

## Establishment of Technical Standards for Personal Dosimetry Performance Test by New ANSI Criteria in Korea

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### 1. Introduction

The Korean Regulation of the Act provides a procedure for testing the performance of dosimetry system for the purpose of monitoring personnel exposure to ionizing radiation. This regulation is based on the ANSI N13.11-1993[1] standards (Personnel Dosimetry Performance – Criteria for Testing) and enforced since 1995 in Korea.

Through undergoing periodic review of the ANSI Standard by ANSI policy, several modification of ANSI N13.11-1993 was issued by ANSI N13.11-2001 and 2009[2] with considering that the standard should be applied the real radiation working fields.

The important changes of ANSI N13.11-2009 compared to the 1993 version can be shown in the other literature[2].

In this paper, for the new performance test, the Test Categories were revised, and the test procedures necessary for the performance test such as the type of radiation, type of mixed radiation field, dosimeter irradiation methods and the number of irradiations dosimeters in each test category were determined.

### 2. Methods and Results

The important changes of the new performance test to determine in this paper can be summarized as in the below.

#### 2.1 Selection of Reference X-Ray Radiation Fields(NIST Beams and ISO Beams)

When X-Ray irradiations are performed for the test, NIST and ISO X-ray beams can be used together by the ANSI N13.11-2009 criteria. But ISO X-ray beams used in ANSI 2009 can be covered all of the energy ranges for the performance test (below 300 keV), and NIST X-ray beams are not widely used for the reference X-ray fields in the world. So, Even though ANSI 2009 performance criteria are adopted the ISO and NIST X-ray beams, radiation fields for the test should be selected by the ISO Standards.

→ Adopt all of the ISO Beams(WS, HK Series in Fig. 1) in the ANSI 2009 for the performance test(Exclude NIST Beams).

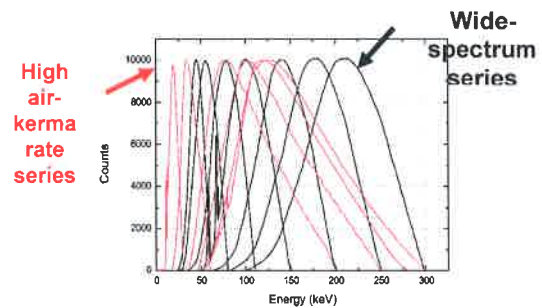


Fig. 1. ISO Wide spectrum and high kerma rate series.

#### 2.2 Replace M150(NIST Beam) with ISO beam in the accident category(IC) of ANSI 2009

It is examined the beams characteristics to replace M150 with similar ISO beam(Average Energy, Spectrum, Maximum Energy, FWHM etc.). Average energy of M150(~73keV) is similar to the 70keV (Datum point of law and high Energy), so average E. of replaced ISO beam should be also around 70keV. W110 of ISO beam is selected as the alternative radiation beam of M150.

#### 2.3 Exclusion of nuclear materials(Pu, U) and Am-241 in the test categories

Pu(II D), U slab(III D) and Am-241(II A) are excluded because of their non-suitability of domestic environment. These radiation field are using for DOELAP.

#### 2.4 . High energy gamma fields (Co-60 and Cs-137)

Energy response of personal dosimeter is not different from Co-60 and Cs-137 as shown in Fig. 2. So only Cs-137 is used in the test.

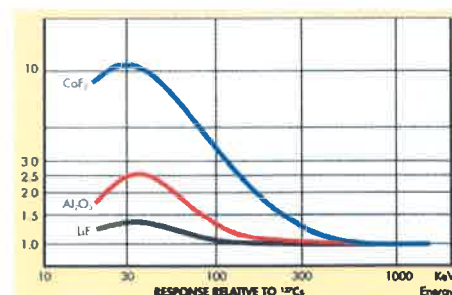


Fig. 2. Energy response of the personal dosimeters.

### 2.5. Determination of the Test Categories

Finally the determined test categories are in the Table 2 with the test irradiation ranges and tolerance levels to consider the Korean situations.

Table I: New test categories, test irradiation ranges and tolerance levels

Test Categories	Test Irradiation Ranges	Tolerance Level(L)	
		Hp(10)	Hp(0.07)
I. Accidents(Photons) Cs-137, WS110	0.05 ~ 5 Gy	0.24	-
II. Photons/Photon Mixtures Cs-137, X-Ray(WS, HK Series), Cs-137/X-Ray <sub>3</sub> (Photon Mixtures) $E_{inc} \geq 20$ keV for X-Ray and Cs-137 $E_{inc} \leq 70$ keV, $\alpha = 0^\circ$ $E_{inc} > 70$ keV, $\alpha = 0^\circ, 40^\circ, 60^\circ$	0.5 ~ 50 mSv	0.3	0.3
III. Betas Sr/Y-90, Kr-85	2.5 ~ 250 mSv	-	0.3
IV. Beta+Photons <sup>1</sup> (II + III)			
Shallow	3.0 ~ 300 mSv	-	0.3
Deep	0.5 ~ 50 mSv	0.3	-
V. Neutron+Photons (II + Bare Cf-252, II + D <sub>2</sub> O-moderated Cf-252)	1.5 ~ 50 mS	0.3	-

Next year, we will conduct a preliminary performance test on all the readers in Korea using the determined test categories to examine the suitability of the revised performance test standard.

### 3. Conclusions

Revised test categories for the personal dosimetry performance test are established to reflect the on-site conditions where the radiation workers are exposed and to conform the international standards. The characterizations of the new system are as followings.

- 1) Easy to maintain traceability the Irradiation system by using ISO radiations
- 2) Reflecting the dose response according to the incident angle of photon by the movement of the radiation workers to the test item
- 3) Strengthened evaluation of low-energy beta particles, reflecting low-energy beta that are being used for medical use
- 4) Addition of non-moderated Cf-252 source to improve the performance evaluation of high-energy neutrons from accelerators, etc.

### REFERENCES

- [1] Health Physics Society, ANSI N13.11-1993, 1993.
- [2] Health Physics Society, ANSI N13.11-2009, 2009.