PREPAREDNESS

Metrology for mobile detection of ionising radiation following a nuclear or radiological incident.

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# The development of transportable radioactivity-in-air monitoring systems in the framework of EMPIR project "Preparedness"

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## Introduction

The accident at Fukushima has increased interest in rapidly-deployable radioactivity-in-air monitoring equipment. Specifically, there is a demand for air sampling systems that incorporate gamma-ray spectrometers for (near) real-time measurement capability.

Through the Preparedness project, three distinct air monitors are being developed;

1. Light-weight, CdZnTe-based monitor for use by first responders (Kromek, UK)
2. Compact, rapidly-deployable $CeBr_3$-based monitor for use by recovery workers (IJS, Slovenia)
3. Automated, transportable HPGe-based facility for medium-term monitoring of large area (Nuvia/CMI, Czech Republic)

## 1. QuantAir-Prep

The QuantAir-Prep is being developed by Kromek with support from NPL. The monitor is based on the iodine-in-air monitor, QuantAir (see fig. 1), and incorporates a 1 $cm^3$ coplanar grid CdZnTe gamma-spectrometer. The library of radionuclides available for analysis will be expanded to include key nuclides likely to be encountered during a range of scenarios. Monte-Carlo detection efficiency models will be developed and validated using spiked-filters prepared by NPL.


Fig. 1 – The Kromek QuantAir iodine-in-air monitor.

## 2. MARE

The Monitoring Air Pump for Radioactive aErosols (MARE) is being developed by IJS (see fig. 2). The instrument combines a high sensitivity $CeBr_3$ gamma-spectrometer and high-volume air sampler (200 $m^{-3}$ $h^{-1}$).

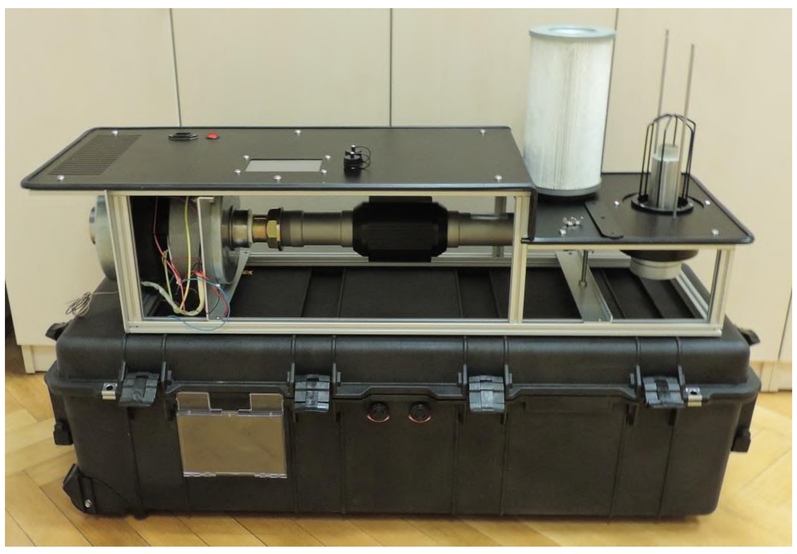

Fig. 2 – The IJS monitoring air pump for radioactive aerosols.

The MARE instrument is built into a flight case which enables rapid deployment and re-deployment. The device will be upgraded to allow easy control from a remote location to perform real-time analyses of the measured data and determine the absolute activity concentrations for the radioisotopes in air. The device firmware will be upgraded with a radionuclide identification algorithm for autonomous analysis and reporting. NPL will provided spiked filters for the calibration and validation of the instrument.

## 3. CEGAM

The Continuous Environmental Gas Aerosol Monitor (CEGAM) facility (see fig. 3) is being developed by Nuvia (CZ) with support from CMI. The facility incorporates an electro-mechanically cooled HPGe detector and high-volume air sampler (60 $m^3$ $h^{-1}$) for high-resolution, high-sensitivity measurement. The modular design and automated function of the system offers a cost effective and flexible solution for medium to long-term monitoring of a site of interest.

Fig. 3 – The Nuvia CEGAM facility.

Special software will be developed for the fully automatic operation, calibration and spectral evaluation. This will include the implementation of sub-software for subtraction of NORM contribution from gamma spectra. The system will be tested in-situ at the laboratory responsible for monitoring the surroundings of the NPP Dukovany (CZ).

## Summary

The ionising radiation and radioactive contamination caused by a nuclear or radiological event, including major NPP accident or terrorist attack, may pose a significant health risk to the public and create major socio-economic hardship.

New detector and communication technology promises to improve the quality of radiological data and the speed with which it can be collected and analysed following a nuclear or radiological incident.

Through the Preparedness project, new air monitoring technology is being developed and will be metrologically validated. This technology will allow on-line and real-time measurements to be made and will lead to an increase in the safety of first responders, recovery workers and the regional population. This technology will be widely disseminated to maximise the impact of the project.

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