DigiWaste Platform

The World's First Fully Digital Platform for Nuclear Waste Management

CAEN SyS

Systems & Spectroscopy Division

Digitizing Nuclear Waste



The Challenge

The process of dismantling and decommissioning nuclear infrastructure increasingly demands methods for a full traceability of waste material to improve quality management and operational safety. Precise waste management and minimization procedures provide dual benefits; the optimization of costs associated with D&D and the minimization of dose exposure to operators and personnel.

The lack of a consistent and straightforward solution to digitize the huge amount of data produced during D&D operations is a critical issue, one which challenges the Operator's ability to maintain a high assurance of operational quality and measurement accuracy.

The use of tools and instrumentation from disparate sources, sources often unable to share information with each other, has forced Operators to devise ad hoc management systems. These management systems are often based on complex and sometimes even incomplete or inaccurate logbook notations. The result is a complex procedure burdened with a poor QA/QC and an increased likelihood of errors.

Dr. Massimo Morichi

International Qualified Radioprotection and Nuclear Measurements Expert

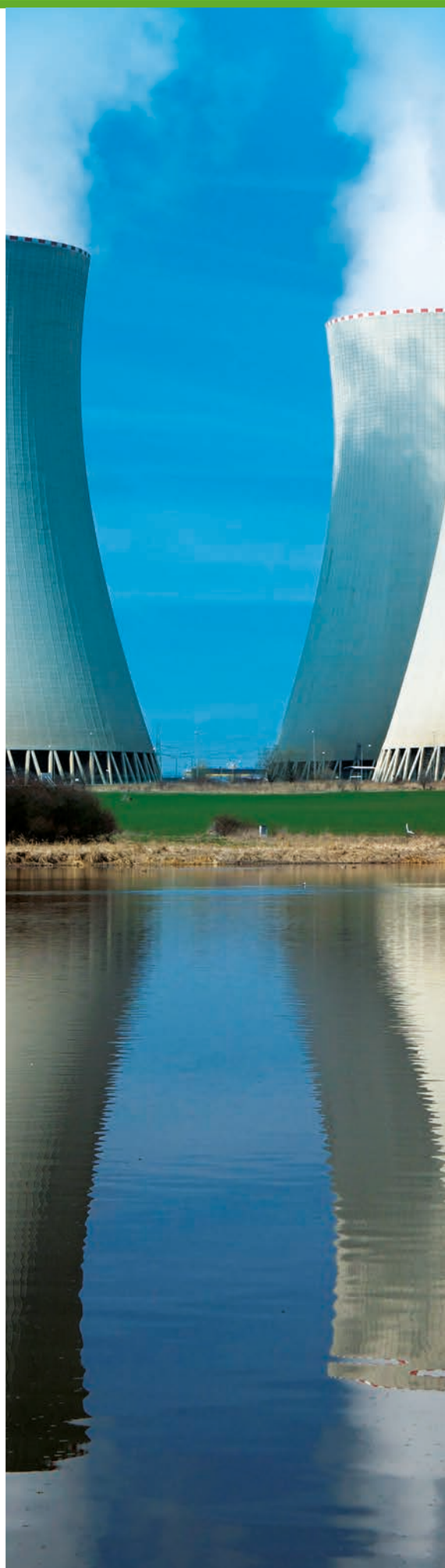
DigiWaste Platform

The Solution

The CAEN SyS DigiWaste Platform is the first fully comprehensive solution that provides seamless digitization of D&D activities. The system offers easy tracking of any type of radioactive material or object produced through D&D operations thanks to the use of specialized and radiation tolerant UHF RFID tags. The data included in these RFID tags is integrated into a central database, where all relevant information associated with the D&D cycle is securely stored and easily accessed by authorized personnel.

The DigiWaste Platform relies on an innovative and unprecedented handheld instrument, the RadHAND. This pioneering technology combines state-of-the-art radiation measurement capabilities with read/write UHF RFID tagging, all while integrating a color camera, an audio recorder, and a GPS and UWB tracking for both outdoor and indoor positioning. By leveraging this system, D&D operators can easily identify radioactive sources and initiate the waste tracking process at the earliest possible phase of the D&D cycle.

All the information produced in subsequent D&D activities can be uploaded, collected and processed by the customizable database framework, RadBASE. This information, together with operational instructions, can be accessed by on-field operators equipped with dedicated, ruggedized, and highly portable RFID readers of the RadREAD family.



The Benefits

DigiWaste Platform offers several major benefits in terms of optimization, safety, security, and compliance. These advantages are achieved by having easy, fast, and reliable access to all the information collected at any time during the D&D cycle.

Data Access
Quick access to all information produced during the D&D activity cycle

Tagging
Easy identification and tracking of all RFID-tagged items

Automation
Automation inventory of tagged waste containers and report generation

Categorization
Waste bagging, caterization and group-waste monitoring

Task Assignment
Assign Operator-specific tasks and instructions

Sorting
Waste sorting according to user defined criteria

Synchronization
Continuous monitoring and update of waste data

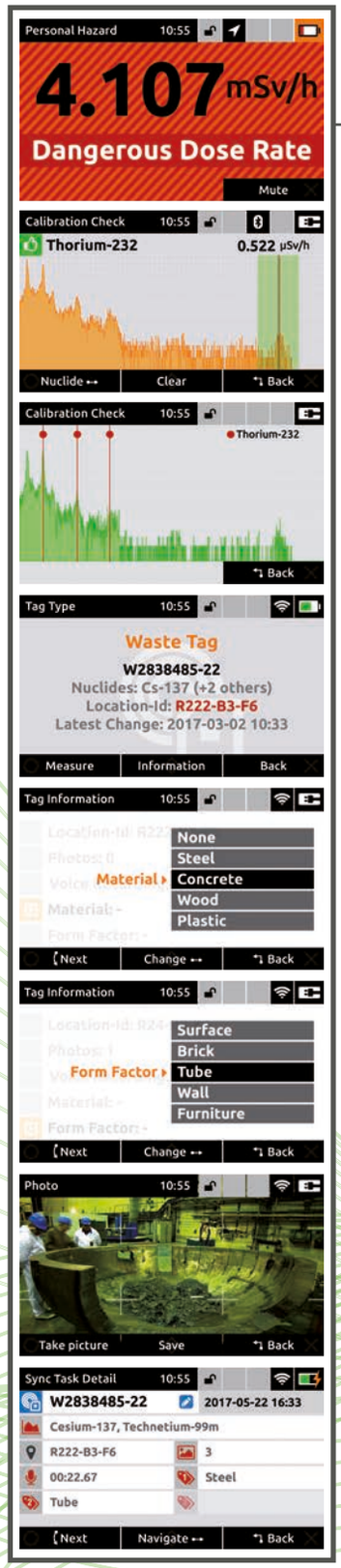
Traceability
Historical data traceability of the waste

Mapping
New-site characterization with interactive mapping of sources

TOTAL BENEFITS

- Cost Saving
- Reduced Operational Time
- Improve Quality Assurance
- Enhanced ALARA

Spectroscopic Radiation Measurement and UHF RFID Tagging Handheld



Collimation kit for high activity background

RadHAND 600 PRO
Tripod-Mount.
Ideal for remote access and monitoring via web interface of fixed measurement locations.

USB Connection

Battery Pack

UHF RFID Reader

Camera - Bar Code Scanner

Detector

RadHAND 600 PRO

Spectroscopic Radiation Measurement and UHF RFID Tagging Handheld

RadHAND is the world's first hand-held instrument designed to perform both spectroscopic radiation measurement and UHF RFID tagging of nuclear waste material and objects.

Main Features

- State-of-the-art algorithms allow top performance on nuclide identification and dose-rate measurements
- Fully wireless connectivity for hands-free operation
- 8hr operation on battery
- Multiple Units may be linked to develop a network of sensors
- Integrated GPS for geo-localization and timing information (customizable in-door applications)
- Locally encrypted data may be saved on-board or transmitted to a secure remote database
- Supports integration of external application-specific probes such as alpha/beta contaminameters, neutron detectors, and high resolution CdZnTe gamma spectrometers

Highlights

- Measure nuclear waste
- Securely store all Waste data (incl. Audio/Video)
- Write Waste data into RFID tags
- Sync with DataBase (Web-interfaced)

RadRFID

Rad-tolerant UHF RFID tag family

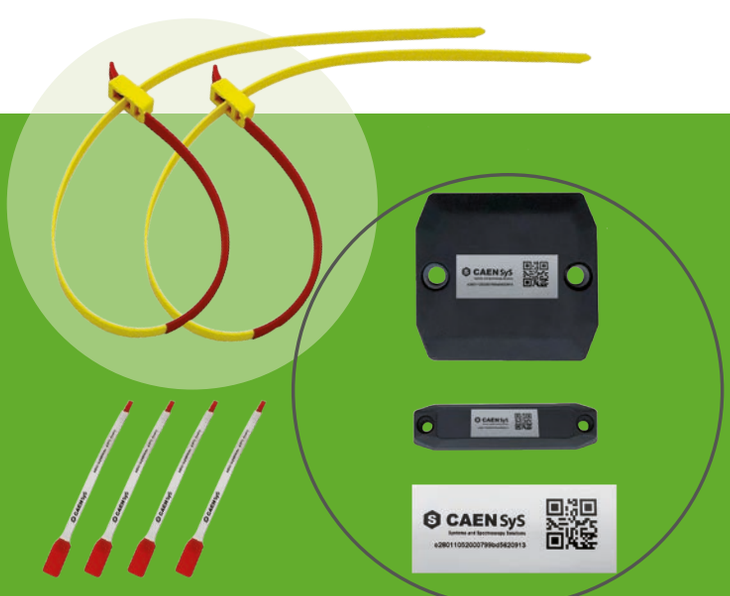
CAEN SyS uses UHF FRID technology that allows the Operator to read/write RFID tags at a distance and without the benefit of line-of-sight, as is required by competitive technologies.

CAEN SyS UHF RFID tags are able to sustain a total dose of more than 300 Gy. This ensures long-term, reliable, and accurate data collection, updating, and storage for tagged objects.

Our RadRFID tags are available in a wide range of shapes, sizes, and materials to provide the best possible fit for the many objects, containers, and enclosures found throughout the D&D and Waste Management cycle.

Highlights

- Technology extensively used in the logistic field
- Embedding internal memory for local information storing
- Univocal item association (unique EPC & tag)



RadREAD

Stand-alone, ruggedized portable UHF RFID reader family

Our RadREAD devices are specially designed to provide the Operator with quick and easy access to all relevant D&D information contained in the RadBASE database by simply scanning the RFID tag.

Operators equipped with the portable UHF RFID readers can be assigned tasks and specific operational instructions as well as up-to-date information in real-time. This approach greatly increases efficiency; which results in lower operational cost and enhanced compliance with the ALARA approach through a shorter potential exposure time.

- Wireless connectivity via Bluetooth and Wi-Fi
- Rugged, IP65 rated case supports operation in harsh environments and easy decontamination
- Raised buttons allow users to interface and control unit while wearing gloves
- Bar code reader included for a seamless transition from legacy tracking systems

RadBASE

Database framework for data storage and integrated customized processes

RadBASE is a data management framework designed to support the development, tracking and integration of information critical to D&D and waste management activities.

Our secure web service employs high level data encryption and a multi-layered user access strategy to ensure safe and secure network management. User-specific access levels determine the type of data an operator may retrieve.

Network administrators are granted full control and access management for all integrated devices. Each device transmits live, real-time information on instrument status, location, measured radioactivity levels and alarm status, task progression, and RFID tag inventory.

The devices can also receive, in real time, operator-specific instructions from network administrators and managers.

Use Cases

Decommissioning & Dismantling

The DigiWaste Platform manages the digitization of all relevant information produced throughout the D&D cycle and supports the integration of previous or legacy data.

Site assessment

- Smart handheld devices for spectroscopic characterization of the site
- Storage of data in a secure central database server and in-situ rad-tolerant RFID tags

Clean-up & material removal

- Operators can easily read back previous measurements and descriptions on RFID tags
- Optimization of the activities and ALARA approach

Waste Bagging

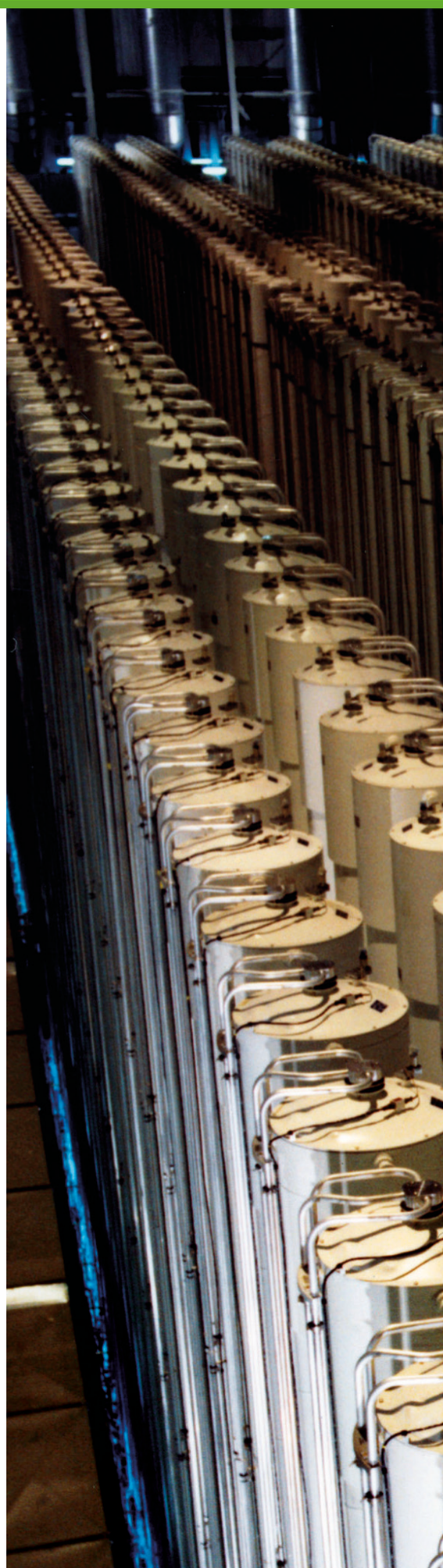
- Bags are measured and tagged with RFID tags of waste for easy and efficient waste tracking

Bag Characterization

- Bag characterization options include both fixed and mobile measurement stations

Barrel filling and stock

- Barrels are filled with waste, measured and tagged for long term storage or transportation to repository



Interim Storage of Nuclear Waste

The DigiWaste Platform can also be adopted as an interim waste storage solution for monitoring activities and verifying waste status. Variations in measured quantities can be automatically measured and updated in programmable time steps and updated in both the central database and in associated RFID tags.

This approach supports real-time data analysis and early recognition of any deviation from safe values for critical quantities such as dose rate. It also allows the user to closely monitor measured vs estimated values in specific isotope evolutionary scenarios.

- Monitoring activities and status of waste
- Trends automatically registered by the instruments and data updated in RadBASE and RadRFID tags
- Real-time data analysis and early recognition of any deviation from safe values
- Waste integrity and containment status control
- Fixed RFID readers for automatic inventory, tracking, and handling of waste

Use Cases

Radioprotection

The DigiWaste platform is an ideal solution for radioprotection applications at nuclear sites where periodic measurement patrols are required. The system allows for each measurement point to be associated with a specific UHF RFID tag, thus enhancing security and adherence to ALARA.

- RadBASE collects, secures and stores periodic measurement data. Data is also saved locally in the tag memory and refreshed upon new measurement.
- RadBASE can show trend plots of the measurements and automatically generate reports.
- The systems supports automated warnings, addressed to Supervisors, should measurements deviate from the accepted safe value range or demonstrate significant consecutive values. The Operator response is recorded and is also available in real-time for adiminstrators.
- The RadHAND 600 Pro integrates embedded positioning systems. This feature allows Operators to quickly and easily produce radiological maps for indoor and open-field site characterization.

Safety, Transparency, and Respect for the ALARA Concept:

The DigiWaste Platform enables operators to easily share waste characterization datasets with Safety Authorities, allowing inspectors to quickly verify procedural compliance on-field by simply scanning tagged items, via the RadREAD unit and accessing the RadBASE database.

Legacy Waste

The DigiWaste Platform is a complete solution for legacy waste assessment and management.

It enables quick, preparatory waste evaluation using the RadHAND 600 Pro and associated probes and gamma cameras for hot spot detection.

Each item can be tagged with RadRFID tags and assigned to specific operational streams by on-field Operators equipped with the RadREAD devices. Operators can also receive instructions and specific tasks defined within the RadBASE database or as instructed by supervisors.

- Automated tagging and prescreening of legacy waste with high efficiency gamma spectroscopy
- High Resolution Low-Energy gamma spectrometry
- Gamma imaging integration with Hot-Spot identification and positioning
- Real time data insertion on central database and RFID tags
- Selection of different operational streams for waste characterization and storage in repository

Other Scenarios

Augmented Reality

- On field operators can retrieve information and instructions from the platform and visualize them in mixed reality while working on specific tasks through Mixed Reality wearable devices
- Perfect for demonstration and training exercises in virtual scenarios

Radiological Mapping

Combination of radiometric measurements, GPS and indoor positioning information for geo-referenced mapping

Nuclear transportation

Measurement and Tracking of medical and industrial radioactive items from production site to end user

D&D and Nuclear Waste Management

Site assessment, clean-up & material removal

- Dose and Dose Rate meter
- Search and Identification of radioactive sources, contaminated objects and hotspots
- Possibility to use geometric templates for quantitative analysis
- UHF RFID tagging of the measured items and storage of most sensitive data in RFID tag
- Full description of measured items and transmission of data to remote database

Waste Characterization and Storage

- Survey and tracking of waste up to final disposal

Neutron Activated Electronic Components Management

Safety assessment, Digitization, Q&A control

- Dose Rate meter
- Identification of radionuclides, activated components
- Potential to use dedicated library
- UHF RFID tagging of the measured items and storage of most sensitive data in RFID tag
- Full description of measured items and transmission of data to remote database

CAEN SyS

CAEN Spectroscopy Division

CAEN SyS, the new Systems & Spectroscopy Division of CAEN SpA, is a worldwide leader in development of Radiation Measurements Systems and Spectroscopy Solutions, engaged with high performance operations involving Nuclear Facilities, Measurements Laboratories, Security and Safeguards Applications.

CAEN SyS Systems & Spectroscopy Division is built upon CAEN traditions of teamwork and partnership.

The CAEN Network Companies is a cluster of Companies with excellence know-how. Decades of collaboration and co-development with very large international research projects have maximized CAEN SyS capability to translate customer's needs and expectations into cost-effective and reliable solutions.

CAEN SyS enormously benefits from its foundational relationship with CAEN, a world leader in designing multi-input electronics for a wide range of radiation detectors, and nowadays is involved in several leading-edge R&D collaborative projects, to continue expanding and developing expertise in high-level electronic design, and to extend competence and skills into complementary and relevant applications for the benefit of the community.

CAEN SyS is committed to delivering exceptional nuclear measurement instrumentation, expertise and technical support, offering radiation detection instrumentation and integrated turn-key solutions with added value and operational benefit for customers, enhancing safety and security through nuclear measurements in the SECURITY, SAFETY and LABORATORIES areas.

For more information visit: www.caensys.com

Publications

Characterization via the RadHand Device integrated into the REACh System for a Low-cost in-situ Waste Characterization of Nuclear Waste; E. Fanchini, Sean Kelly Jr, A. Pepperosa, Kevin Tuite, M. Locatelli; Abstract ANIMMA 2021

Characterization via the RadHand Device integrated into the REACh System for a Low-cost in-situ Waste Characterization of Nuclear Waste; E. Fanchini, Sean Kelly Jr, A. Pepperosa, Kevin Tuite, M. Locatelli; Abstract SFEN, International Conference on Decommissioning Challenges: Industrial Reality, Lessons learned and Prospects, Avignon (France) June 7-9 2021

An innovative Platform Allowing Digitization of Operative Radioprotection Measurements and to Characterize NORM and TENORM; A. Pepperosa, M. Morichi, F. Rogo; IAEA International conference on the Management of Naturally Occurring Radioactive Material, October 19-30 2020

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