Andra Call for Projects
with the support of the
Investments for the Future Programme

SCCoDRa

Monitoring and testing for corrosion in metal components used for radioactive waste disposal

Project supported by Andra under the "Investments for the Future Programme" ("Investissement d'Avenir") - Selected under the Andra Call for Projects: "Optimisation of post-dismantling radioactive waste management", organised in cooperation with the French National Research Agency (ANR).

Duration: 48 months

Project launch: 09/2017

Total project cost: €2.5 million

Including funding under the Investments for the Future Programme: €1.25 million

Type of financial support: Subsidy with ROI guarantees for the State

Locations: Nantes, Senlis, Villeurbanne, Rillieux-la-Pape, Lacanau de Mios, Fraisses

Coordinator: Centre Technique des Industries Mécaniques (CETIM)

Partners:

- INSA Lyon, the French National Institute of Applied Science
- MATEIS Materials Science laboratory, INSA Lyon
- LVA, Laboratory of Vibration and Acoustics, INSA Lyon
- Origalys Electrochem
- VLM Robotics
- Institut de la Corrosion (French Corrosion Institute)
- Certification: ViaMéca competitiveness cluster

Contact: Gouenou GIRARDIN, gouenou.girardin@cetim.fr

BACKGROUND

The Industrial Centre for Geological Disposal (Cigeo) is a project to build a deep geological disposal facility for radioactive waste in France. It is being designed for the disposal of the most highly radioactive, long-lived waste : intermediate-level long-lived radioactive waste (ILW-LL) and high-level waste (HLW).

If approved, Cigeo facility will operate for around a hundred years. Many different materials will be used for the various components of the disposal facility, including the engineering structures and radioactive waste containers. The design for Cigeo is currently based on the use of tried and tested materials, including metals (steels), which play a major role. Andra has therefore carried out studies on the corrosion of these metals for many years. Part of this research, SCCoDRa focuses on developing innovative tools for inspecting and monitoring steel corrosion over time.

OBJECTIVES

SCCoDRa is an industrial research project with two key objectives:

- to develop a nondestructive testing (NDT) technique (contactless) to inspect metal radioactive waste containers upon reception at the disposal facility (in the case of ILW-LL) to verify their integrity simply, quickly, reliably and precisely. Such a technique must therefore assess corrosion of the containers by means of complete though-thickness mapping;
- to develop a methodology for monitoring corrosion in certain metal structures within the facility over time. In particular, this applies to the steel tubes (sleeves) placed inside the micro-tunnels for HLW ("HLW disposal cells"). Here also, the methodology should be based on innovative technology developed in the areas of NDT, electrochemistry, and electrical techniques such as potential drop (ACPD-DCPD-FSM).

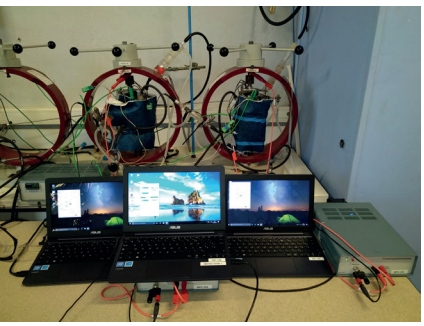
Gantry equipped with 2 robots (14 controlled axes) with a tool changer adapted to the different CND technologies used to control the integrity of the radioactive waste containers - Lucas/Clemessy type configuration

Institut de la Corrosion
French Corrosion Institute

ANDRA
French national radioactive waste management agency

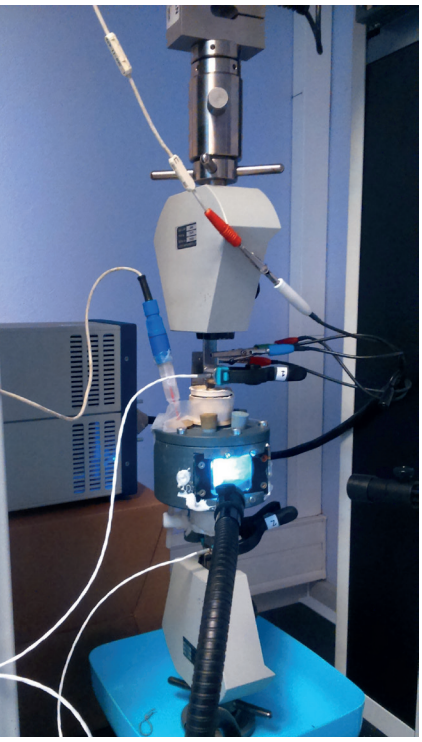
Andra Call for Projects with the support of the **Investments for the Future Programme**

SCCoDRa Monitoring and testing for corrosion in metal components used for radioactive waste disposal



Crack propagation monitoring of a CT specimen

Simulation of guided wave propagation in a tube



Combined acoustic emission and electrochemical noise to monitor stress corrosion cracking

PROJECT SEQUENCE

The SCCoDRa project is a four-year project. It will involve:

- research laboratories, including the French Corrosion Institute and the LVA and MATEIS laboratories at INSA Lyon (specialising in Vibration and Acoustics, and corrosion testing, prevention and monitoring, respectively);
- CETIM, a technical centre recognised for its expertise in corrosion, nondestructive testing and monitoring;
- industrial firms specialising in the design of electrodes and measurement instruments in the field of electrochemistry (Origalys Electrochem) and developing agile robotics solutions (VLM Robotics).

EXPECTED RESULTS

Innovation

The first objective of this project is to develop a prototype contactless automated assessment unit able to perform complete through-thickness mappings of metal containers. The main areas of innovation under the SCCoDRa project involve adapting and developing tried and tested NDT techniques (EMAT, active infra-red thermography, eddy current and laser ultrasound) and developing a standalone probe controller unit to provide a test technique that adapts to different container configurations and overcomes the constraints relative to radioactivity.

The second objective of the SCCoDRa project involves developing an innovative methodology for monitoring corrosion, combining different general and localised approaches. This will draw on existing technologies with specific development in the field of instrumentation and data analysis and expertise developed in the fields of NDT (acoustic emissions, guided waves, etc.), electrochemistry and field signature method (FSM).

The project will specifically focus on the ability to monitor the development of corrosion in large-scale structures in a complex environment (accessibility, radioactive environment) and to do this over long periods of time.

Economic impact

The challenge is to be able to deploy robust and reliable testing and monitoring tools that will function in an environment that is subject to major constraints and where human intervention is not possible. All of these advances will have a direct positive impact on costs and on the safety and security of personnel at these facilities.

Impact on radioactive waste management

The inspection techniques developed for the first part of the project will not only be used to test container integrity but also ensure whether or not they comply with the specifications for acceptance at the disposal facility. This inspection technique may also be of interest to certain waste producers that have to manage metal-encased containers in long-term storage.

The challenge in the second part of the SCCoDRa project is to develop innovative tools to improve monitoring programmes at the Cigeo disposal facility throughout the operating phase. Detecting and monitoring corrosion is particularly important in the case of the metal sleeves installed to ensure the mechanical stability of HLW disposal cells for at least 500 years, and also to meet the requirements regarding the reversibility of the facility (Article 2 of the Act of 28 June 2006).

Application and commercialisation

The aim of the SCCoDRa project is to develop robust corrosion testing and monitoring technology that will operate over very long periods of time. In addition to applications in the nuclear industry, these technologies could be used in sectors such as "Oil & Gas" as well as growth sectors such as marine renewable energy. These industries have to meet testing and monitoring requirements for infrastructure in hostile environments and with long operating lives (25 to 30 years in the case of marine renewable energy).