European Metrology Research Programme
Delivering Impact

Nuclear incident alerts

In the event of a nuclear incident, authorities need to know how to respond to protect the public. A pan-European monitoring network, using Geiger-Mueller counters, stands ready to detect sudden increases in ionising radiation. These counters measure radiation levels accurately, but cannot distinguish between different photon energies, originating from different radionuclide. Modern instruments can make this distinction but need better characterisation before they can be deployed in monitoring networks.

Challenge

Following a major nuclear incident, fast decisions are needed on issues from protecting the public to prevention of contaminated food entering the supply chain. Different radioactive isotopes, or radionuclides, present different risks. For example, radioactive iodine can accumulate in the thyroid gland, whilst caesium on grass consumed by dairy cows can contaminate milk supplies. Different responses to the specific risks present are required to minimise disruption.

Radiological dose rate monitoring networks were introduced in Europe following the Chernobyl disaster. Most networks use robust and simple to operate Geiger-Mueller counters for detecting changes in radiation levels, but these cannot detect the type of radionuclide present. Identifying specific radionuclides in real-time would allow faster and more appropriate countermeasures. It would also solve a problem created by naturally occurring radon, which is mostly harmless, but when rain washes its decay products from the atmosphere increasing the natural radiation background detectors incorrectly record a false positive response.

Newer radiation detection methods use scintillation materials, which produce flashes of light in proportion to the incoming energy from ionising radiation emitted by various radionuclides. Light is measured with spectrometry instruments to identify the radionuclides present. These detectors could increase the information available for decision-making but need better characterisation to increase confidence in their performance before deployment in monitoring networks.

Solution

The EMRP project *Metrology for Radiological Early Warning Networks in Europe* compared a range of scintillation detectors, using radioactive sources to simulate the nuclides in different types of radioactive contamination following an incident. This comparison demonstrated that these detectors would be suitable for use in radiation monitoring networks. The project also evaluated historic data on naturally occurring radon gas background dose rates and monitor positioning to understand how different factors affect measurement results. Finally, it performed comparison studies in the field to demonstrate expected scintillation detector performance post installation.

EMRP projects operate a scheme enabling workers from other EU institutions to acquire improved skills by visiting sister organisations. As an example, a Polish researcher active in maintaining Poland's early warning monitoring system gained valuable experience in measurement best practice during a fixed-term contract at PTB in Germany.

Impact

As a result of the project, major upgrades have been made to monitoring networks in Poland and Germany.

Polish company TD-ELECTRONICS, has upgraded their electronics and software in new compact spectro-dosimetric probes developed for use in Poland's dose rate monitoring networks using project derived knowledge and field trial performance evaluations. These are being installed in Poland's National Atomic Energy Agency radiation monitoring network, with further upgrades to 13 existing and 30 new stations anticipated in the near future.

BfS, operator of Germany's radiological monitoring stations, has developed a complete detection system using novel scintillation materials, with automatic data relay and upgraded analysis software that was performance tested in the project. This system can create automated alerts for elevated radiation levels, whilst also differentiating between real events and false positives from radon decay product wash out.

These new systems help rapidly identify real contamination events and relay accurate hazard information for authorities making decisions on countermeasures, whilst reducing false positives that have the potential to cause costly and unnecessary interventions.

Greater accuracy for radiation monitoring networks

The EMRP project *Metrology for Radiological Early Warning Networks in Europe* characterised a range of scintillation-based spectrometric detectors to determine their suitability for dose rate and contamination monitoring in Europe's radioactive early warning networks. The effects of the natural radiation background and detector positioning were investigated for installed instrumentation, leading to the generation of corrections which increase dose rate measurement accuracy by typically a factor of two. Novel prototypes of airborne radioactivity monitoring instruments for networked real-time radionuclide identification were tested using simulated contamination on spiked filters in the project. To increase the harmonisation of data supplied to EURDEP, databases of historic data were compiled for use in identifying trends in ambient background radiation and for preventing false alarms. These developments will contribute to the greater availability of robust data for authorities making decisions that affect public safety in the event of trans-border radioactive contamination spread.

© gevende

EMRP
European Metrology Research Programme
Programme of EURAMET

The EMRP is jointly funded by the EMRP participating countries within EURAMET and the European Union

www.euramet.org/project-ENV57

Stefan Neumaier

PTB, Germany
+49 531 592 6150 | stefan.neumaier@ptb.de

11326/0519 - ENV57 19011