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Final Conference
Impact workshop 6.6.2024 - *Digitalization Advancements for Monitoring*

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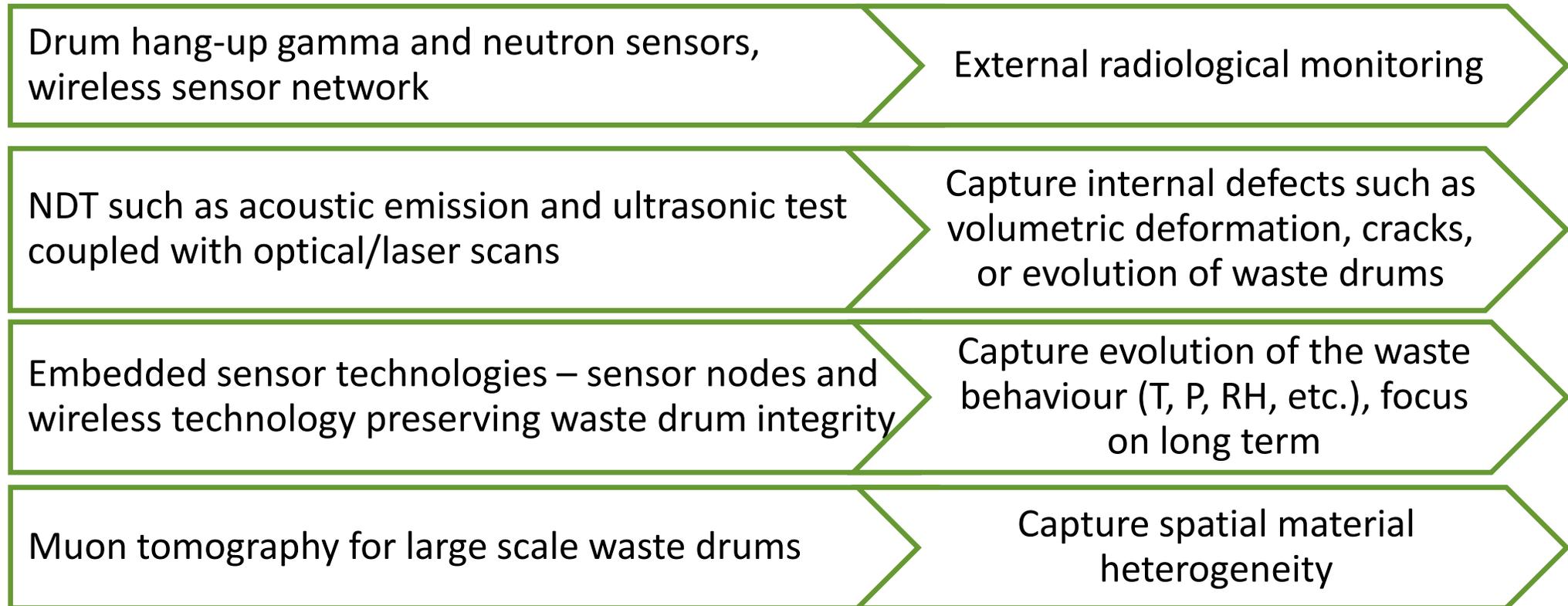
Key PREDIS Impact - in 4 broad categories

New monitoring technologies developed within this project

Validation of the technologies using real scale demonstration tests

Feasibility of Digital twin deployment

Innovation in data handling, processing and decision framework

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Key PREDIS Impact – New monitoring technologies

Drum hang-up gamma and neutron sensors, wireless sensor network	External radiological monitoring
NDT such as acoustic emission and ultrasonic test coupled with optical/laser scans	Capture internal defects such as volumetric deformation, cracks, or evolution of waste drums
Embedded sensor technologies – sensor nodes and wireless technology preserving waste drum integrity	Capture evolution of the waste behaviour (T, P, RH, etc.), focus on long term
Muon tomography for large scale waste drums	Capture spatial material heterogeneity

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Key PREDIS Impact – New industrial scale validation

7 industrial scale demonstration tests successfully conducted to validate the monitoring technologies in realistic conditions – surface laboratory/interim storage facilities around Europe

Demonstrated data acquisition from 1000s of km via virtual private network (no internet required)

Demonstrated wireless signal and power transmission across metallic containers (RFID)

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Key PREDIS Impact – Digital twin

Digital twin proof of concept developed for a realistic homogeneous cemented waste drum degradation process (lab -> industrial -> digital twin -> integration with PREDIS dashboard)

An alternative Digital twin dashboard developed embedding chemical models to feed into decision analytic framework

Developed a data driven model (machine learning) to address complex degradation processes at the drum scale (artificial neural network based)

Key PREDIS Impact – Data handling, processing and decision framework

A new customizable data platform developed for sensing and condition monitoring, prediction generation, data integration and management, and decision support

Scalable, layers of digital dashboard for access by different stakeholders (e.g., regulators)

Industrial scale demonstration proved that sensor data can be fed into Microsoft Azure cloud platform, and visualized on the developed decision platform

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Key PREDIS Impact – Challenges, hence opportunities

No doubt, technical challenges remain with the monitoring technologies, implies TRLs at various degrees of maturity

Phenomenological understanding and robust model development is key for digital twin deployment

Heterogenous waste poses even more significant challenges for digital twin deployment

Challenges with data driven models for decision analytic frameworks yet to be unraveled (training data sets not available if degradation has not kicked in, or the sensor data might not be enough to build a digital twin)