

The Assessment of Internal Doses for the Korean Nuclear Medicine Workers based on the Thyroid Bioassay Measurement of ¹³¹I

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INTRODUCTION

PURPOSE & NECESSITY

- Assessment of Internal Doses by intake of ¹³¹I on the nuclear medicine workers in Korea
- Judgment of the need for a routine personal monitoring on the Korean nuclear medicine workers who deal with ¹³¹I

Dosimetric data and Intake & E(50) for I-131

- $T_{1/2} = 8.04$ d, γ energy 0.36 MeV (Intensity 81%)
Inhalation : vapour, Class SR-1, $f_1=1.0$, $e(50)_{inh} = 2.0E-08$ Sv/Bq
- $I = \frac{M(t)}{IRF(t)}$, $E(50) = I \times e(50)_{inh}$
I : Intake, M(t) : thyroid activity at a time after inhalation,
IRF(t) : intake retention fraction at a time after inhalation,
E(50) : committed effective dose, $e(50)_{inh}$: dose coefficient

Korean nuclear medicine

- 1,279 workers in 3,019 hospitals (136 hospitals for ¹³¹I) in 2007
- The annual used amount of ¹³¹I

Year	2006	2007	2008	2009	2010
TBq	38.8	54.1	62.3	73.2	77.8

METHODS

Thyroid Measurement

- Reference** : KINS, "Study on Internal Exposure Data of Radiation Workers in Nuclear Medicine", KINS/HR-857, 2008
- Detector** : 2" NaI(Tl) scintillation detector with collimator
- Detection efficient** : 0.1% (25 cm distance), MDA : 1.09 kBq
- Subject** : 81 workers of 5 nuclear medical institution
- Measurement** at the next day after work
- total 649 measurements during a month

Evaluation of Intake & E(50)

- Condition** : Repeated acute inhalation, Vapour(SR-1), $f_1=1.0$
- ICRP-66 HRTM, ICRP-30 GI model, ICRP-67 systemic model
- IRF : 0.23 (at 1 day after an inhalation of ¹³¹I with vapour)
- Committed effective dose coefficient, $e(50)_{inh} = 2.0E-08$ Sv/Bq
- Computer code for internal dose evaluation: BiDAS & IMBA
(※ BiDAS: Bioassay Data Analysis Software developed by KAERI)
- Estimation of E(50) due to annual intake of ¹³¹I
= E(50) due to intake of ¹³¹I during a month X 12 months

RESULTS & DISCUSSION

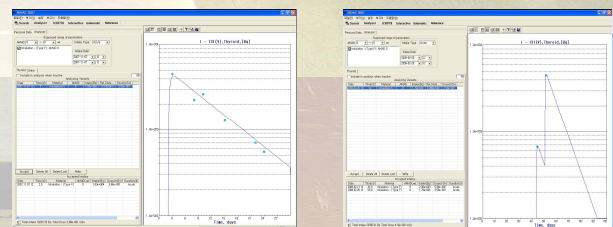
Thyroid measurement data of I-131

Hospital	A	B	C	D	E
Subjects	26	15	12	14	14
Contaminated Workers	6	2	7	9	6
Detected Numbers	9	3	24	15	12
Activity (>0.5 kBq)	~4.5	~0.7	~4.5	~1.3	~6.7

Duty of the contaminated workers

- Injection & Medication / Distribution & Transportation / Patient examination / Radioactive waste treatment / Radiation safety control / and etc.
- There was no special connection between a duty of workers and the extent of contamination.

Evaluation of Intake & E(50) (Example)



Estimation of E(50) by the annual intake of I-131

(Unit : mSv)	E(50) by monthly intake	E(50) by annual intake
Range	0.11 ~ 0.58	1.32 ~ 6.96
Average	0.25	3.01

- (Cf) only for the workers exceeded 0.1 mSv by the monthly intake
- 10 workers (12% of Subject) > 1 mSv (E(50) by annual intake)
 - 6 workers (7% of Subject) > 2 mSv (E(50) by annual intake)

CONCLUSIONS

- Internal doses for the nuclear medicine workers in Korea have been assessed on the basis of thyroid bioassay measurement data of ¹³¹I.
- Thyroid activity was detected in 10% of the total 649 measurements for 81 workers in 5 nuclear medicine hospitals during a month in 2007.
- Committed effective doses by inhalation of ¹³¹I during a month were in the range of 0.11 to 0.58 mSv, and 0.25 mSv on average on the 10 workers exceeded 0.1 mSv.
- 6 workers have been expected to exceed 2 mSv resulted from an annual intake of ¹³¹I. Conclusively, about 10% of Korean nuclear medicine workers who deal with ¹³¹I needs a routine personal monitoring.