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## #09-55 The CORSAIR Project. Characterization of a portable instruments for NORM characterization of stone blocks

*Thursday, June 24, 2021 11:00 AM (20 minutes)*

The CORSAIR (Cloud Oriented Radiation Sensor for Advanced Investigation of Rocks) project was born to meet the EU guidelines 2013/59/EURATOM and now the Italian legislation decree D.Lgs.101/2020 on safety standards for protection against ionizing radiations.

With this project there is a specific focus on the detection of the NORM (Naturally Occurrence Radioactive Materials) contribute coming from stone blocks used in the engineering field.

As a matter of fact, radiological measurements and traceability of materials are two aspects becoming more and more important in this and for the green building sectors.

In Europe exist regulatory restrictions on the maximum level of radiological emissions for materials used in public and private building structures. A similar approach is also adopted in other countries all over the world. These legislations not only are fixing the radiological limits, but forbid purchasing and incoming of not controlled or above limits materials in the country. These legislations are acting on import/export of the stone market, one of the Italian sectors already affected by the incoming of low cost not natural (Okite, high pressure laminate or ceramic stones) and not certified natural stones.

All these aspects drove the CORSAIR project to design an automated cyber-physical system capable of providing a real-time measurement of the radioactive activity concentration index for building materials according to regulations of more than 20 different countries. It quantifies activities, abundances and related effective dose-rates of natural radionuclides ( $^{40}\text{K}$ ,  $^{232}\text{Th}$ ,  $^{238}\text{U}$ ) and their progenies).

The system is empowered by cloud-based technology consisting of sensing nodes, data collection gateways and a centralized cloud application. These components are interconnected in a star-of-stars topology, exploiting GPS, Bluetooth, LoRaWAN, WIFI network connection and providing specific user interfaces with an Android app running on smartphones.

Measurements are conducted through in situ  $\gamma$ -ray spectroscopy techniques on blocks of rock at quarries or processing centres.

The system is designed for providing an autonomous, fast, repeatable, real-time and non-destructive method to measure the radiometric indexes with a 30 min measurement.

The innovative aspects of the system are due to the integration of several elements: its autonomous operation that does not require expert operator to provide results, the easy fruition of the results of the material characterization thanks to the cloud database, the presence of the RFID tags used to uniquely identify each analysed block, the energy calibration and the fully-automated results computation.

All system outputs are finally synced to a cloud database, where they can be easily accessed by operators and clients, enabling to trace the materials along the full market chain, from extraction to the final customer, with modern technologies preventing the placing on the market of blocks hazardous to public health and as a warranty of the origin of the block thanks to the RFID tag used.

This presentation after describing the system will provide tests results performed in-situ on real blocks and the comparison with laboratory measurement performed to characterize the radiological system.

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