Nuclear energy directorate

CADARACHE

ISO 9001
ISO 14001
OHSAS 18001

Chicade

A technological platform serving R&D and the nuclear industry

- nuclear measurement
- chemical and radiochemical analysis
- characterisation and examination of radioactive objects:
  - from small samples to large waste packages
  - from a few micrograms to several tonnes
  - from a few becquerel to several terabecquerel

General view of the facility: Chicade licensed nuclear facility (INB1) based at Cadarache

The activities performed in CHICADE have a threefold purpose:

- **Research & development**
  - **development and qualification of non-destructive nuclear measurement methods**
  - **development of chemical and radiochemical analysis methods**
  - **support for R&D waste characterisation programmes**
  - **design and manufacture of special fission chambers for in-cor neutron measurements.**
- **Supporting clean-up and dismantling operations**
- **Supporting the nuclear industry.**

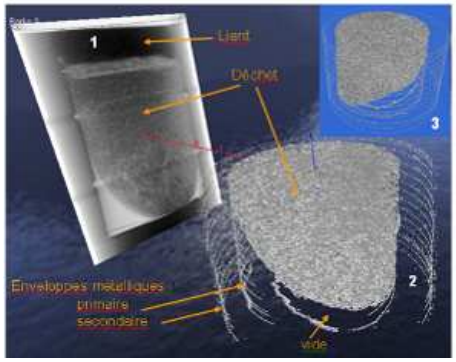
Main industrial and R&D partners :

- **ANDRA:** Expert laboratories for “super-controls” on waste packages from the Aube waste disposal facility.
- **EDF:** Dismantling of EDF graphite-moderated gas-cooled power plant.
- **AREVA NC:** R&D for the monitoring of nuclear reprocessing and conditioning processe.

[1] Known as an *installation nucléaire de base* in French

Available tools and methods:

Non-destructive nuclear measurements:



Interactive visualisation of radiographic and tomographic images

- Physical characterisation using active imaging, radiography and tomography

TRANSEC station capable of accommodating irradiating packages up to 200 litres / 500 kg

- Radiological characterisation using gamma spectrometry and neutron measurements (active and passive).

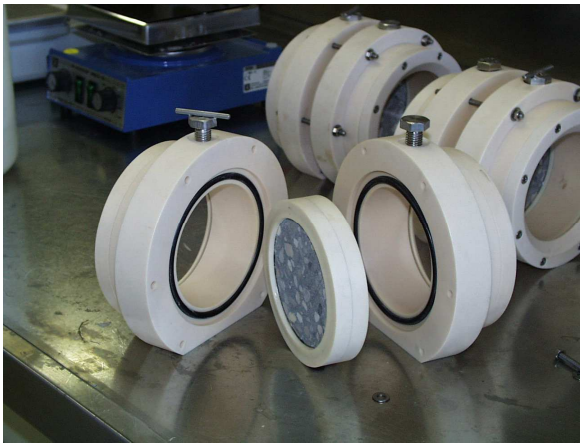
- Elementary characterisation using neutron interrogation or excitation

SYMETRIC neutron measurement cell designed to characterise fissile material in irradiating packages

Sampling and sample preparation:

- Waste inventory, coring and dissolution of irradiating objects.

Measurement of physicochemical properties:



- Mechanical resistance, diffusion, leaching, porosity and gas permeability

- Measurement of waste package gas releases and volatile radionuclides

Sample preparation in a glove box before analysis

Available tools and methods:

Chemical and radiochemical analysis:

- Selective separation (precipitation, liquid-liquid extraction and ion exchange chromatography)
- Determination of toxic elements and organic compounds by mass spectrometry and chromatograph.
- Alpha and gamma spectrometry and determination of long-lived emitting nuclides

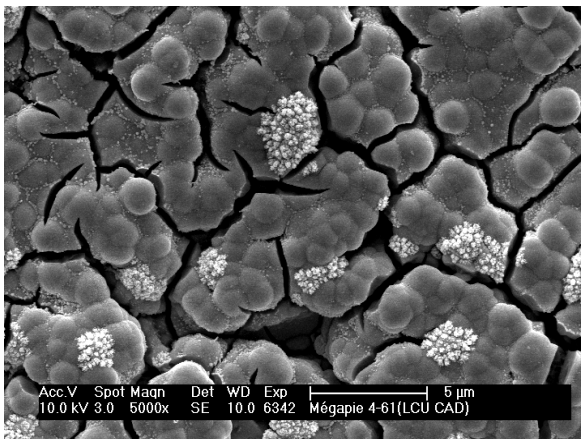
Sample preparation for diffusion coefficient measurements

Electrodeposition bench before alpha nuclide analysis

Design and manufacture of fission chambers:

- Fissile depositions electrolysed in a special glove box (^{242}Pu, ^{237}Np, ^{232}Th, ^{244}Cm, etc.)
  Monitoring the deposited mass and isotopic composition

- Assembly and gas filling of chambers
  The chamber parts are welded by TIG or laser and then vacuum heated before being filled with pure gas (Ar, Ar+N2, etc.)



SEM view of a uranium-235 deposition

Fission chambers (Ø1.5 mm, 4 mm, 8 mm)

Equipment:

The CHICADE technological platform includes 7 laboratories and 4 large-volume test halls housing chemistry laboratories, gloves boxes, shielded cells and irradiation bunkers, in addition to a fission chamber design & manufacturing laboratory.

CHICADE is equipped with sampling means and sample preparation tools such as the ALCESTE device that can contain packages up to 10 T, 2 m^3 and 11 TBq.

New developments:

CHICADE is regularly upgraded and will soon be equipped with two new devices:

- **CINPHONIE - Large underground cell for neutron and photon irradiation**
- **CADECOL - Shielded cell used for the destructive characterisation (cutting) of waste packages up to 5m^3).**

More information:

- **Master plan of the CHICADE platform**: Jean-François MONTIGON (CEA/DEN/DSN/DIR), assistant programme du Département de Services Nucléaires.
  Tél.: 00.33.4 42 25 23 52 E-mail : jean-francois.montigon@cea.fr

- **Chicade facility**: Eric FONTANAY (CEA/DEN/DSN/SEEC), Service Manager, Facility Manager.
- Tél.: 00.33.4 42 25 30 68 E-mail : eric.fontanay@cea.fr

- **Sampling & sample preparation, measurement of physicochemical properties, and degassing measurement**: Dominique CARRE (CEA/DEN/DSN/SEEC/LECD), Laboratory Manager.
  Tél.: 00.33.4 42 25 35 71 E-mail : dominique.carre@cea.f

- **Non-destructive nuclear measurements:** Philippe BERNARD (CEA/DEN/DTN/SMTM/LMN), Laboratory Manager.
  Tél.: 00.33.4 42 25 28 29 E-mail : philippe.bernard@cea.fr

- **Chemical and radiochemical analysis**: Christophe GUY (CEA/DEN/DEC/SA3C/LARC), Laboratory Manager.
  Tél.: 00.33.4 42 25 73 55 E-mail : christophe.guy@cea.fr

- **Fission chambers:** Frédéric BERHOUET (CEA/DEN/DER/SPEX/LDCI), Laboratory Manager.
  Tél.: 00.33.4 42 25 39 75 E-mail : frederic.berhouet@cea.fr