



PREPARING FOR **RADIOLOGICAL AND NUCLEAR** THREATS



MIRION
TECHNOLOGIES



MIRION IS YOUR EXPERT IN RADIATION SAFETY, MEASUREMENT AND SCIENCES

In periods of high geopolitical tension around the world, **preparing for the unexpected** is essential. Deployments of hazardous materials resulting from conflict could severely impact critical installations, disrupt operations, and put people in harm's way.

It is important that detection systems are portable, easy to use, or carried out through unmanned capabilities. Survey equipment will also be required for environmental decontamination and monitoring exposure to personnel.

The invisible threat of radiation in the form of intended or collateral damage to nuclear facilities and subsequent hazards require **individual and collective protection** of areas and workers.

- 1 Personnel Protection
- 2 Collective Protection
- 3 Intelligence, Security, Reconnaissance
- 4 In-Situ Measurements
- 5 In-Vivo Measurements

Contact us:

To discuss your CBRNE threat needs, please reach out to:

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Outside U.S.: marketing-europe@mirion.com

PERSONNEL PROTECTION

Individual protection involves Electronic Personal Dosimeters (EPD), which are wearable devices made to track the dose of soldiers or responders who may operate in a CBRN environment with potential radiological hazards. Self-reading dosimeters provide the dose information directly in the field.

Some EPDs can measure the INR dose (Initial Nuclear Radiation dose), be connected to a dosimetry system to track the dose of each person or be augmented by beta or neutron modules. Some EPDs can even be used as a dose rate survey meter to enable more advanced surveys.

Electronic dosimeters for the battlefield (with Initial Nuclear Radiation Measurements)

SOR/T™ Electronic Dosimeter and **MBD-2™ Personal Dosimeter** are self-reading electronic personal dosimeters (EPDs) for tactical use providing INR dose measurements (gamma and neutron flash dose).



SOR/T (/T for Tactical) Electronic Dosimeter

- Provides dose and dose rate alarms
- Typically worn under the clothes or in small pockets
- Works with the XOM/T™ field dosimeter reader, DosiXOM PC software, and DosiDEF™ dosimetry system to consolidate and manage the dosimetry of the soldiers
- Also suitable for residual and occupational dose monitoring
- NATO AEP-75 compliant (Tactical/Residual/Occupational)



MBD-2 Tactical/Occupational Personal Dosimeter

- Worn on the wrist or clipped to a lanyard or clothing
- Readout from a smartphone or a laptop using NFC pairing
- Meets certain portions of ANSI N13.11 for personnel dosimetry. Calibrated to be worn on the wrist vs. around the neck which may be less cumbersome.

1 Personnel Protection

Electronic dosimeters for the battlefield or first responders

The **SOR/R dosimeter** (/R for Residual Dose) and **DMC-3000 dosimeter** (with optional modules) are both suitable for residual/occupational dosimetry and are both compatible with a dosimetry system and can be provided with calibration tools. If basic gamma survey capability is also desired, the **RGU-100 Military Pocket Radiac** has survey meter capability for measuring dose rates and doses.



SOR/R Residual Dose Electronic Dosimeter

- For CBRN contaminated environments
- Typically worn under clothes or in small pocket (thin form factor)
- NATO AEP-75 compliant (Residual/Occupational)
- Compatible with the military dosimetry system: XOM/DosiXOM/DosiDEG
- Compatible with DosiFFR software



DMC 3000™ Electronic Alarming Dosimeter

- Typically worn on the chest over the clothes, hands-free readout from the top display
- Two buttons to easily operate
- Military-grade immunity to radio frequencies
- Modules for telemetry, beta, and neutron dose measurements
- Compatible with DosiFFR software

Dosimetry systems:

- The **XOM** field reader (wireless readout, through protective gears) and the related **DosiXOM/DosiDEF software** dosimetry systems.
- The **LDM-320** desktop dosimeter reader connected to **DosiFFR (for First Responders) software** for dose management, typically running on a rugged laptop.



COLLECTIVE PROTECTION

Survey meters are typically used to monitor an area to limit the radiation exposure of a military squad/unit/crew (gamma or beta/gamma dose rate surveys) and to avoid contamination by monitoring surfaces (alpha/beta/X). The same devices can also be operated on unmanned drones/robots or for crew safety in vehicles thanks to specialized mounts that include readout capabilities.

Portable survey meters without probes (gamma irradiation)

Survey meters (without probes) measure the radiation exposure hazards (gamma dose rate) and provide safety alarms.



RGU-100™
High Sensitivity Military Pocket Radiac

Provides nuclear survivability and measures the INR dose (for both gamma and neutron levels).



UltraRadiac™-Plus
Personal Radiation Monitor

Specially designed for fire/rescue teams with a highly visible yellow color and pouch for firemen's garments.

2 Collective Protection

Portable survey meters without probes (gamma irradiation) *continued*



RDS-30™ Radiation Survey Meter

Basic emergency response survey meter, commonly used by responders as part of a kit, together with the RDS-80 contamination meter.



RDS-80™ Radiation Survey Meter

The RDS-80 is the most basic alpha/beta contamination meter (no probe), typically used by responders along with the RDS-30 gamma survey meter.



RDS-32™ Radiation Survey Meters

This survey meter can be used with or without probes, by specialists or non-specialists. Its clear and self-explanatory display makes it usable with minimal training.



AccuRad™ PRD Personal Radiation Detector

This personal radiation detector is more sensitive to detect from a distance and localize hazards. It is the most relevant device for personnel doing preventative rad/nuc detection, who are also the first responders in case of a hazardous situation. Its unique radar feature and dynamic graphing capabilities provide rapid location and isolation in a compact/rugged device.

Portable survey meters with probes

Specialized CBRN response teams require additional capabilities such as screening persons, vehicles, and goods for contamination. To perform these tasks, survey meters should be connected to probes to allow surveys in tight spaces.



RDS-110V™ Military Radiac Set

The most ruggedized device for the battlefield. It provides the INR gamma and neutron dose measurement, nuclear survivability, and EMP protection. It connects to an external beta/gamma dose rate probe.



RDS-100P™ Radiation Detection System

A military grade device without nuclear survivability and INR dose measurement capability but it has the advantage of connecting to a much larger suite of probes including for alpha, beta, and X-ray contamination assessments.



RDS-32™ Radiation Survey Meters

These meters have an internal gamma dose rate measurement capability and do not require a probe to measure basic gamma dose rates. It displays clearly and simultaneously the internal dose rate and the measurements from the widest variety of dose rate, contamination, and search smart CSP™ probes (the meter detects the type of probe and there is nothing to configure on the meter). Easy enough for non-expert use while providing the highest productivity to specialists.

2 Collective Protection

Mobility – crew protection

Military or civil defense vehicles may be exposed to radiation. To limit exposure and contamination challenges while continuing their missions, crews need to be warned of a radiation hazard without exiting the vehicle. The collective protection of the crew is usually achieved by survey meters with vehicle mounting options.

RDS-110V, RGU-100, and RADIAC meters

Military grade equipment providing dose rates and safety alarms. They withstand CBRN environments and EMP.

- The **RDS-110V** meter can measure the INR dose, can be taken out of the vehicle for surveys, and provides beta/gamma dose rate measurements.
- The **RGU-100** meter has an internal probe and is more compact.
- The **RADIAC** meter is the best choice for permanent installations and connects to up to three probes to monitor the inside and the outside of the vehicle for reconnaissance missions. A naval version is also available for military vessels.



AccuRad PRD Personal Radiation Detector

Vehicle mount available. The PRD provides detection and safety alarms without user intervention and can measure doses on a continuous basis. The unit can be taken out for search and localization tasks and has a fast response time to secure areas for the public.



Decontamination – mass screenings

In case of a radiological or nuclear event, people, vehicles, equipment may need to be screened for contamination. An example is triage at hospitals and decontamination facilities. This can be done using survey meters and contamination probes, but it can also be done using an emergency response portal for higher throughput and seamless experience for the public.

MiniSentry™ 2 Transportable Gamma Portal Monitor

- Transportable
- Quick and easy to set up
- Simple clean/contaminated status indication
- Very little operator training
- Works in adverse weather conditions
- Battery powered
- FEMA-REP-21 compliant



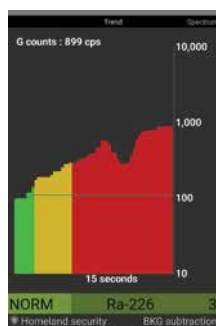
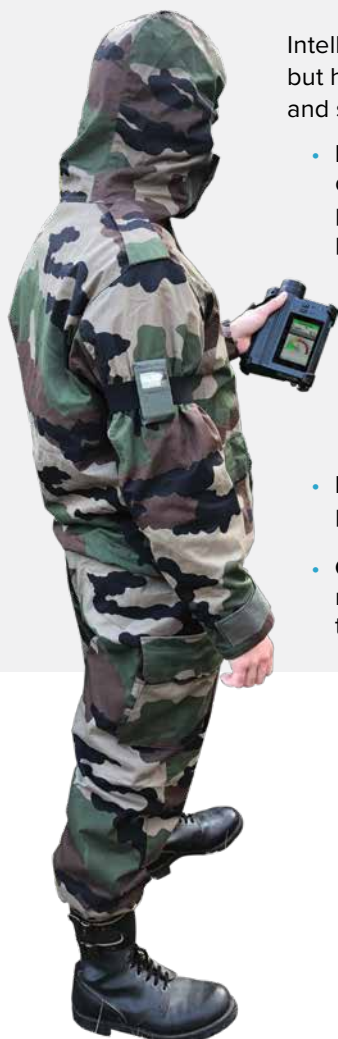
INTELLIGENCE, SECURITY AND RECONNAISSANCE

Intelligence, Security, and Reconnaissance are very different topics but have common operation requirements and require both mobile and static detection and monitoring equipment.

- **Intelligence and security:** unlike the C and the B of CBRN detection, RN detection has the advantage of possibly being prevented before the release thanks to gamma rays that are present and detectable prior to deployment:
 - *Intelligence:* detect threat materials related to nuclear proliferation or development of weapons of mass destruction, or orphan sources (MORC – Materials out of Regulatory Control)
 - *Security:* detecting threat materials around Major Public Events (MPE), securing routes for VIPs or the public, and detecting trafficking at borders
- **Military reconnaissance:** detect and evaluate hazards without exposing personnel, and secure safe pathways for the troops to continue their mission.
- **Civil defense consequence management:** secure the area for other responders, avoid unnecessary evacuations, and give the area safely back to the public.



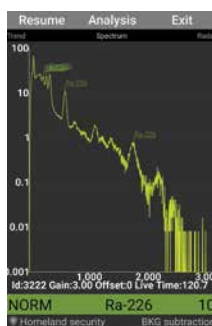
SPIR-ACE™ Radionuclide Identification Device (RIID) with quantitative assessment capability with GenieXport™ option



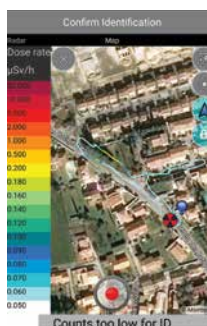
Locate the source



The Radar screen provides direction to the source.



Spectrum showing identified peaks



Mapping with hotspot localization.

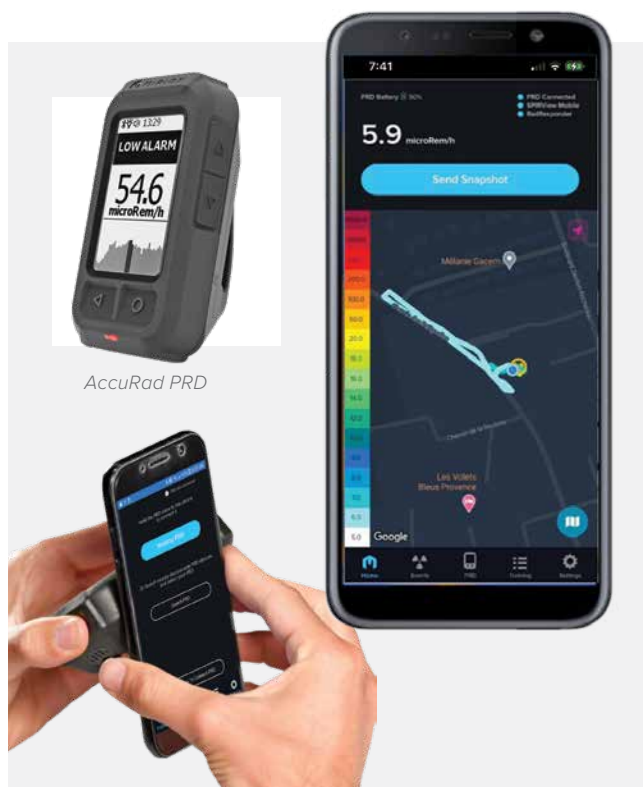
SPIR-Ace Radionuclide Identification Device (RIID) on robot



3 Intelligence, Security and Reconnaissance

Mobile monitoring

These applications involve long-range detection and search/localization capabilities, because the threat materials are potentially hidden, shielded or far away. Equipment should provide no alarms for varying background, but high sensitivity to artificial sources. It should also be able to identify the radionuclides in order to understand immediately and reliably the nature of the threat or hazard, while discriminating from in-vivo medical sources often found in populated areas or at choke points.

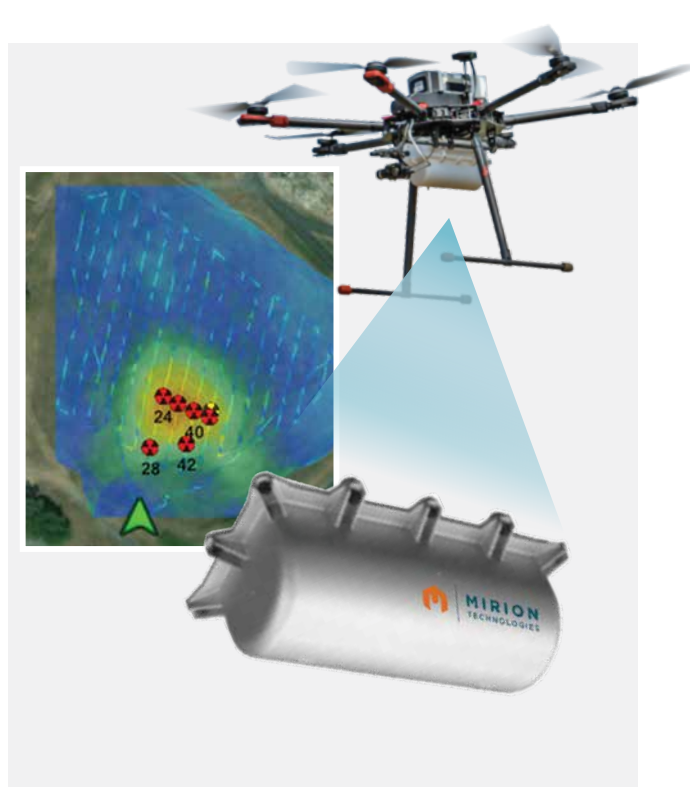


AccuRad PRD

AccuRad Smartphone App

The AccuRad PRD provides a great sensitivity for radioactive materials detection and localization. The Smartphone app augments its capabilities by providing mapping and transmission capabilities (reachback and streaming).

- Android and iOS versions
- Single or Batch configurations
- Reach-back event data to the cloud:
 - Email
 - SMS
 - RadResponder
 - SpirVIEW Mobile™ Supervisor (real-time streaming)



SPIR-Explorer™ Sensor

The SPIR-Explorer system is the lightest drone/UAV/vehicle mounted sensor providing real-time nuclide identification. It can be supplied with radio transmission systems for field reconnaissance with real-time no-loss feedback. It requires a drone or robot that can carry 1-2 kg.



SPIR-Explorer Sensor on Spot® (Boston Dynamics)



SPIR-Ace™ Radio Isotope Identification Devices (RIID)

A handheld radionuclide identification device. It may also be used on robots thanks to its internal localization, battery, and transmission capabilities.



SPIR-Pack™ Human Portable Radiation Detection and Identification System

The most sensitive portable detection system with nuclide identification, most appropriate in urban areas or indoors.



Spir-Ident™ Mobile Advanced Spectroscopy Platform

SPIR-Ident platform is the most sensitive system, ideal for large area surveys by helicopter, to screen the neighborhoods of major public events or to secure the way for VIPs.



SpirVIEW Mobile™ Supervisory Software

This equipment can be remotely monitored using the SpirVIEW Mobile Situational Awareness system for centralized alarming and remote expertise or integrated with other logistical/tactical packages.

3 Intelligence, Security and Reconnaissance

Perimeter detection or monitoring

The security of critical infrastructures or public venues also involves perimeter/gate monitoring to prevent radioactive materials from entering. Critical infrastructures such as air/naval bases or government facilities could be made unusable because of CBRN attacks. The multi-role equipment proposed here can also be used to monitor the area after an attack and to continue the operations.



AccuRad PRD Personal Radiation Detector

The AccuRad PRD can be worn by security officers or used as networked area monitors aiding in localized response and situational awareness.



SPIR-Pack Human Portable Radiation Detection and Identification System and SpirVIEW Mobile Supervisory Software

The SPIR-Pack system and SPIR-Ident software are mobile systems demonstrating very efficient detection and alerting when deployed at choke points as vehicle and pedestrian monitors because they provide real-time radionuclide identification and alarm only for real threats. The screening can be unattended and covert.



MiniSentry 2 Transportable Gamma Portal Monitor

The MiniSentry 2 monitor is a deployable portal that is suitable to detect threat materials on pedestrians and vehicles. It can also be redeployed for triage or decontamination facilities in case of an event. It doesn't provide radionuclide identification to sort natural/medical alarms from threat materials, but this can be done efficiently by combining with a handheld radionuclide identification device such as the SPIR-Ace unit utilized during secondary assessment steps.

For permanent installations, Mirion has a range of portal monitors.

**To learn more, please visit:
www.mirion.com**

IN-SITU MEASUREMENTS

The detection of radioactive/nuclear threats or emergency response involves measuring dose rate to limit the exposure of responders, assessing the nature of the radioactive materials with nuclide identification, and evaluating surface contamination. Beyond this point, it's necessary to understand the activity levels of the contaminants in Becquerel units. This can be done in laboratories but in crisis it is more efficient to do it in-situ.

In-situ measurements

All the solutions noted are fully compatible with Mirion ISOCS™ (In Situ Object Counting System) and Genie™ 2000 spectroscopy software or Genie-FieldPro™ software for non-experts which provides advanced analysis and assessment tools normally found in a laboratory. The ISOCS factory characterization of the detectors allows rapid efficiency calculations without sources for a wide range of simple and complicated geometries.

In other words: “go anywhere, count anything” and you can leave the lab behind.



Aegis™ Transportable HPGe Spectrometer

The Aegis detector provides laboratory-grade measurements in the field.

- Electrically cooled HPGe (Gold standard for activity calculations supported in the field)
- Rugged for field use (IP65 ingress protection, rugged tablet display, -20 °C to +50 °C)
- Hot swappable batteries



ISOXSHLD™ In Situ Object Counting System

This ISOCS (In Situ Object Counting System) Shield has been designed as the optimum in convenience and functionality for in situ gamma spectroscopy with a germanium detector.

- Can be positioned and configured to handle almost any sample geometry (soil/floor, samples in small containers or Marinelli beakers)

4 In-Situ measurements

In-situ measurements *continued*



SPIR-Ace Radio Isotope Identification Devices (RIID)

The SPIR-Ace radionuclide identification device is ISOCS characterized for further quantitative assessment and analysis outside the device using Genie 2000 software.

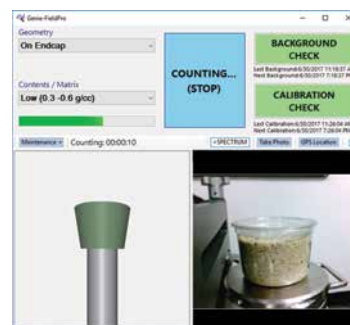
- Lightweight and easiest to use radionuclide identification device
- Scintillators: sensitive NaI, or LaBr₃ for complex mixtures
- Active energy stabilization for field-use even in contaminated environments
- Embedded search, mapping, and fast nuclide identification
- Spectrum acquisition at selected locations by field monitoring teams
- Wireless remote web page to control from a safer/ more comfortable location as required
- Further analysis using Genie 2000 software: remote after reachback or back at the lab/vehicle



FoodScreen™ Radiological Food Screening System

The FoodScreen Radiological Food Screening System is a complete, transportable food analyzer for quickly determining whether raw or processed food has become contaminated from a radiological event.

- Transportable
- Intuitive and specialized Genie-FieldPro user interface
- Provides rapid assessment capability of bulk food packages



Genie-FieldPro™ Gamma Spectroscopy Sample Counting Software



IN-VIVO MEASUREMENTS

Just after an event, the most important need is often to screen people for external contamination (see “collective protection” – “decontamination – mass screenings”). Since airborne radioactive particulates may be inhaled, and raw contaminated food may be ingested either by military forces, responders, or the public. Authorities should consider setting up screening facilities near the event to screen the population within the first few days or weeks after the event. Not only does this support the need for early intervention, but often alleviates a number of the psychological concerns faced throughout the impacted area. The purpose of in-vivo counting is to measure internal contamination rapidly and efficiently supporting a high-volume throughput and providing a systematic processing of all individuals.



FASTSCAN™ High Throughput Whole Body Counter

The FASTSCAN system uses large area sodium iodide detectors and Apex-InVivo™ and Genie software to achieve low minimum detectable activities with count times as fast as one minute.

- High throughput with scanning times as low as one minute (150 Bq of Co-60)
- Modular shield construction for easy assembly
- Understand the origin of the contamination thanks to the nuclide identification
- Apex-InVivo interface for easy operations, reporting, and data management



ACT-LC™ HPGe Detector for Actinide Lung and Whole Body Counters

The ACT-LC Ge Detector was designed specifically for the detection of internally deposited actinides, particularly uranium, plutonium and americium.



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