

## **Experimental determination of correction factors for assessment of the activity discharges of radionuclides bound to aerosol particles from nuclear facilities**

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From the stacks of nuclear facilities radionuclides bound to aerosol particles - beside radionuclides in gaseous form like noble gases, tritiated water vapour or C-14 containing carbon dioxide – are discharged into the environment. For the assessment of the discharged activities of these radionuclides a part of the effluent air stream is extracted by means of a rake of extraction probes and conducted by primary and secondary sampling tubes to the sampling devices equipped with particulate filters. The discharged activities are calculated using the measured activities of the radionuclides on the deposited particles and the measured volumes of the effluent air stream and the air stream through the particulate filters.

Through the following effects the activity concentrations at the upstream side of the particulate filters are generally lower than those in the free effluent air stream:

- anrepresentative extraction due to uneven distribution of air velocity and activity concentration in the effluent air stream over the diameter of the stack;
- changes of size distribution for activity and particle number due to anisokinetic extraction;
- losses of aerosol particles and activities of the bound radionuclides in the sampling tubes, generally due to turbulent deposition and impaction. The losses of aerosol particles with aerodynamic diameters larger than 3 µm are considerable. The losses of the activities of the aerosol particle bound radionuclides depend on the aerosol particle losses and the activity size distribution, which is a logarithmic standard deviation with a geometric mean diameter of about 1 µm in general; the values of these losses are in the range of some percent up to 40 percent. (Vogl, 1994).

Therefore, for the assessment of the true activity discharges correction factors have to be used. The so-called tube factor takes into account only the losses of activity in the sampling tubes and is defined as the activity concentration at the inlet of the extraction probes to the activity concentration at the upstream side of the particulate filters. The so-called total correction factor considers all the above mentioned effects and is defined as the mean activity concentration in the effluent air stream to the activity concentration at the upstream side of the particulate filters.

For the experimental determination of both correction factors test aerosol particles may be used which differ from the aerosol particles in the effluent air by being radioactive, by the chemical composition or by a much higher mass concentration. In all cases the activity size distribution or the mass size distribution of the test aerosol particle collective must be similar to the activity size distribution of the radionuclides carrying aerosol particles in the effluent air stream. For most experimental determinations powders like titanium dioxide are dispersed.

For the experimental determination of the tube factor a known amount, e. g. activity or mass, of these test aerosol particles are injected into the inlets of the extraction probes. In case of the total correction factor, these test aerosol particles are injected into the air stream at several locations upstream of the extraction rake.

The amount of the test particles deposited on the particulate filter may be determined gravimetrically or by other methods, e. g. XFA.

The value of the tube factor is the ratio of the injected amount of the test aerosol particles and the amount of the test particles on the particulate filter. The value of the total correction factor is the mean value of the ratios of the injected amounts of the test aerosol particles and the amounts of the test particles on the particulate filters.

For 12 investigated nuclear facilities in Germany the values of both correction factors are in the range between 1,1 and 1,6.

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