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Short Communication

Calibration, Control and Servicing of Radiometers Used in Radiological Protection - Abnormalities and Defects Visualized in The Known Field of Ionizing Radiation

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Man does not have a sense that will allow to detect the presence of the ionizing radiation field and to determine its intensity. The only way to determine human safety is to select an appropriate dosimetric instrument, correctly calibrate it, prepare it for operation, properly use it, and regularly control it, so that the results obtained during measurements are correct. Performing 12,800 calibrations of radiometers allowed for the collection of experimental data allowing to determine the properties of radiometers and their most frequently observed faults. Observation of the instruments' behavior at the calibration stand allowed for the identification of some irregularities and defects in the functioning of the instruments, resulting from their software and operation, and the possibility of detecting a large part of the irregularities could only be noticed in the known field of ionizing radiation. One of the causes of irregularities are defects in the design and software of dosimetry devices, the most common ones are: no signaling of exceeding the dose rate threshold, signaling of exceeding the dose rate threshold at different dose rate values and at different times: e.g. from 30 seconds to 3 minutes, low indications of the devices, the same response for different ranges and different reference values or in the same range, non-linearity of instrument indications, large discrepancy between correction factors of adjacent ranges. Other irregularities are the consequences of using the devices in a manner inconsistent with the manufacturer's recommendations, most often they include: false indications of a device equipped with faulty power sources (faulty batteries, leaked batteries), faulty or partially functional (worn out) charger socket - no possibility of efficient charging of the batteries (defective batteries, after being charged, quickly discharge during the measurements, this causes lower and lower indications of the device, misleading the user. ionizing radiation), in the case of sets: a radiometer with a probe, where it is quite common practice to roll the cable in a rough way and force it into the case, which causes its damage, no indication of the power source status.

Incorrect indications lead to incorrectly performed repairs of the radiometer: e.g. the installation of a plexiglass indicator made of plexiglass instead of a glass one causes uncontrolled deflection of the pointer due to the accumulation of electrostatic charges which directly affect the pointer, which in the end leads to the indication of values that have nothing to do with measured by the actual dose rate, due to the fact that some older devices are powered by cells of unusual dimensions, it often happens that replacement batteries are pressed into the device by force, which prevents their subsequent replacement. Aging of instruments or their individual components, especially unevenly in time: the cables connecting the radiometer-probe sets become stiff and prone to breakage over time. The result may be the lack of a signal from the probe, or a signal enriched with crackles from a damaged wire, which leads to the absence or indication of erroneous values (the defect can be detected only in the known field of ionizing radiation), the decrease

in the capacitance of the integrator over time causes the lowering of the actual indications, after a longer period of use (e.g. 30-35 years) of use (aging) of the device, the magnet in the indicator itself gets old, which causes a largely underestimated value, connectors used very often, e.g. radiometer-probe connector, wear out as a result of use, or deform - worsening contact.

Defects in the indications: e.g., different response to the same reference value due to unstable supply voltage to the probe (faulty power source), instability of the parameters of the instrument elements due to aging, incorrect software. The device "goes silent" during the measurement: Each device has an end of its measuring possibilities, which may manifest in the fact that the device, after receiving a dose of high for it, may stop working for some time (from several seconds to even several minutes), which may after such a long time it may lead the user to erroneous conclusions that, for example, the instrument is damaged.

Summary

The failure of dosimetric instruments is associated with the occurrence of changes related to the passage of time and not always the correct operation of these radiometers, Many anomalies can only be detected in the reference radiation field, Regular inspection of the devices allows for the detection and possibly earlier removal of irregularities in the functioning of the devices, which will visibly improve the safety of people professionally exposed to ionizing radiation.