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Radiation monitoring: an integral part of good health physics practice

Radiation monitoring is an integral part of good health physics practice at every medical facility that performs radiation therapy and nuclear imaging activities. It is the core discipline of Radiation Safety Officers (RSOs), Health Physicists, Medical Physicists, Radiologists and Nuclear Medicine Technicians and it is almost universally their responsibility to be acutely aware of radiation exposure rates for facility staff and patients.

As helpful as ionizing radiation can be, it can also be an invisible hazard, and monitoring worker exposure to radiation is paramount in any facility where multiple sources of it can reside. The human body is remarkably tolerant to radiation in low doses, but controlling those doses, and minimizing exposure, often referred to by the acronym ALARA – As Low As Reasonably Achievable, is the rule.

Large hospitals and sprawling medical facilities, with multiple sources of neutron and gamma radiation in use for treatments and diagnostics, are prime candidates for radiation monitoring. Furthermore, many larger institutions will operate cyclotrons to manufacture nuclear tracers or nuclear medical isotopes. As such, radiation monitoring includes monitoring the environmental release of radioactive particulates or positron decay to the atmosphere as part of any license requirement to operate a cyclotron. Accurate and documented monitoring is essential for periodic mandatory reporting to the NRC for license renewals of cyclotrons, radiology labs, and other such facilities.

RSOs are responsible for all Radiation Controlled Areas (RCA) within the facility. RCAs are quite simply designated areas where radiation sources exist and where some exposure by workers can be anticipated, such as in radiological labs. RSOs have the responsibly of keeping track of critical RCAs, areas that require radiation monitoring with contamination survey meters, area monitoring, and passive or active dosimetry instruments for facility staff or patients. RSOs are trained to use new monitoring products such as area monitoring systems after installation, and to learn the intricacies of operation and the software that allows adjustment of the monitors' set parameters.

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Area Monitoring Solutions

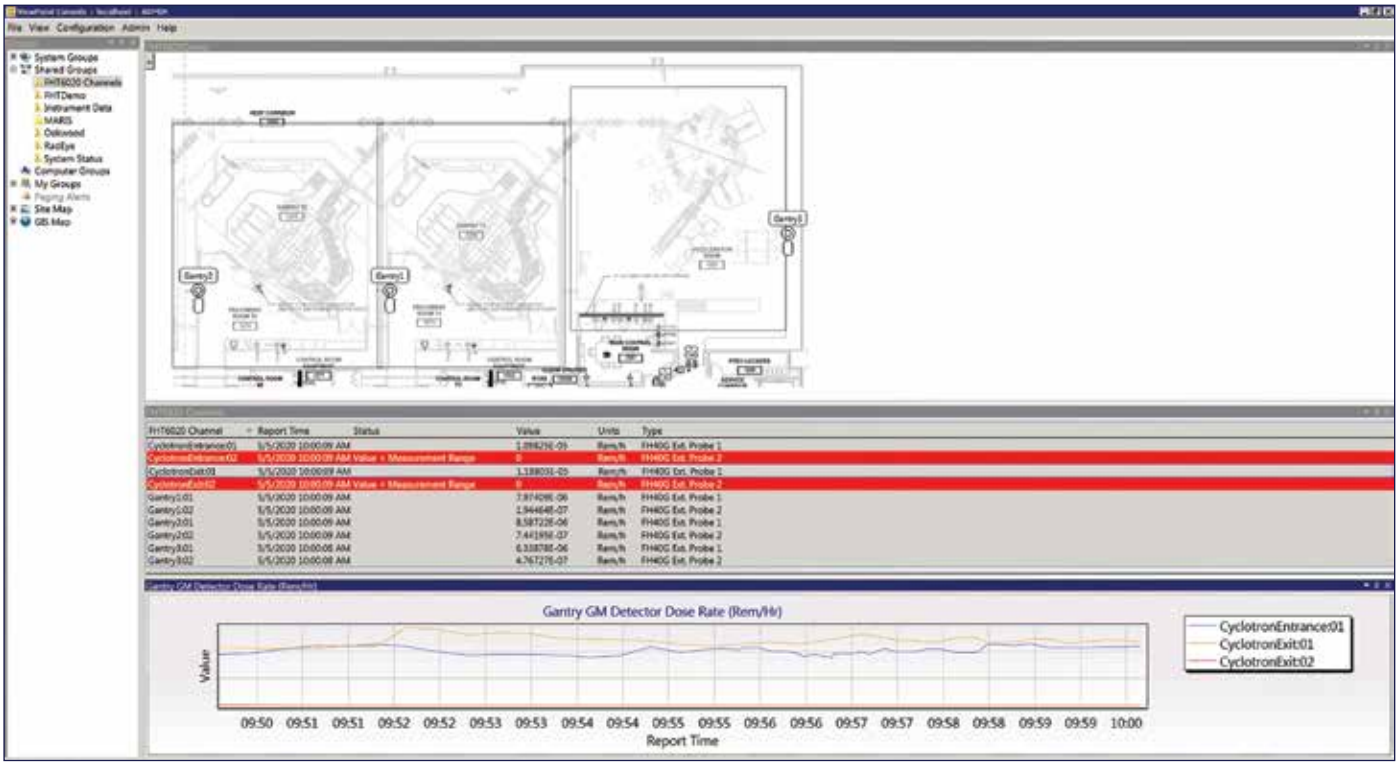
Area monitoring solutions include wide energy, neutron, and gamma detectors, and also as secondary radiation control systems in cyclotron beamlines or gantries. Their purpose is to be a mechanism to maintain control of an area or a room such as a proton beam lab or radio chemistry lab in real time, and can be mounted on the walls and integrated into a facility's interlock systems to control doors or alarms as a function of the alarm set points that are programmed into the area monitor for neutron readings or gamma readings. With the data collected, the RSO can run reports (e.g., histogram) of what has transpired during a given day while the lab has been operating so that one may, for example, show any data that might be of interest during peak times of operations, e.g., where the dose goes up or down, for the purposes of controlling employee exposure to ALARA levels, and thus regulate doses that patients or employees might be exposed to during the course of the operating day.

Building-wide Systems

Larger systems can be installed throughout the hospital complex, for example, and offer an area monitoring solution for the whole building or complex and be integrated with an alarm system. Typically, such a system is installed because the facility hosts a cyclotron or synchrotron or accelerator in the building. If alarmed, there is some type of radiation event going on and people must evacuate the building. At that point the health physicist or the certified health assist can see from the monitor what the issue is and take appropriate action. For this reason, and to protect the hospital from liability, there is usually a requirement that hospitals have a secondary monitoring system in place for back-up and as a secondary safety system on the walls or just to survey a given area that they suspect may have radiation.

Dosimeters and Dosimetry Services

Workers in facilities where radiation is potentially present are accustomed to wearing dosimeters and participating in dosimetry services. Dosimeters measure the dose of radiation that a person has been exposed to, or accumulated, during the course of a day or several days, whatever interval that the RSO has established based on the worker's expected exposure. Dosimeters range from the simple to more complex, and are worn as one would a



badge, preferable on the chest. Dosimeters are typically for personnel or staff, not patients, in a facility. Simple, passive dosimetry badges are worn and record the wearer's dose of record, then are returned to a dosimetry services provider to be scanned or checked, reset, and returned for re-use.

EPDs

Sometimes it's important or necessary to monitor personal radiation exposure in real time. One example is the EPD TruDose Electronic Personal Dosimeter, a pager-sized wearable device that monitors Gamma and Beta radiation in real time. It gives workers the ability to monitor their exposure to radiation, with improved accuracy and simplified operation over previous generations of EPDs. They are available with or without telemetry and integrate with many different systems, including ViewPoint and webREMS.

Survey Metering

Small, universal multipurpose survey meters are used for performing general surveys in a lab to make sure that there's no contamination remaining after the preparation of a sample, for instance. Nuclear medicine personnel who work with medical isotopes or in facilities that use radiation need to monitor their risk of exposure at all times not only for their own safety but to meet occupational safety regulations. Thermo Scientific RadEye G20-10 and G20-ER10 X-ray and Gamma survey meters are essentially lightweight, compact Geiger counters intended for measuring ambient equivalent dose and dose rate measurement.

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Full Body Contamination Monitoring

Primarily designed for emergency response situations, full body contamination monitoring systems are designed for use when an accident occurs as part of an emergency response preparedness plan. An example is the Thermo Scientific TPM-903B Transportable Radiation Portal Monitor, which can be quickly set up and resembles a portal or doorway such as one might expect to see in the security line at an airport. The portal monitor is a lightweight, portable gamma radiation detector equally suited for either permanent or temporary installation to screen personnel without the need for excessive searches of pedestrians, wheelchairs, walkers, and such.

NBR

Some radiation detection and measurement instruments offer a feature known as NBR, or Natural Background Radiation discrimination capability. It is able to distinguish between different forms of radiation, e.g., the difference between gamma emitting nuclear material and a patient who has undergone radiation therapy. This capability is generally not of interest in the medical facility or hospital setting, where the overriding concern is with the total dose rate to the patients and employees during a given time as a function of safety.

Conclusion

Radiation monitoring is a critical factor in protecting the health and safety of staff as well as patients in hospitals and medical facilities where radioactive materials and radiation are an integral part of everyday business. Good radiation procedures and monitoring are consistent with NRC compliance and not only health and safety but also to protect health care facilities against unforeseen or unfounded claims and litigation.

Find out more at **thermofisher.com/radiationmeasurement**

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