

# §14. Measurement of Radioactivity Concentration in Working Environment of Radioisotopes Facility

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To look over the current measurement of radioactivity concentration in working environment of many radioisotopes facilities, a questionnaire survey was carried out. 64 responses were obtained in 128 radiation facilities, which the questionnaires were sent to. The main results were obtained by aggregate analysis of the answers for questionnaires as the followings.

Major radio-nuclides subject to measurement are listed in Table 1.  $^3\text{H}$  and  $^{14}\text{C}$  were measured in more than 85% of facilities replied,  $^{32}\text{P}$  and  $^{125}\text{I}$ , in about 60 - 50% of those.  $^{35}\text{S}$ ,  $^{51}\text{Cr}$ ,  $^{35}\text{Ca}$ , and  $^{131}\text{I}$  are also measured. These nuclides are often used in radioisotope-facilities.

**Table 1 Major nuclides measured**

Nuclide	Number of facilities	Ratio (%)
$^3\text{H}$	57	89.1
$^{14}\text{C}$	56	87.5
$^{32}\text{P}$	38	59.4
$^{125}\text{I}$	31	48.4
$^{35}\text{S}$	18	28.1
$^{51}\text{Cr}$	9	14.1
$^{33}\text{P}$	5	7.8
$^{45}\text{Ca}$	4	6.3
$^{131}\text{I}$	4	6.3

Sampling of radioisotopes in air was mainly performed using various collectors listed in Table 2. A dust sampler and a HC-collector are used in 70% and 50% of facilities, respectively. The HC-collector is used for collecting  $^3\text{H}$  and  $^{14}\text{C}$  in air. The dust sampler is for trapping dust containing other nuclides like  $^{32}\text{P}$  and  $^{35}\text{S}$ . For  $^{125}\text{I}$ , an activated charcoal filter is usually used in place of a filter paper attached to the dust sampler.

**Table 2 Sampler used for collection**

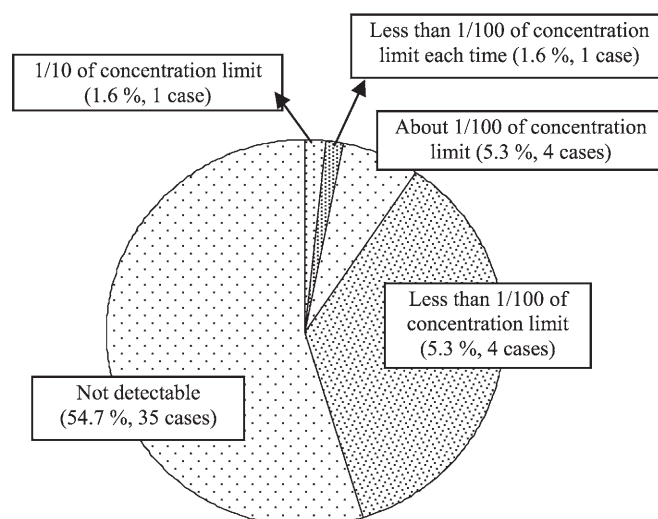
Sampling device	Number of Facilities	Ratio (%)
Dust sampler	45	70.3
Low volume sampler	13	20.3
Filtering collector	12	18.8
Activated charcoal trap	10	15.6
Solid material collector	4	6.3
HC-collector	32	50.0
Liquid condensation	23	35.9
Refrigeration condenser	13	20.3

Prepared samples are measured using proper measurement devices and radioactivity concentrations in air are evaluated. The measurement devices usually used are listed in Table 3. A liquid scintillation counter is the device to measure beta radioactivity (like  $^3\text{H}$  and  $^{14}\text{C}$ ) contained in air in about 70% facilities surveyed. Gamma radioactivity in borne particles is measured using a gamma counters and other devices.

**Table 3 Measurement device used**

Measurement device	Number of facilities	Ratio (%) "
Liquid scintillation counter	44	68.8
Gamma counter	16	25.0
NaI-scintillation counter	18	28.1
Plastic-scintillation counter	14	21.9
Ge-semiconductor detector	9	14.1
Gas-flow counter	4	6.3
ZnS-scintillation counter	3	4.7
GM-detector	3	4.7
Vented ionization chamber	3	4.7

Figure 1 is the summary of results of radioactivity measurement performed in working environment for these three years. 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.



**Fig.1 Results of radioactivity measurement performed in working environment**