

## Profile SFR-25

### PLINIUS 2

### FRANCE

#### GENERAL INFORMATION

NAME OF THE FACILITY Platform for Improvements in Nuclear Industry and Utility Safety  
ACRONYM PLINIUS 2  
COOLANT(S) OF THE FACILITY Water, sodium and gas  
LOCATION (address): CEA Cadarache,  
13108 Saint Paul Lez Durance  
FRANCE  
OPERATOR CEA  
CONTACT PERSON  
(name, address, institute,  
function, telephone,  
email):

STATUS OF THE FACILITY Under Design  
Start of operation (date): 2020

MAIN RESEARCH FIELD(S)

- Zero power facility for V&V and licensing purposes
- Design Basis Accidents (DBA) and Design Extended Conditions (DEC)
- Thermal-hydraulics
- Coolant chemistry
- Materials
- Systems and components
- Instrumentation & ISI&R

#### TECHNICAL DESCRIPTION

##### Description of the facility

This facility will be operated at a large scale of corium inventory: up to 500 kg. It will be an international user facility devoted to all Severe Accidents sequences (In Vessel/Ex Vessel) aiming at validation of materials, codes and devices.

The building of the PLINIUS-2 facility is designed and optimized to conduct experimental programs providing security requirements, in particular, in the presence of sodium and water in separated halls. The building is structured on two levels with 3 corium experimental halls in the basement:

- Water Interaction (FCI) hall (4) with an associated steam processing hall
- Material and mitigation hall (6,7)
- Sodium Interaction (FCI) hall (2) with the associated sodium treatment hall

The furnace hall (1), connected to the generator hall is at ground level, above the experimental hall. The furnace will be installed in an airtight enclosure that will be moved over the experimental halls above the selected test section. The separate-effect tests hall is also located on the floor level close to the corium load preparation room. Access panels for each hall facilitate the handling operation from a separated hall with a crane. The control room, the conventional experimental hall (Low Temperature) are located in the non restricted area. The design of the facility enables the use of X-Ray in each experimental hall up to energies of 30 MeV (9 MeV on PLINIUS-1).

The surface of the facility about 3000 m<sup>2</sup> will cover new experimental needs (the sodium and separated-effect tests halls, analytical tests) and requirement for the preparation of the charges.

### Acceptance of radioactive material

Yes

### Scheme/diagram

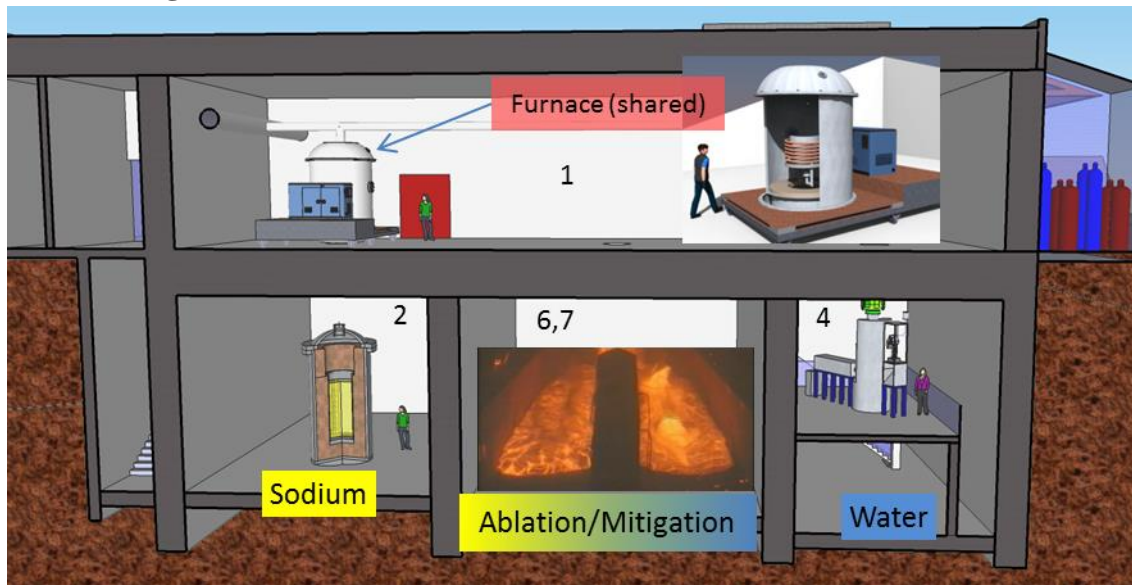


FIG. 1. Scheme of the PLINIUS 2 facility

### 3D drawing/photo



FIG. 2. View of the PLINIUS 2 facility

### Parameters table

|  |  |
|--|--|
| Coolant inventory  | Sodium inventory: few m <sup>3</sup>   |
| Power  | Around 3-4 MW  |
| Test sections  |  |
| TS #1<br>Corium/sodium<br>interaction  | <u>Characteristic dimensions</u><br>Crucible height: 2500 mm<br>Crucible diameter: 1000 mm   |
|  | <u>Static/dynamic experiment</u><br>Dynamic (corium injection in static sodium)  |
|  | <u>Temperature range in the test section (Delta T)</u><br>Around 3000 K for the corium<br>Up to 850°C for liquid sodium  |
|  | <u>Operating pressure and design pressure</u><br>To be defined   |
|  | <u>Flow range (mass, velocity, etc.)</u><br>Up to 500 kg of corium   |
| Coolant chemistry measurement and control (active or not, measured parameters) | Sodium quality will be controlled and depending of the design options, a sodium purification unit could be used to prepare each sodium batch.  |
| Instrumentation  | Instrumentation devoted to: <ul style="list-style-type: none"> <li>• Very high temperatures (3000°K) measurements</li> <li>• Polyphasic flows analyses</li> <li>• X-ray analyses</li> <li>• Post-test material analyses</li> </ul> |

## COMPLETED EXPERIMENTAL CAMPAIGNS: MAIN RESULTS AND ACHIEVEMENTS

New facility

Based on 20 years of experience with corium experimental research at the PLINIUS-1 platform

## **PLANNED EXPERIMENTS (including time schedule)**

For SFRs, three major issues will be studied and correspond to different experimental configurations [29]:

- Study of the Fuel Coolant Interaction in steady state (simulating large corium flows out of the core region) with a sodium-filled test section. This encompasses the following research issues:
  - Risks linked to the core catcher ablation by a coherent melt jet;
  - Study of debris bed formation in view of its coolability;
  - Sodium and water vapor explosion experimental data base shall be completed by a few tests with a low sodium subcooling (simulating a long-lasting melt flow to the lower plenum) and the effects of combined steel and uranium oxide jets; Two separate test sections will be built in two separated rooms of PLINIUS2 for corium-water and corium-sodium interactions;
  - Validation of relocation processes through engineered Corium Dispersion Channels.
- Study of Corium-Core catcher material interactions, including sacrificial material ablation by coherent melt jets, and corium pool behavior and coolability
- Study of corium dispersion mitigation device.

## **TRAINING ACTIVITIES**

As it is planned to use PLINIUS-2 as a “user-facility” performing experiments for external partners besides the experiments for CEA own R&D programme, some training will be provided to these partners when they stay at the facility. Nevertheless, due to the constraint of regulated work with nuclear materials, it is not expected that foreign partners do effective work in contact with uranium dioxide.

This facility will also host interns and doctoral/postdoctoral students which will receive practical training on the spot.

## **REFERENCES (*specification of availability and language*)**

1. GASTALDI, RODRIGUEZ G., AYRAULT L., COLLARD B., DUMESNIL J., DUJET F., JOURNEAU C. O., LATGE C., SANSEIGNE E., SERRE F., TKATSCHENKO I, WILLERMOZ G., Experimental platforms in support of the ASTRID program: existing and planned facilities, Proceedings of ICAPP 2014, Charlotte, USA, April 6-9, 2014, Paper 14060