

## Measurement of Air Sampling for RI treating facilities in Nuclear Medicine

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### 1. Introduction

The facility treating in nuclear medicine is contaminated by particles, inert gas, and vapor regarding radioisotopes. Since the worker for the facilities can be inhaled in the contaminated air, air in the facility should be sustained less than DAC limitation even though the period and method to measure the radio activities in the air are dependent on the size of the facilities and the type of the contamination. We performed air sampling and measuring their radio activities in the facilities treating nuclear medicine. The methods and results of the air sampling will be described in this KNS conference.

### 2. Air sampling in the facilities

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

#### 2.1 Method of the Air Sampling

The need to perform surveys is based on limiting dose to workers. According to 10CFR20[1,2], worker intakes of RI should be monitored if the intakes are likely to exceed 10% of the annual limit on intake. One of the methods to monitor the intakes is to estimate the potential for the intake of the RI, such as air sampling. Based on the experience with a wide range of the facilities, equipment, and process, the potential intake is one millionth of the unencapsulated RI in the work location for 1 year.

Air sampling systems consist of an air sample collector with an appropriate collection medium, an air mover to move the air through the collector, and a equipment for controlling the flow rate.

Potential intakes were calculated by equation (1).

$$I_p = Q \times 10^{-6} \times R \times C \times D \quad (1)$$

where R is the release fraction,  
C is the confinement factor,  
D is the dispersibility.

The location of the air sampler is 1.5meter, representing the region of the inhalation, from the earth

of the facilities. Air sampler was used to HI-Q and DF-40-8 of F&J. Considering the low level of the detection limit, the collection time was fixed maximum 60 minute. Average collection flow rate was 40L/min. Used collection filter was NAC-100L from domestic company.

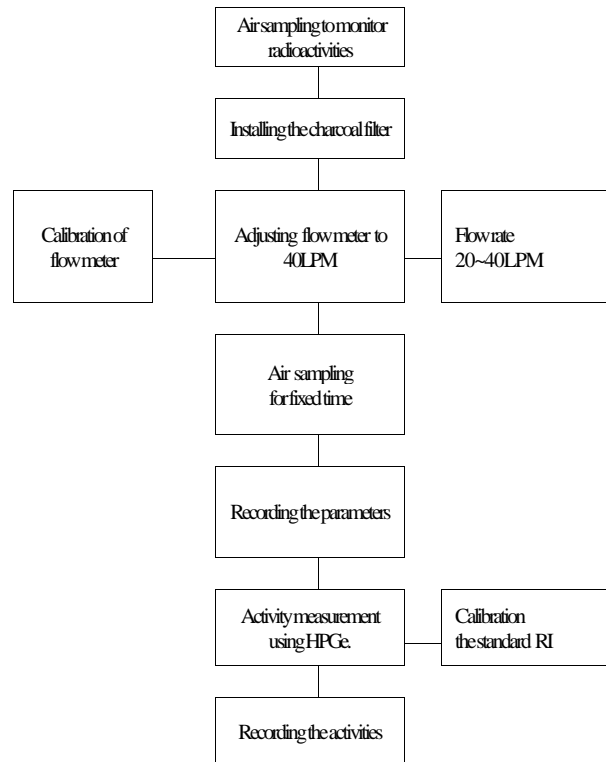


Fig. 1. Air sampling procedure

The radioactivities of the air samples were measured and analyzed by a high purity germanium detector (MCA 100 from CANBBERA). The procedure flow chart of the air sampling and measuring the activities is described in Figure 1. Air sampler was measured for a production room, a distribution room, and an aisle in a department of the nuclear medicine.

#### 2.2 Results of the Air Sampling and the Radioactivity Measuring

The results of the radioactivities of the air sampler in nuclear medicine facilities show in Table 1. From the measured activities, we estimated the associated DAC

values.

The 4 radioisotope materials (an iodine 131, an iodine 123, a meta-stable technetium 99, and a fluorine 18) were observed in all rooms of the department of nuclear medicine. F-18 in the aisle was observed just one time.

I-131 radioactivity of the production room was 37.6 Bq/m<sup>3</sup> and 475.4 Bq/m<sup>3</sup> in maximum. I-123 average radioactivity shows 26.7 Bq/m<sup>3</sup> in case they treated 21,600 mCi of I-123 for 2 month. Measured I-131 radioactivity of the production room was 133.0 Bq/m<sup>3</sup> of maximum (average 46.6 Bq/m<sup>3</sup>) in case they used 14,250 mCi (13,366 mCi in capsule and 884 mCi in liquid) for 2 month. Measured I-131 radioactivity of the aisle 72.7 Bq/m<sup>3</sup> of maximum (average 13.3 Bq/m<sup>3</sup>). In case of I-131, associated DAC shows 1.19 in maximum at production room.

I-131 is a significant RI and shows the maximum radioactivities and their DACs. This is the reason that the workers treating I-131 in liquid increase.

### ACKNOWLEDGEMENT

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### REFERENCES

- [1] USNRC regulation report, 10CFR20
- [2] USNRC regulation report, NUREG-1400 final report, 1993

*Table 1. Radioactivities and Associated DACs of the Facilities.*

		Production room		Distribution room		Aisle	
		Activity (Bq/m <sup>3</sup> )	DAC	Activity (Bq/m <sup>3</sup> )	DAC	Activity (Bq/m <sup>3</sup> )	DAC
I-131	min	0.061	1.5E-04	7.650	1.9E-02	0.690	1.7E-03
	max	475.4	1.19	133.0	3.3E-01	72.70	1.8E-01
	average	37.62	9.4E-02	46.55	1.2E-01	13.32	3.3E-02
I-123	min	0.088	4.3E-06	0.256	6.4E-06	0.140	3.5E-06
	max	79.73	2.0E-01	0.633	1.6E-05	3.120	7.8E-05
	average	26.66	6.7E-02	0.406	1.0E-05	1.748	4.4E-05
Tc-99m	min	0.726	1.8E-06	ND	ND	ND	ND
	max	4.470	1.1E-05	ND	ND	ND	ND
	average	2.598	6.5E-06	ND	ND	ND	ND
F-18	min	0.003	1.7E-08	ND	ND	3.45	1.7E-05
	max	0.368	1.8E-06	ND	ND		
	average	0.186	9.0E-07	ND	ND		

### 3. Conclusions

Air sampling measurement was performed to survey estimate internal exposure for the workers at the facilities in nuclear medicine in a hospital. Production room shows higher activities than distribution room even it is not enough data of radioactivities for 2 month.