Results from a measurement campaign in dismantling nuclear sites: a study of the false alarms emitted by CAM

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Given the emergence of new problems related to radioprotection survey in dismantling operations, it is necessary to significantly improve knowledge related to radioactive aerosols measurements. A contamination air monitor (CAM) continuously measures gross α and β activity concentration in the air (Dominikov *et al.,* 2001). In these specific atmospheres, alarms often appear but not related to any artificial activity concentration: they are considered as false. As a consequence, the generated false alarms are attributed to the presence of radon daughters in large quantities and could lead to a trivialization of the risk. Our study aims at characterizing ambient aerosols according to CAM measurement in order to provide better explanation of the false alarms.

Thus, we conducted a measurement campaign in a dismantling nuclear site (former NPP Brennilis). During three weeks, we have recorded all the parameters from the CAM used there, an ABPM203M from Mirion Technologies[1] company. Simultaneously we have measured the aerosols size distribution and concentration with an optical particle counter Fidas Mobile (Pallas) and an Andersen impactor. The radon and its daughters were measured independently by an AlphaGuard (Saphymo) and a BWLM-PLUS-S (TracerLab).

The artificial alpha-activity has obviously varied, regularly presenting some increases, and six times the alpha alarm threshold has been crossed. The CAM filter never seemed to be clogged and the ambient conditions were pretty stable, without any relation with the alarms. Moreover, none of them can be associated to the ^{222}Rn nor its daughters variations: the ^{222}Rn, and its daughters, cannot be the direct cause of false alarms.

However, the aerosols characteristics measurements highlight one particular point: each artificial alpha activity peak measured by the CAM can be related to significant increases of aerosol mass concentration (figure 1) and mass median diameter (values upper than 10 µm). These increases are mainly due to particles resuspension during cleaning operations on working area. Sampling filters from the CAM were analysed by MEB & EDX imaging and showed that the filters were effectively covered by coarse particles upper than 10 µm.

We propose two hypotheses on the impact of these coarse aerosols. Firstly, the particle resuspension could lead to an increase in concentration of ^{210}Po, an alpha-emitter far in the ^{222}Rn decay chain, which may not be compensated by the CAM. Secondly, we know that the coarse particles cause a degradation of the alpha spectrum (broadening toward lower energies). The CAM compensates dynamically the background noise especially due to ^{222}Rn progenies. Despite this compensation, the kinetics of evolution of aerosol size distribution during punctual resuspension event may be too fast for the CAM algorithm to compensate properly the spectrum degradation, resulting in detection of events in the artificial region of interest.

Three points have to be foreseen in the EPICEA laboratory (Monsanglant-Louvet *et al.,* 2012): the ^{210}Po issue, the response time of the CAM and the parameters of its algorithm. A second measurement campaign focused on the response time of the CAM algorithm will be also conducted.

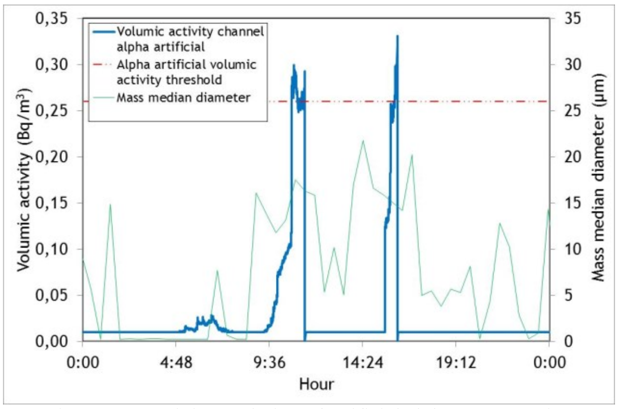

Figure 1 – Conjoint evolution of artificial alpha concentration measured by the CAM and the particle median diameter measured by the optical counter.

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Dominikov, V. N. *et al.* (2001) *Applied radiation and isotopes*, 55, 543-547

Monsanglant-Louvet, C., Liatimi, N. and Gensdarmes, F. (2012) *IEEE transactions on nuclear science*, 4: Vol. 59

[1] https://www.mirion.com/products/particulate-monitors-2/