SnT 2025 8 SEPTEMBER ONLINE DAY 9 TO 12 SEPTEMBER AT HOFBURG PALACE, VIENNA & ONLINE
CTBT: SCIENCE AND TECHNOLOGY CONFERENCE

First results of world's first Snow White air sampler equipped with $LaBr_3$ detector

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National Institute for Public Health and the Environment
Ministry of Health, Welfare and Sport

INTRODUCTION AND MAIN RESULTS

Recently, a new Snow White air sampler is installed at a new location. The new Snow White is equipped with a $LaBr_3$ spectroscopic detector. This detector continuously measures the activity concentration on the filter during the sampling. An increase in activity concentration can now be detected in real time. This is the first Snow White in the world with such a detector. On this poster, the first results of the new system and the new location is presented.

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P3.2-404

A new high volume sampler

Like many other countries worldwide, the Netherlands utilizes a high volume sampler to collect substantial amounts of air for the measurement of radioactive particulates. For many years, RIVM has been responsible for conducting this sampling and measurement within the Netherlands. After approximately fifteen years of operation, RIVM acquired a new high volume sampler in January 2025. Like its predecessor, the new sampler is once again a Snow White model manufactured by Senya Os. This model is also employed at particulate stations within the International Monitoring System (IMS) of the CTBTO.

The old Snow White on the roof of the RIVM premises.

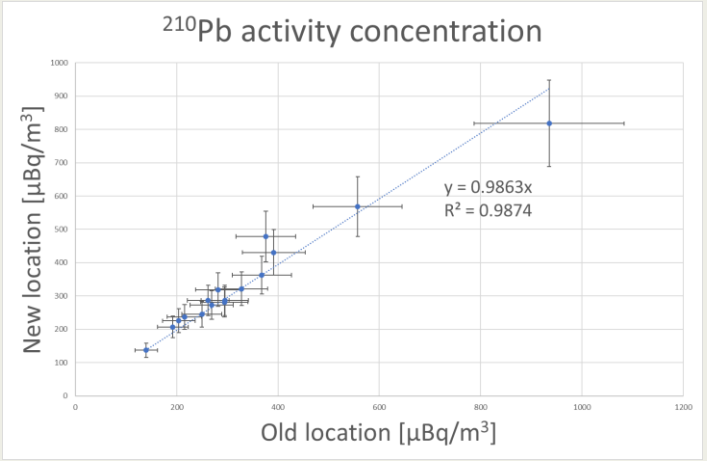
A new location

The new Snow White sampler has been installed at a different location, situated several dozen kilometers from the original site. Additionally, unlike the previous Snow White sampler which was positioned on the rooftop of the RIVM premises, the new device is now placed at ground level.

This change in both location and installation height may have implications for the sampling results and should be taken into consideration during data analysis. Consequently, both the previous and the new Snow White samplers are currently being operated in parallel. This approach enables a direct comparison of their performance under the differing circumstances.

The new Snow White on the new location.

Site comparison



Several nuclides have been used to compare the old and new location. In the graph presented above, the activity concentrations of lead-210 at both locations are shown, based on weekly samples collected between March and June 2025. A linear regression can be fitted to the concentrations measured at both sites. The results of this analysis indicate that there is virtually no difference in the lead-210 activity concentrations between the two locations. A similar analysis of the beryllium-7 activity concentrations yields the same conclusion.

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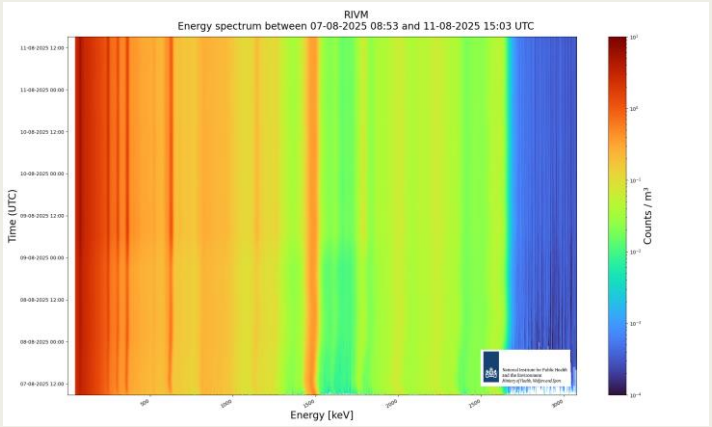
$LaBr_3$ detector

The new Snow White sampler is equipped with a $LaBr_3$ detector, which is mounted directly above the filter. This installation marks the first instance worldwide in which a Snow White sampler is outfitted with an integrated detector. The presence of the $LaBr_3$ detector allows for the continuous collection of a gamma spectrum during the sampling process. As a result, it is now possible to perform preliminary analyses in real time. If unusually high levels of radioactivity are detected in the air, the airflow through the sampler can be reduced accordingly. This adjustment helps to limit the total activity accumulated on the filter, thereby enhancing safety during the subsequent laboratory analyses.

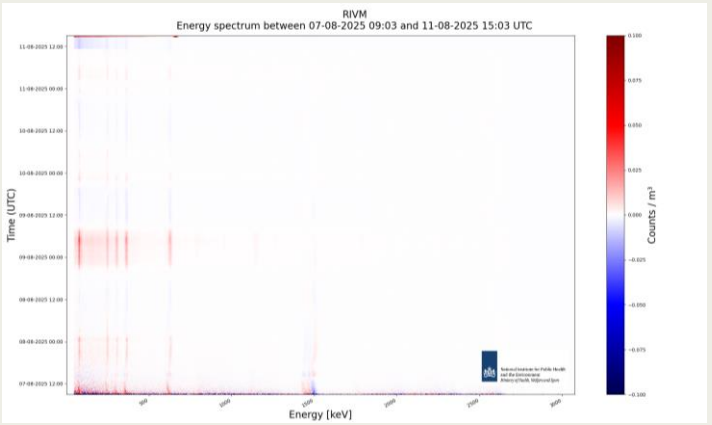
The detector on top of the filter.

Spectrum analysis

Although no processing software is supplied with the Snow White system, it is possible for users to develop their own analytical tools utilizing the spectrum files generated by the detector. These spectrum files can be processed to extract valuable information regarding the presence and concentration of various radionuclides in the sampled air.



In the figure above, the evolution of the gamma spectrum during a sampling period is illustrated. Several prominent gamma lines are clearly visible in the spectrum, corresponding to isotopes such as ^{40}K, ^{214}Pb and ^{214}Bi. The presence of these characteristic peaks demonstrates the effectiveness of the detector in identifying radionuclides during air sampling.



In order to enhance the visibility of changes in the activity concentrations, additional graphs have been generated. In the graph presented above, the data have been processed such that, for each successive time point, the spectrum from the previous measurement is subtracted from the current spectrum. This differential approach allows for the clearer identification of temporal trends in the data. Specifically, it reveals the day/night variation in the concentrations of ^{214}Pb and ^{214}Bi, which is less apparent in the raw spectra. Furthermore, this method significantly improves the ability to detect possible instances of contamination by artificial nuclides.

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