

# ORCADE

Recycling electrical cables  
in waste from decommissioning nuclear sites

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:** 05/2017

**Total project cost:** €1.75 million

**Including funding under the Investments for the Future Programme:** €870,000

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

**Locations:**  
Marcoule,  
Donzère,  
Trept

**Coordinator:** A3i

**Partners:**

- A3i (Inovertis)
- CEA DEN (DTCD, DEIM, DUSP)
- MTB

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## BACKGROUND

Decommissioning nuclear facilities will generate large quantities of radioactive electrical cable, which will be disposed of as very low-level waste (VLLW). Based on the experience of dismantling some of the laboratories at the CEA site in Marcoule, of all the VLLW resulting from dismantling these facilities, electrical cable is estimated to account for more than 3% in terms of weight and more than 10% in terms of volume.

The metals used in these cables, which are insulated (see image below), are not, in general, contaminated. Any radioactive contamination is located on the surface of the sheathing. Furthermore, the metals used in these electrical cables (copper and aluminium) are valuable and are therefore worth recycling. Recycling would also reduce the volume of radioactive waste that needs to be disposed of, and would thereby reduce the related disposal costs and optimise use of disposal facility capacity.

Recycling these metals however implies being able to downgrade the classification of the metals in the electrical cable from radioactive (VLLW) to conventional waste, so that they can be cleared for reuse.



► Copper medium-voltage cable

## OBJECTIVES

The ORCADE research project aims to develop two approaches to reduce the volume of VLLW electrical cables for disposal:

- Approach A, known as "stripping", will focus on developing deployable technology for recovering the metal wire in the cables and preventing any transfer of contamination from the sheathing, with a view to reclassifying it as conventional waste that can be cleared for recycling;
- Approach B entails adapting conventional industry solutions to the nuclear field, in this case adapting the process currently used to recycle non-radioactive electrical cable to comply with nuclear safety requirements. This involves developing a solution to separate, sort and reduce (by shredding) the volume of waste in order to separate the metal wire from the sheathing. In France, this option cannot currently be used to recycle the metal wire in cables, but only to reduce the volume for disposal. It will therefore only be considered as a fallback solution if the results of research on Approach A are inconclusive.

## PROJECT SEQUENCE

The project, scheduled to last for 48 months, is divided into three key stages:

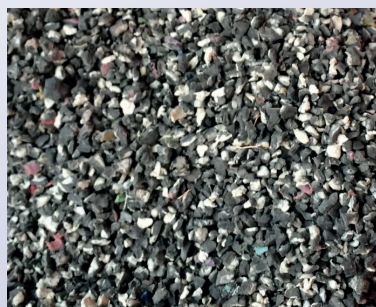
- Precise characterisation of the inventory of contaminated electrical cables: heterogeneity of the materials found during dismantling operations, the nature and location of contamination. The aim of this stage is to define a "standard cable" representative of the inventory of contaminated cables, which will be used in tests throughout the project, as well as a methodology for validating the absence of contamination in the metal conductor wires



► Mobile "cable box" made by MTB  
(to be adapted to the nuclear sector)



► Metal residue, copper granules,  
size 4-6 mm



► Plastic residue, a mix of PE-PEX/PVC,  
size 2-5 mm

once they have been separated from the sheathing;

- Development of the "Approach A" solution (stripping with a view to recycling): design and production of a reduced-scale prototype (non-nuclear), validation tests, study on industrial deployment of the prototype (extrapolating and scaling the technology for the actual tonnage of cable) and a study of the regulatory framework with a view to downgrading the classification and clearing the waste. A major mid-project milestone review will be held to decide, based on the results of these studies, whether or not to go ahead with Approach A or resort to Approach B;
- Technology transfer: this last stage in the project will entail an environmental analysis (Life Cycle Assessment) and a market study to specify how the technology developed can be marketed.

The ORCADE project is supported by three partners:

- A3i, an SME specialised in engineering and equipment manufacturing, with expertise in adapting processes to the nuclear field.
- MTB, an SME specialised in recycling non-radioactive cable, which holds the patent for the conventional cable recycling technology. MTB is the market leader in this sector.
- The CEA, as a potential customer for the technology, will provide all its experience in both R&D and as a radioactive waste producer, with a view to characterising the "electrical cable" waste inventory and understanding the mechanisms involved in contamination transfer in the cables.

## EXPECTED RESULTS

### Innovation

Technologically, both stripping (Approach A) and shredding (Approach B) processes exist in the conventional sector. The ORCADE project aims to innovate primarily by adapting these processes for use in the nuclear sector. In particular, deploying Approach A will require the development of techniques and methodologies designed to guarantee the absence of

contamination in the metal conductor wire, with a view to obtaining regulatory authorisation to recycle it. The ORCADE project thus implies not only technical innovation but also regulatory innovation.

### Economic and social impact

As a result of this project, constructing the required facilities (Approach A or B) and operating such facilities, will form a new business opportunity for A3i and MTB, which will then be able to expand their activities in the sector.

The sale of processing units, in France and worldwide, will create or maintain around fifteen jobs for the two SMEs, A3i and MTB.

For radioactive waste producers, reducing the volumes of waste for disposal implies savings on the cost of waste disposal, as well as revenue from the sale of recycled metals.

### Impact on radioactive waste management

Contaminated cable generated by dismantling nuclear facilities is currently placed in disposal facilities without prior processing. Whether Approach A or Approach B is finally adopted, the ORCADE project will result in reducing the volumes of radioactive waste to be disposed of. It is thus in line with a circular economy approach.

## APPLICATION AND TRANSFER TO INDUSTRY

Above all, the ORCADE project aims to meet an industrial need in France's nuclear sector: future dismantling of facilities managed by EDF, ORANO and the CEA will generate thousands of metric tons of cable.

The results of the project could also be extrapolated and applied to:

- cable waste from foreign nuclear facilities;
- e-waste other than radioactive electrical cables: other system parts, such as small pipes.

A specific study on the potential commercialisation of the technology developed under ORCADE will therefore be expected on completion of the project.