

Measurement of Urinary Radioactivities for the Workers in Nuclear Medicine

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1. Introduction

The workers treating in nuclear medicine is likely be internally exposed by particles, inert gas, and vapor regarding radioisotopes. Since the worker for the facilities can be inhaled in the contaminated air, Bioassay method, such as urine, can be a useful tool to assess the internal dose for the workers.[1,2] Table 1 shows RI nuclides can contaminate the facility and the workers. Physical data and dose coefficient of the RIs are also shown in table 1. According to dose coefficient, I-131 is severe nuclide for workers. Urinary measurement for the workers was performed. The methods and results of the urinary measurement will be described in this KNS conference.

Table 1. Dose Coefficients and Physical Parameters of the Considering RIs

Nuclide	Half life	Absorption type	f1	e_inh(50)(Sv/Bq)	
				5um AMAD	Vapor
I-131	8.04d	F	1.0	1.1E-8	2.0E-8
I-125	60.1h	F	1.0	7.3E-9	1.4E-8
Tc-99m	6.02h	F	0.8	2.0E-11	-
F-18	1.83h	F	1.0	5.4E-11	-

2. Urinary Radioactivities

In this section the method and the results of the radioactivities of the urine in the Nuclear Medicine facilities are described.

2.1 Method of Urinary Radioactivityites

Urinary method as indirect bioassay data was normalized based on the sampling protocol. Generally, Urinary data are automatically normalized to a total 24-hour excretion by use of the standard approximate 24-hour sampling protocol of collecting all urine voided between 30 minutes before retiring at night and 30 minutes after rising in the morning for two consecutive

nights. This protocol was originated at Hanford. If the sample is collected properly, a total or approximate 24-hour urine sample result was used. A proper 12-hour sample result was normalized by doubling the result.



Fig.1. Measuring instruments for the urinary radioactivity

A sample that was supposed to contain 24-hour excretion may not be analyzed if the volume was less than 500 ml because the volume was too small to represent a true 24-hour collection. Alternatively, the result was

- 1) normalized to 24-hour excretion based on information from the provider,
- 2) ignored, or
- 3) normalized by volume to 24-hour excretion.

To normalize by volume, 1600 ml for males and 1200 ml for females should be used for 24-hour excretion unless the person-specific daily excretion rate is known. However, acquired urines, dependent on the worker's working condition, was measured around 300ml after 3-4 days from RI treating. Even though it was not enough to get daily accurate radioactivities, we can acquire meaningful data to compare between the hospitals.

Figure 1 shows a high purity germanium detector from the urine sample. 40ml of urine samples were extracted to put on the detector from 300ml and insert 5cc of formalin to be cloudy or corrupted.

2.2 Results of the Radioactivities of the Urine Samples for the Workers

The radioactivity results of around 80 urinary samples for the works are shown in table 2. I-131 was detected from urine of the workers for radiology, patient room, distribution room and were detected 33% of the worker in A hospital, 25% of the worker in B hospital, and 22% of the worker in C hospital.

Radioactivity was measured 97.3 Bq/L in maximum for a worker at Radiology Lem. This worker, experienced for 20 years, treated 2,250 mCi(Solution 30 mCi) of I- 131 and stayed a distribution room at all time. Especially, I-131 was detected for the worker not to treat this RI.

Table 2. Radioactivities and Associated DACs of the Facilities.

	Working point	Treating nuclide	Radioactivity (Bq/L)
A	Sky	Tc-99m	2.03
	Lem	Tc-99m,I-131	97.3
	SPECT	Tc-99m	9.36
	E.cam		2.94
B	Nurse for patient room	I-131	4.75 ~ 19.1
	Etc.	I-131	1.34 ~ 16.3
C	Nurse for treating room	I-131	4.11
	Gamma camera	Tc-99m, I-131,111,123	9.29
	Distribution		1.82 ~ 2.46

3. Conclusions

Urinary measurement was performed to survey the internal dose of the workers in nuclear medicine. Many workers treating I-131 were internally exposed by I-131.

Especially, I-131 was measured in urine of the worker not to treat this radioisotope materials, this is the reason most of the workers staying in nuclear medicine access I-131 distribution room. Urinary results are being studied and compared by the working condition, such as working time and treating radio isotopes. We are preparing the profound study on the internal exposure dependency on the working condition.

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REFERENCES

- [1] USNRC regulation report, 10CFR20
- [2] ICRP report, 78