European Metrology Research Programme

Delivering Impact

# Fingerprinting nuclear waste

Nuclear power accounts for more than a quarter of the EU's electricity supply and will continue to play a major role in the energy sector as Europe tries to meet growing energy demands while reducing carbon emissions. Over the next 25 years, around 250 nuclear facilities across Europe are scheduled for decommissioning. To protect public health and the environment, the millions of tonnes of waste generated needs to be sorted and appropriately stored according to the level of radioactive contamination.

**Europe's National Measurement Institutes working together**

The European Metrology Research Programme (EMRP) brings together National Measurement Institutes in 23 countries to address key measurement challenges at a European level. It supports collaborative research to ensure that measurement science meets the future needs of industry and wider society.

# Challenge

A large proportion of nuclear power plant waste has minimal radioactive content, well below biologically hazardous levels, and once classified as 'free release' it can be sent for recycling. However, all nuclear waste is necessarily subject to strict regulations governing its release and the criteria for free release into the environment are particularly stringent.

Measurements of both the nuclear fingerprint and radioactive half-life of waste are used to determine the appropriate level of storage and accurate knowledge of these properties is key to avoiding unnecessary storage time and costs. Until recently, site measurements have lacked the necessary accuracy to enable waste fingerprint characterisation for 'free release' waste designation. Improved on-site nuclide specific waste assessment and segregation methods would help minimise disposal costs and enable the rapid consignment of different waste types to the most appropriate storage or disposal facilities.

# Solution

Research carried out within the EMRP project *Metrology for radioactive waste management* has enabled the construction of the first dedicated transportable waste assessment facility for this purpose. The project developed improved fast testing methods, which enable the precise determination of nuclear waste fingerprints - an essential capability for identifying the most appropriate disposal routes.

# Impact

Through participation in the project, ENVINET, a leading provider of products and services for the monitoring of environmental radiation, has developed a new transportable waste measurement facility. This facility takes the new measurement methods developed within the project directly to decommissioning sites. The improved accuracy and speed of the results enable efficient on-site measurement of waste assumed for free release - in particular, the correct identification of waste suitable for free release should avoid the significant costs associated with unnecessary long-term storage.

Within the project, ENVINET was able to both validate the transportable facility and also demonstrate to the Czech authorities that it had developed the expertise needed to meet the stringent criteria governing the free release of nuclear waste, enabling a site license to be granted. Subsequently, the first consignments of 150 tonnes of accumulated waste at the ÚJV Řež site in the Czech Republic have been accurately and efficiently sorted prior to release for disposal. The ENVINET facility will next be used at a decommissioning site in Italy.

As more and more nuclear plants become available for decommissioning, and those reactors that have been cooling for several decades reach the final dismantling stages, increasing amounts of waste will require efficient and accurate sorting. ENVINET's transportable waste facility, made possible through the research carried out within the EMRP project offers a timely and cost-effective solution to this growing problem.

## Plant decommissioning in Europe

After nuclear fuel removal and draining of fuel ponds, the reactor building, the most heavily contaminated part of the site enters a period of radioactive decay prior to complete disassembly to return the site to near its original state. Other buildings and structures (e.g. the turbine hall and cooling circuits) have significantly less radioactive contamination and can be removed soon after plant de-fuelling. These contain the majority of the slightly contaminated waste material requiring safe disposal but are none the less hugely expensive to monitor and remove.

Spain's Vandellos 1, a 480 MWe gas-graphite reactor which suffered a fire, underwent reactor decommissioning and dismantling after an initial 13y cool down period over 63 months costing EUR 93 million. The reactor vessel is in Safstor for another 15y.

Germany has 11 plants for dismantling and a budget of EUR 30 billion set aside for this purpose.

In France the CEA is decommissioning the UP1 fuel reprocessing plant at Marcoule, work is expected to spread over 40y and cost some EUR 5.6 billion.



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**www.euramet.org/project-ENV09**

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