



LEAK DETECTION ON PIPELINES OR TANKS

Presentation of the technology

Who? Industrialists, fluid network operators who need to identify and pinpoint the exact location of fluid leakage in pipelines or tanks quickly.

What? This solution allows operators to identify and locate liquid leakage that might turn out to be electrical conductors.

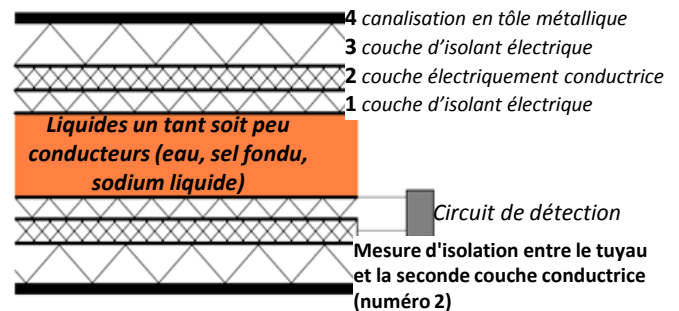
Where? This solution can be used *on new or existing structures* such as pipelines, ducts or storage facilities (eg. storage tanks) at a maximum operating temperature of 350 ° C. It can be used in the following structures: *chemical plants, desalination stations, nuclear power stations, ...*

How? By identifying a short circuit.

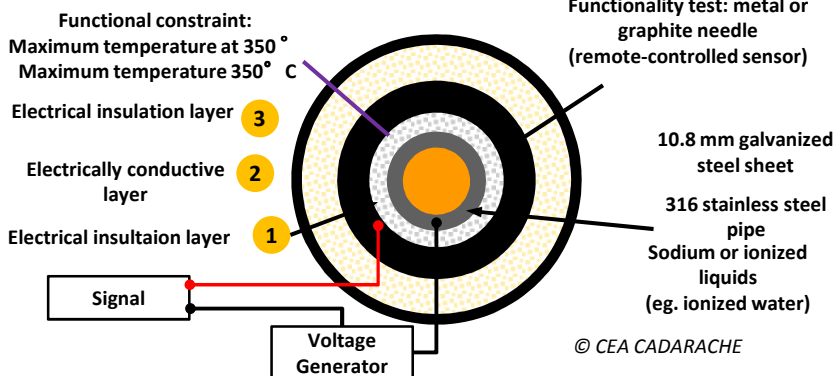
Why? **Dependability, safety and protection of the environment.** Their purpose is to monitor pipelines or tanks, identify and locate leaks as they occur and limit their consequences and impact.

The scope of the invention includes :

- ✓ A fluid leakage detection system,
- ✓ A transport pipeline using a fluid leakage detection system,
- ✓ A process for coating pipes,
- ✓ A method for monitoring the operating state of a fluid leakage detection system.



The principle of leak detection is based on the loss of electrical insulation between an ionized liquid (eg. sodium) and the electrically conductive layer (2) of the pipe. During a leak, the ionized liquid flows through the first electrically insulating layer (1) and will be able to make contact between the pipe and the conductive layer (2). The electrical properties of the liquid will close the detection circuit which, in turn, will trigger an alarm.



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Results obtained from this type of prototype:

- 1 Ex: mineral wool fibers (thickness: 2-15 mm.)
- 2 Ex: Malleable element: carbon felt, graphite felt or stainless steel (thickness: 5/10/20/30/50 mm)
- 3 Ex: Rockwool (thickness: 20/50/100 mm.)

Maturity Level

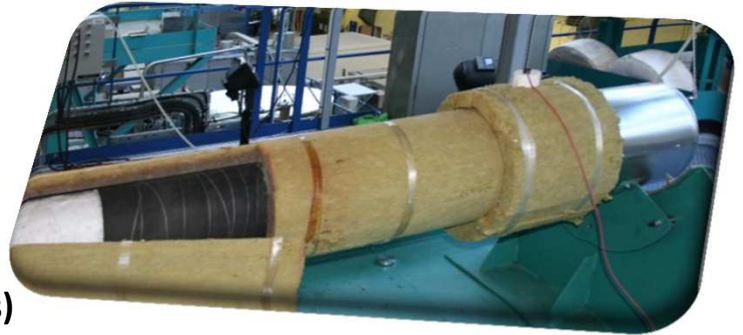
The invention has been the object of numerical simulations. Its level of technological maturity (TRL) is: 4-5 (Validation component and / or model in a relevant environment, eg. FUTUNA 2).

Patents

The invention is protected by two patents (FR2964456 and FR1302220 filed in 2010 and 2013 respectively) and an international application filed in 2011 WO2012032233.

Advantages of the technology

- **Rapid detection of any type of leakage conductive fluids (30 minutes in comparison to other conventional leak detection systems that take several hours)**
- **Precise pinpointing of the leak conductive fluids**
- **Avoids problems of triggered “false alarms”**
- **Solution cost (the purchase and installation of this solution is 18% to 40% cheaper than for a detector beaded son)**
- **Easy to assemble on pipes, ducts or storage facilities (eg. storage tanks) new or existing. Furthermore, the creation of specific areas of detection is possible to identify a leak even more accurately.**



Value added offer

The DEN ***offers industrialists the necessary equipment and technical expertise for any scientific project necessitating leakage detection on conducting fluid pipelines***

Users benefit from a practical training session explaining the use of the equipment.

Assistance, provided by the personnel, is guaranteed at the time of the analyses.

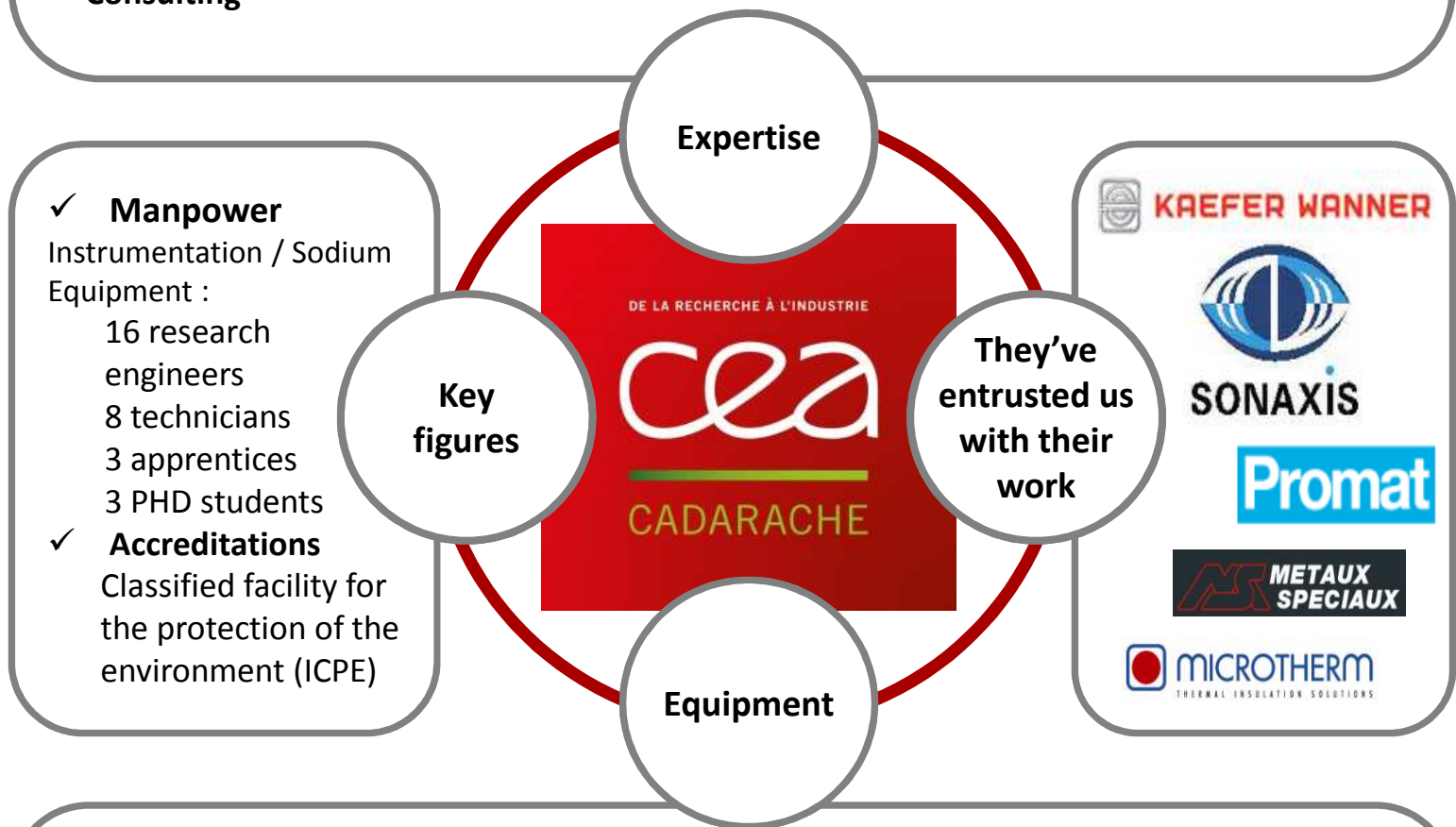
Consultancy is offered for the optimization of the experiments and the sample analyses.

The goal of CEA/DEN is to meet the requests expressed by industrialists whether they be in terms of:

- ***Using the test means of the DEN's Sodium platform*** for specific analyses,
- ***License concession*** of this technology (Patent & Know-how) on the French and international markets,
- Creation of new ***collaborations***.

The DEN has thirty years of expertise and know-how in handling sodium and materials that have been in contact with Sodium. The DEN, in partnership with the INSTN, maintains a sodium school and liquid metal training school offering various sessions dedicated to the handling of sodium and liquid metals by focusing on both the safety and technical standpoints. It also has a program of study involving:

- ✓ **Sodium technology**
- ✓ **Work conditions in hostile environments** (heat, noise, cramped quarters, lack of space, ..)
- ✓ **Specific instrumentation usable at high temperatures,**
- ✓ **Construction, Installation and Operation of sodium facilities.**
- ✓ **Thermal Simulation / CAD**
- ✓ **Implementation of tests under severe conditions (temperature)**
- ✓ **Consulting**



- ✓ **Manpower**
Instrumentation / Sodium Equipment :

16 research engineers
8 technicians
3 apprentices
3 PHD students

- ✓ **Accreditations**
Classified facility for the protection of the environment (ICPE)

They've entrusted us with their work



The CEA/DEN has considerable testing and development means at their disposal that enable them to validate their client's technologies:

- ✓ **Methods of testing liquid metal and adapted to the implementation of liquid sodium (max 600 ° C)**
 - Instrumentation / a metrology chain suitable for liquid metals
 - Rapid detection system leak Sodium
- ✓ **Test loops (mockups produced on a reduced scales or full-scale assemblies)**
- ✓ **Water tanks of different sizes (ranging from tens to hundreds of liters of water)**

Challenges & Markets

Quality assurance and performance guarantees for the purpose of improving the availability and the safety of large systems such as reactors; these are the main issues of this theme. So providing instruments and measurement techniques that can guarantee the condition of pipelines or various other structures is of paramount importance, particularly in the **nuclear** and **steel** industries.

A major actor in the fields of research, development and innovation



The French Commission for Atomic and Alternative Energies relies on the excellence of its fundamental research and provides a supporting role to industry.

The CEA operates over 10 centers throughout France. It develops many partnerships with other research organizations, local authorities and universities.

Recognized as an authority in its field of expertise, the CEA is fully involved in the European area of research and is rapidly asserting a growing international presence .

Concerning the technology presented in this document, and more generally , the technologies for measuring heat transfer and thermal fatigue of materials, the CEA provides industrial **expertise** to analyze their challenges as well as **R & D support to adapt their technologies to suit specific needs.**