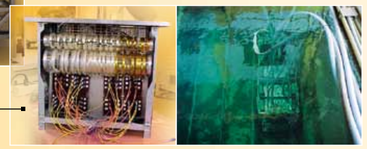
AMONG OUR ACHIEVEMENTS...



Irradiation qualification of Ball Valves VIMER (Modular Isolation Valve with Fast Maintenance), with actuator conducted between 2 pans of POSEIDON sources
(VANATOME – TRACTEBEL)

5 years long study of optical fibers ageing under irradiation at low dose rate, carried out in an airtight chamber submerged in the Poseidon pool
(CEA/IRSN)

Qualification irradiation performed using electron beam on paint coatings conditioned for severe accident, for the program EPR
(EDF/SEPTEN)

'LOCA' test achieved in the Cesar cell on a 'HZR' valve + seals
(JASPAR Valves SA - TRACTEBEL)

K1 qualification of power cables for the EPR program conducted in cell Caline **(NEXANS - EDF/SEPTEN)**

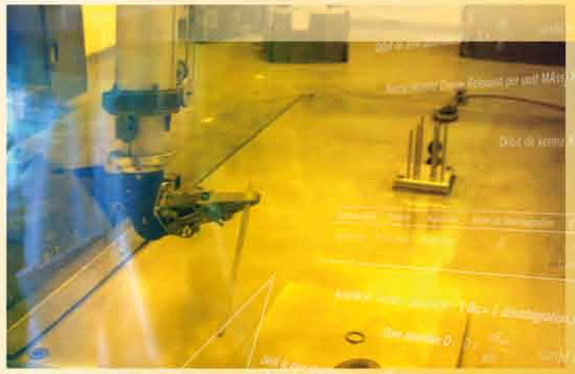
Engine valve (L. BERNARD) and engines (CEB) K1 qualification performed in the CALINE cell
(EDF/SEPTEN)

Ageing irradiation conducted in the CALINE cell on a HTA electrical penetration
(AUXITROL - EDF/SEPTEN)

CERTIFICATIONS

- The Direction of Nuclear Energy **is certified ISO 9001** notably for the activities of exploitation of nuclear installations and the achievement of services.

- In addition, the LABRA is within the **ISO 14001** certification scope of the CEA Saclay Center



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Design **vu** integral

LABRA

Laboratory of Applied Radiations

NUCLEAR QUALIFICATION OF MATERIALS AND EQUIPMENT

RADIATION TESTING OF ELECTRONIC COMPONENTS AND SYSTEMS

DIRECTION OF NUCLEAR ENERGY
NUCLEAR ACTIVITIES
DIRECTION OF SACLAY

énergie atomique • energies alternatives

LABRA

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MORE THAN 30 YEARS OF EXPERIENCE

On the ageing of materials:

In the framework of a 'defence in depth' type strategy, the operators of nuclear installations must prevent the ageing of components. The design, the manufacture of the components, the choice of materials must be adapted to maintain a satisfactory level of safety throughout the life duration of the installation, both in normal and accidental operating situations.

In particular for reactors, the 'resistance of equipment or materials to radiation exposure under given thermodynamic and chemical conditions' constitute a legitimate concern for the operators in the design phase of the new generation reactors (EPR), but also in the perspective of life extension of existing power plants.

Within the Laboratory of Applied Radiation (LABRA) located on the Saclay site, CEA has assembled the tools and skills enabling operators to test the equipment and materials, and allowing experts and researchers to conduct specific studies.

Thus, almost thirty years ago, the teams of CEA / LABRA, of EDF and FRAMATOME defined the terms of reference for irradiation and thermodynamic testing of the electrical equipment (classified K1, K2, K3), considered acceptable by the Standing Group on Nuclear Reactors. From these initial definitions ensued many collaborations with EDF's Direction of Studies and Research, multiple equipment qualifications for PWR conducted with EDF / SEPTEN, as well as studies carried out to the benefit of safety experts of the IRSN.

Since then, the LABRA, while continuing its partnership with EDF / SEPTEN, puts its facilities and expertise at the service of operators, equipment manufacturers, suppliers and researchers, consistently with the CEA's Direction of Nuclear Energy strategy to support nuclear industry.

On the irradiation of electronic components:

The various radiative environments (space, civil and military nuclear sciences, physics of particles) require manufacturers of electronic components and systems to carry out studies and testing of qualification in order to better qualify their equipment. To meet those needs LABRA provides manufacturers and researchers means of gamma irradiation (Co60) to cover a wide range of dose rates.

A COMPLETE TECHNICAL PLATFORM WITHIN THE INB77

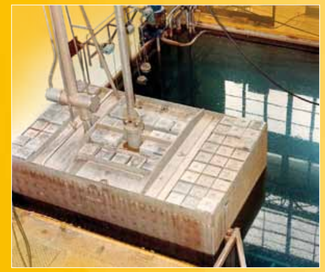
The irradiator **PAGURE** has 6 sources of Cobalt 60 (total activity of 740 TBq), arranged in a room of 25 m2. It allows an ageing radiation of small materials, in a range of dose rate from 10 Gy/h to 25 kGy/h.

POSEIDON is a pool type industrial irradiator, able to store 37,000 TBq of Cobalt 60. The power of this irradiator is sufficient to obtain in particular geometries, a dose rate in the bunker of the order of 1 to 10 kGy / h on an experimental volume of 200 liters.

The Van de Graaff accelerator **VULCAIN** delivers electrons from 0.5 to 2.5 MeV. It allows the testing of thin materials such as electrical cables or paint coatings and sealants. Particularly in the framework of 'severe accident' simulations, doses of several dozens of MGy at dose rates of 100 kGy/h and more, can be issued.

The self-protected **GALAXIE** irradiator equipped with a source of Cobalt 60 (activity less than 0.37 TBq), allows an irradiation at low dose rate (0.36 to 3.6 Gy / h) and electronic components arranged radially in a cylindrical chamber (ht: 420 mm, 160 mm radius).

CELLS OF UNIQUE TESTING COMPLETING THE TECHNICAL PLATFORM



CALINE is a parallelepipedic sealed cell, whose dimensions are 2,60 x 1,90 x 1,58 m; it may be immersed in the POSEIDON irradiator pool. Material whose mass can reach 4.5 tons can be irradiated by radiation of cobalt 60 at dose rates of about 1 kGy/h. It is also possible to get a gradient flow inside the cell by changing the geometry of cobalt sources. Equipment installed in the CALINE enclosure can be maintained at a temperature of 70 ± 3°C during irradiation and receive various power supplies and various fluids (gas or liquid).

The Reference Simulation Accident Test cell **CESAR** was designed to investigate sequential or simultaneous action, of the thermodynamic shock produced by the vaporization of water in the primary circuit inside the reactor and the heart radioactive product radiation ('LOCA' test). This equipment includes an experimental chamber of 0.2m^3 in which is placed the material to be tested. Using the boiler and super heater, the steam will raise the cell temperature at 200°C in less than 10 seconds at a pressure of 6.5 bars. The test chamber can be introduced into the POSEIDON irradiator. The test material is then subjected to 'realistic' thermodynamic shock (in the presence of radiation from Cobalt 60).

A NETWORK OF EXPERTISE

In addition to the testing means described above, the LABRA has laboratory tools for the characterization of polymers (mechanical tests and measures of the oxidation level), analysis of radiolysis gases formed during irradiation, and it relies on the network of skills of the Direction of Nuclear Energy and the Saclay Center.