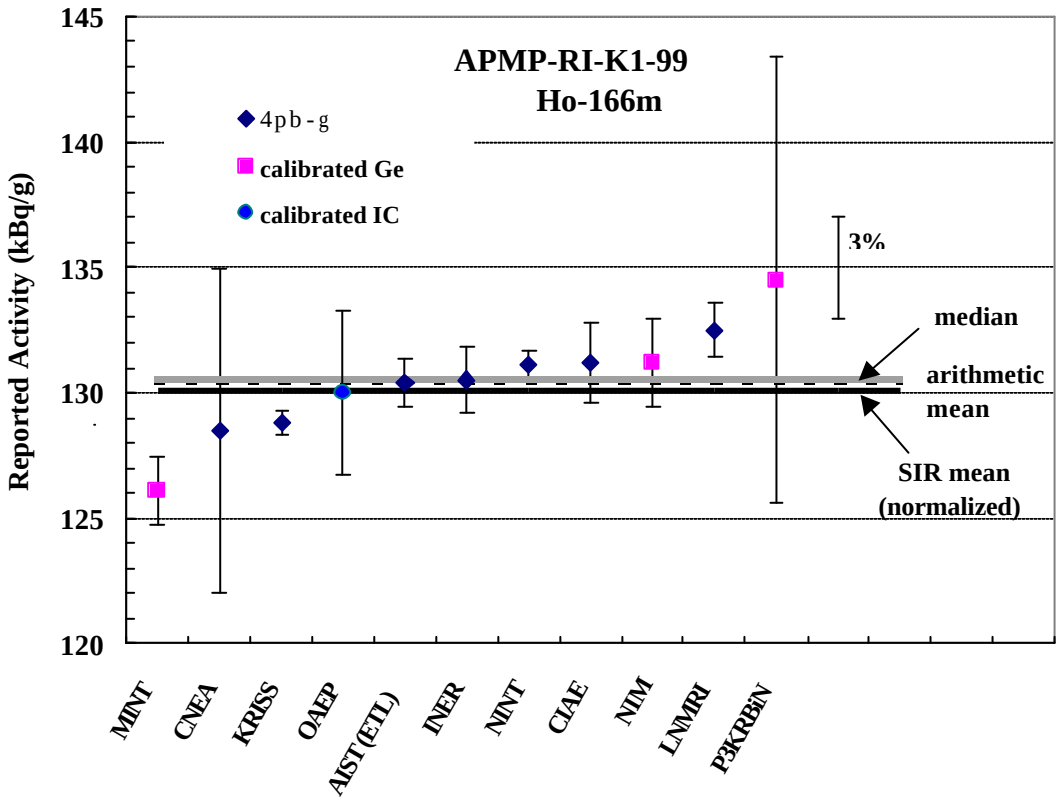

Figure 1. Result of APMP-RI-K1-99 for ^{166m}Ho. The SIR mean was normalized with AIST result. The relative standard deviation of present results was about 1.7%. All ampoules were once measured with AIST ionization chamber to check homogeneity.

The standard deviation of electric current per unit mass of each ampoule was less than 0.1%.

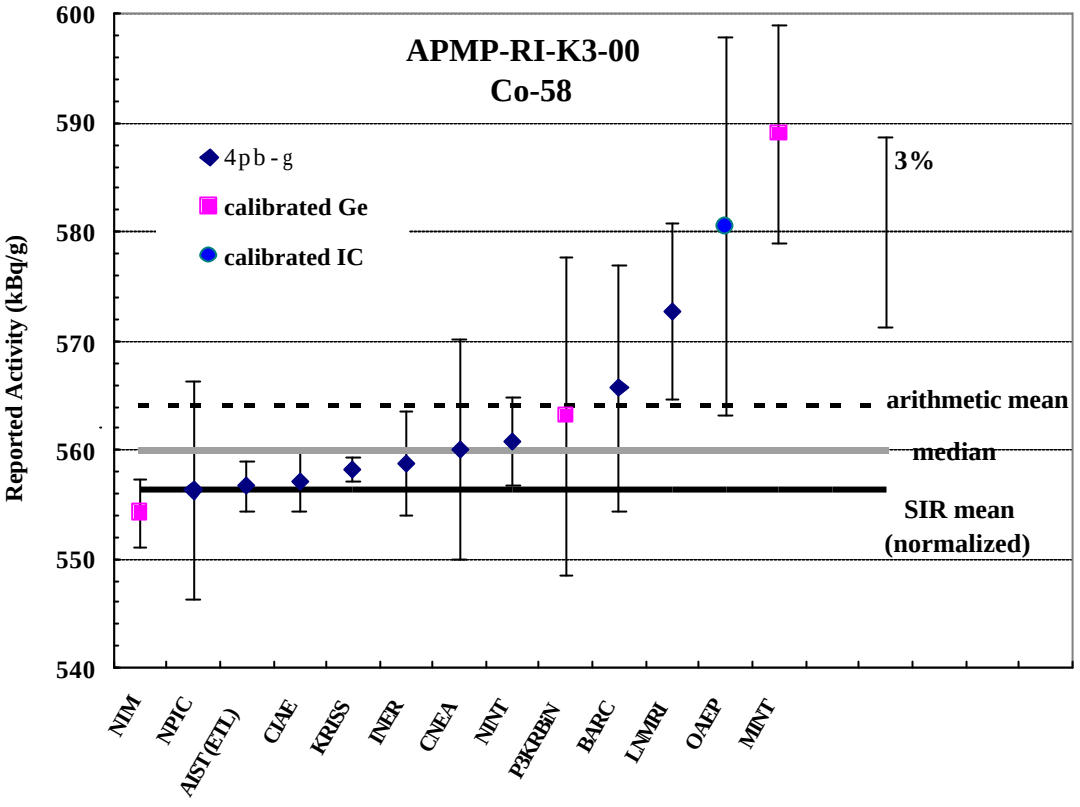

Figure 2. Result of APMP-RI-K3-00 for ^{58}Co

1.2 Bilateral comparisons of b -emission rate from large area source.

The β-emission rate from a large area source of ^{36}Cl has been tested for bilateral base comparisons. The test sample was 10cm by 10cm active area source, which was commercially available from Amersham. The source was measured with a windowless multi-wire counter by AIST, with threshold energy of β-ray was about 0.5keV, and sent to NIST. The same type counter but extrapolation to zero energy method was taken by NIST. Two results were in complete agreement after a small correction for threshold (0.2%). This source was then transferred to INER of Taiwan, directly transferred from NIST for additional comparison. After this, the source was once backed to AIST, and emission rate was measured again. The second measurement of AIST was just the same as it was, which indicated enough capability of such a source as the transfer material for charged particle emission rate standard. At the beginning of March 2001, the source was again sent to KRISS for further comparisons. At this moment, PTB and CSIR of South Africa have expressed their interests. It will be welcomed to take part to this series of emission rate comparison.

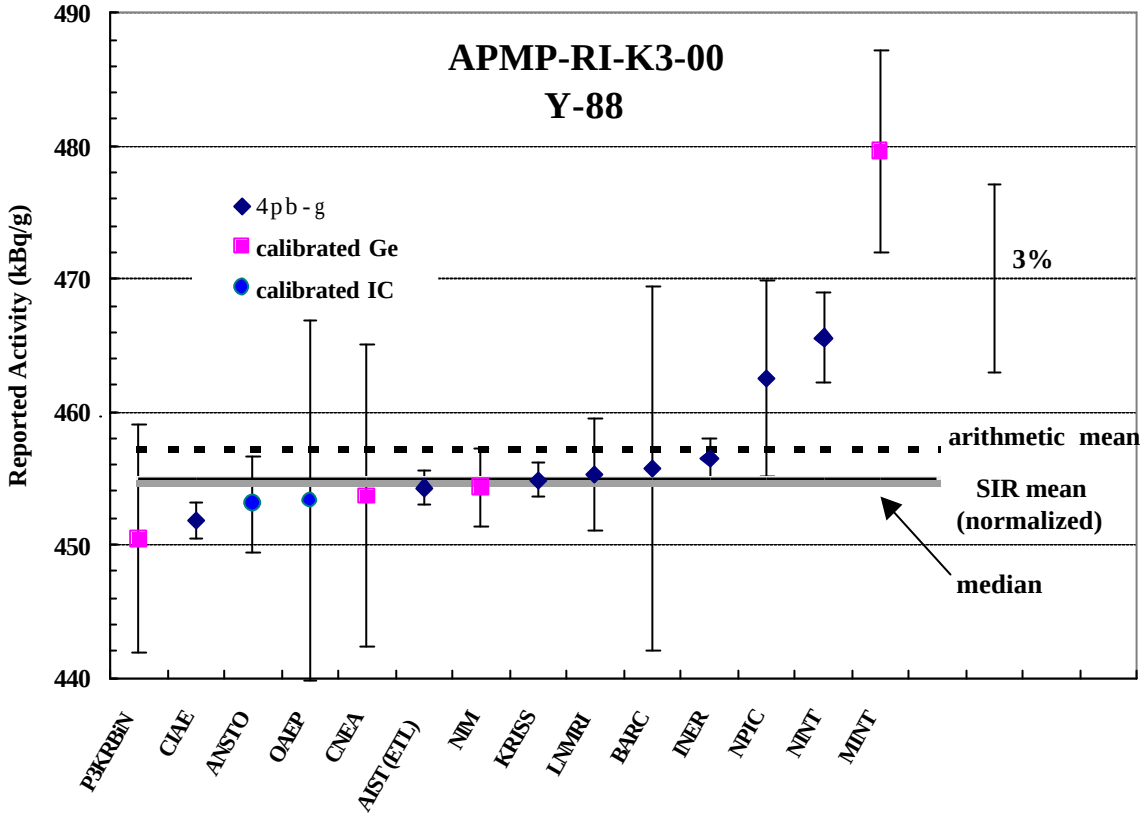

Figure 3. Result of APMP-RI-K3-00 for ^{88}Y

2. Standardization and calibration services.

- Domestic comparison between radioactive pharmaceutical manufactures was carried out by AIST for ^{123}I radioactivity through Japan Radioisotope Association (JRIA).
- Two same secondary standard systems for radioactivity were equipped both AIST and JRIA, and these systems were calibrated with 12 nuclides for establish the secondary standardization system.
- Volume reference sources were produced using enriched ^{40}K (200 times, about 2% in weight.). The ^{40}K source was mixed with other 9 nuclides, and spread into alumina powder homogeneously. These sources were provided for calibration of Ge detectors for environmental radioactivity monitoring.

3. Plans for fiscal years of 2001 and 2002.

- AIST will continue regional key-comparisons in the framework of WG6/TCRI/APMP.
- The results of our regional key-comparison showed about 2 to 3 times larger deviations to that of SIR or other regional key comparisons. In order to get more harmonized results, AIST will support the idea of "Portability of the calibration factors of ionization chambers" through sealed ^{166m}Ho sources.
- In order to satisfy the conditions of Appendix C of MRA, AIST will promote bilateral comparisons of ^{241}Am electroplated sources for α-emission rate and activity.