Preface

A-VORBEMERK-NIEDE

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Preface

In Germany, the monitoring of radioactivity in the atmosphere is based on the following legislation:

- The law regulating the Deutscher Wetterdienst (DWD),
- the Precautionary Radiation Protection Act (Strahlenschutzvorsorgegesetz, StrVG),
- the Radiation Protection Ordinance (Strahlenschutzverordnung, StrlSchV) and the guidelines for the monitoring of emissions and immissions of nuclear installations (REI) that are based on it.

The aim of the monitoring programme is to determine radionuclides that are deposited with precipitation.

Airborne particulate radionuclides are washed out of the atmosphere through processes known as "rain-out" (airborne particulate matter as condensation nuclei for the formation of precipitation) and "wash-out" (washing out of airborne particulate matter through precipitation), respectively. These wet depositions contain radionuclides at a factor of up to 1000 as compared to the activity concentration of radionuclides in the air. The deposition of suspended dust (airborne particulate matter) through sedimentation is referred to as dry deposition.

According to the General Administrative Regulation on the Integrated Measuring and Information System for the Monitoring of Radioactivity in the Environment (AVV-IMIS) (1), gamma spectrometric measurements, measurements of alpha emitters, measurements of Sr-89/Sr-90, Tritium and total beta measurements are to be taken for the environmental section precipitation. REI (2) likewise prescribes, amongst others, gamma spectrometric measurement of the precipitation.

The standard procedure for the determination of individual radionuclides in precipitation is gamma spectrometry. Direct measurement of a precipitation sample (rainwater) in a plastic bottle or a ring dish is a method suitable in the case of higher activity concentrations. If the radionuclides are present only in traces, in a range from 0,1 $mBq \cdot l^{-1}$ to 10 $mBq \cdot l^{-1}$, they first need to be concentrated, however. The detection limits demanded by individual measurement programmes can be achieved by selecting a suitable collection surface area (for the precipitation), collection interval, method of sample preparation, detector, and measurement period.

A tried and tested method is the determination of the total beta activity contained in precipitation. This method does not supply nuclide-specific results, however.

Sampling does not distinguish between wet and dry depositions, but records the total deposition of both wet and dry radioactive substances. The size of the precipitation collection vessel needs to be selected as to reliably collect the total amount of rain that can be expected to fall during the period of time determined by the measurement task.

Rain collectors that work reliably under all conditions require elaborate constructions. Their use in extreme conditions (in mountain situations, exposed to strong winds, high local dust loads etc.) may necessitate special measures to be taken (3).

The collection surfaces for the sampling of precipitation will typically be larger than those of meteorological measuring equipment to ensure that sufficiently large amounts of sample material are collected for subsequent analyses. These collection systems do not conform to the standard set for metering precipitation, however. To facilitate comparability, both the activity concentration in the deposition of the aqueous sample and the separately recorded amount of precipitation can be determined. The latter is recorded using a commercially available standard rain meter with a small collection surface (200 cm^2) or small sensor pad (4). The precipitation collection system and the standardized rain meter are to be set up in immediate proximity to each other. Here, the deposition is determined through multiplication of the activity concentration with the amount of precipitation per square metre and given as activity per area in $Bq \cdot m^{-2}$.

Requirements for the sampling locality of precipitation

The choice of a location for sampling precipitation should be based on the requirements for classical metering of precipitation height. This will always be a spot-measurement. Strictly speaking, the measured precipitation height is only valid at the site of metering. Extrapolation of the metering result from this area to other (neighbouring) sites or larger (similar) areas depends on the degree of representation of the sampling location. In order to achieve the highest possible degree of representation, the following requirements should be complied with (3, 4, 5, 6):

- The wider surroundings of the sampling location should have enough obstacles (loosely arranged buildings and/or vegetation) to provide a certain amount of "horizontal shielding" and so prevent excessive wind speeds. A simple method for evaluating and quantifying horizontal shielding can be found in the literature (3).
- Obstacles in the immediate vicinity of the sampling installation need to be distanced at least as far (preferably twice as far) as they are tall. Possible future changes (growth of trees or shrubs, building activity) have to be anticipated. The installation location should not be situated between wide obstacles of uniform height (rows of houses), as these will create aerodynamic turbulences that falsify results.
- There should be no updrafts at the installation location, which would be the case on slopes, dykes, hillocks and behind large obstacles.
- In the case of structured terrain, individual projecting hilltops, steep slopes or narrow valleys have to be regarded as poor sites for metering installations. If the area to be represented requires that metering points be set up in valleys, on slopes, or at elevated spots, the courses of elevated terrain and valleys relative to the main direction of movement of precipitation fields have to be taken into consideration.

References

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(3) DVWK, Merkblätter zur Wasserwirtschaft 230, Niederschlag – Empfehlung für Betreiber von Niederschlagsstationen, 1994

(4) DIN 5866, Meteorological instruments - Rain-gauge, with a collecting area of 200 cm^2

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