

§2. Measurements Survey of Radioisotope Concentrations in Air in Radiation Workplaces

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In the previous survey¹⁻³⁾, the questionnaires were sent to 128 radiation facilities, and 64 responses were obtained. An aggregate analysis of the answers for questionnaires showed as the followings. Major radio-nuclides subject to measurement in radioisotope-facilities in Japan are ³H and ¹⁴C (more than 85 %), ³²P and ¹²⁵I (about 60 – 50 %) and ³⁵S (about 30 %). As a result of the measurement, air contamination by radioactivity was not detected in about 55 % facilities surveyed, but in 40 % facilities at the same level as or at lower levels than a hundredth part of the regulated concentration limit of each nuclide. All facilities surveyed are found to consider that the radioactivity concentration measured in working environments did not exceed the concentration limit regulated in the law.

Following the previous questionnaire survey, the present measurements survey was conducted to evaluate the current measurement of radioactivity concentration in working environment of many radioisotope-facilities. The measurements survey questionnaires were sent to 101 radioisotope-facilities, and 108 concentration data for 10 radioisotopes were obtained from 13 radioisotope-facilities.

Aggregate analysis was carried out in the same way as before. Table I shows the detection limits of the measurement for respective major radio-nuclides (³H, ¹⁴C, ³²P, ¹²⁵I and ³⁵S). In Table I, nuclides, numbers of measurement data obtained and facilities responded are listed at the left three columns. Relating to detection limits, average values over the data, the minimum and maximum ones (with ratios to legal limits) are listed at the right three columns. These results prove that the detection limits of the measurements were less than the concentration limits regulated for radiation workplaces for major five radio-nuclides, and that the measurement performed at the present time has sufficient sensitivity to detect radioisotope contamination in air at working places.

Table I Detection limits of radioisotope concentration measurement in air for major five radio-nuclides.

Nuclide	Number of Data / Facility	Detection limits (Bq/cm ³)		
		Average	Minimum	Maximum (ratio to legal limit)
³ H	7	6	1.1E-05	3.9E-07 2.9E-05 (5.8E-05)
¹⁴ C	5	4	3.8E-06	2.8E-07 8.0E-06 (2.0E-04)
³² P	11	4	1.5E-06	2.8E-08 3.8E-06 (5.4E-04)
¹²⁵ I	15	3	1.7E-06	2.1E-07 2.5E-06 (2.5E-03)
³⁵ S	4	2	7.3E-07	.8E-07 2.0E-06 (1.0E-04)

Table II is a summary of detection frequency of radioisotope contamination in air before, during and after radioisotope handling for respective major five nuclides. Radioisotope contaminations in air exceeding the detection limits were observed in 11 of the 101 data. Ten of these were obtained at sampling during radioisotope handling. As 47 data were obtained during radioisotope handling, this means a 21.3% detection rate. For measurements before and after handling, the detection rates were 0 and 3%, respectively.

For limited ³H, ³⁵S, and ¹²⁵I, the detection rates were 57.1, 40.0, and 18.8%, respectively, during radioisotope handling. Although some concentrations exceeded the detection limits, all the data were apparently less than the concentration limits regulated for the respective nuclides in radiation workplaces.

Table II Detection frequency of radioisotope contamination in air for major five radio-nuclides.

Nuclide	Number	Working state			Detection rate (%)	
		Before/During/After	During	Entirety		
³ H	Data	6	7	8		
	Detection	0	4	0	57.1	19.0
¹⁴ C	Data	4	6	5		
	Detection	0	0	0	0.0	0.0
³² P	Data	7	13	7		
	Detection	0	1	0	7.7	3.7
¹²⁵ I	Data	5	16	9		
	Detection	0	3	1	18.8	13.3
³⁵ S	Data	2	5	1		
	Detection	0	2	0	40.0	25.0
Total	Data	24	47	30		
	Detection	0	10	1	21.3	10.9

- 1) Nomura, K.: RADIOISOTOPES: 55((2006)217.
- 2) Kawano, T. and Nomura, K.: Radiation Safety Management 7(2008)72.
- 3) Kawano, T. and Nomura, K.: Radiation Safety Management 9(2010) in press.