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A device for monitoring changes in the radiation situation in places where radioactive sources are stored

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To ensure reliable storage of radioactive sources, various physical protection systems are used, including mechanical devices, video surveillance systems, and access control systems. This paper describes a system designed to perform automated monitoring of changes in the radiation environment in real time at the locations of the devices that are part of the system. The system provides visualization of measurement results, generation of an “ALARM” signal and notification of the monitoring network operator in the event of a change in the radiation situation at the location of the detection devices.

There are four types of devices used in the system structure:

- ☒ Device for collecting and processing information;
- ☒ Radon radiometer;
- ☒ Dosimetric device;
- ☒ Mixed radiation detector.

Each kit includes one device for collecting and processing information, one radon radiometer, one dosimetric device and from 1 to 10 mixed radiation detectors. Device for collecting and processing information is the head unit of the system that collects information from detection devices (radiometers and detectors), and also serves as a power source for them. All detection devices within the same room are connected to the same power supply and communication line using junction boxes.

The radon radiometer periodically automatically measures the radon concentration in the room, the dosimetric device transmits data on the dose rate of gamma radiation.

A gamma-neutron radiometer is used in the mixed radiation detectors device to monitor the radiation situation. The sensitive element of the detector is a polystyrene scintillator for registration of gamma quanta, one plane of which is optically connected to a photomultiplier, and five other planes are surrounded by scintillation plates based on 6LiF:ZnS(Ag) for neutron detection. To increase the detector sensitivity to neutrons, the polystyrene- 6LiF:ZnS(Ag) assembly is placed in a polyethylene moderator. A built-in gamma spectrometer is used to monitor changes in the spectral composition of gamma radiation.

The main task of the mixed radiation detectors is to analyze the count rates corresponding to the registration of gamma radiation and neutrons in the control mode and generate an alarm signal when the recorded value goes beyond the permissible upper and lower limits. This ensures the prevention of unauthorized movement of stored radioactive sources.

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Russian Federation

Primary author: CHUVAEV, Sergey (SEC "YAFI")

Presenter: CHUVAEV, Sergey (SEC "YAFI")

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