

New Developments in Radiation Measuring Technique

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Berthold Technologies is a well-known manufacturer of radiation protection instrumentation for many years. The regulations in radiation protection have been widely changed and harmonized in Europe since a couple of years. One consequence was the definition of new operational quantities as for instance in dose rate monitoring the ambient dose equivalent $H^*(10)$. There were even more changes which require new probes as well as new instruments for applications in radiation protection. Besides of this the availability of innovative technologies has enforced the development of new instruments for new applications. This is for instance true in the field of handheld gamma spectroscopy with automatic identification of radionuclides. There are also other issues like illicit trafficking radioactive sources or illegal transfer of nuclear materials, which need special detection techniques.

Berthold offers a wide variety of dose rate monitors for both, gamma and neutron radiation fields. Together with the nuclear research center Karlsruhe the neutron monitor LB 6411 has recently been developed for neutron dose rate monitoring. This detector has superior characteristics to measure the Ambient Dose Equivalent $H^*(10)$ for neutrons. It's sensitivity is extremely high and the energy dependend response matches the new requirements quite perfectly. Currently there are also new gamma dose rate probes being designed to measure the new quantities. These probes cover a wide range of dose rate levels.

In contamination monitoring Berthold offers the new handheld contamination monitor LB124. This monitor is based on proven detector technology with Xenon-filled proportional counters. The instrument is ideally suited for the measurement of photon emitting nuclides as widely used in nuclear medicine. It has a low weight and the user interface is easy-to-be-used. The software offers many useful functions, tools and access to all parameters for experienced users. For unskilled users the instrument's configuration can be predefined by a supervisor as a simple or even as an extremely simple system depending on the special needs on site. Calibration according to ISO 7503-1 is provided for most common nuclides including the new PET nuclides.

One of the most interesting new products is the hand-held gamma spectrometer LB125. The portable battery operated instrument for the laboratory and for the field is ideal to search, localize, identify and measure radioactive materials. The software provides

intelligent analysis and visualization of the measured data and even users which are not nuclear experts can achieve fast and reliable isotope identification. The radiation is detected by NaI scintillator, and pulse height analysis is done with a fast multi-channel analyzer. Applications of this monitor are mainly in nuclear industry, nuclear decommissioning, nuclear waste, steel and scrap, customs, police and military, especially upon the occurrence of unidentified radiation sources. Several examples of measured gamma spectra are shown.

Several cases of illegal plutonium were reported. Most spectacular was the recent case in Karlsruhe, where plutonium was stolen by an employee. Plutonium is extremely dangerous and hard to detect over larger distances. The alpha-particles, gammas and X-rays which are emitted by the plutonium isotopes can easily be shielded by the material itself or by the surroundings. Therefore we designed a new type of instrument to search for plutonium. It is based on the detection of fission neutrons. Neutrons are generated by spontaneous fission of the even numbered plutonium isotopes. These neutrons are very penetrating and the method is therefore very effective. The detection of 10g reactor plutonium at a distance of 1m is feasible within only 10 seconds.