

## Remote visual inspections of Sodium Fast Breeder Reactors (FBR)

Used for the inspection when in service or when draining the vessel to check the sodium retained

Benefit from unique experience in terms of remote visual inspections as part of the inspection when in service or the dismantling of Fast Breeder Reactors (FBR)

### Challenge

When dismantling a sodium reactor, the main aim is to drain as much sodium as possible. Remote visual inspections are carried out in order to confirm the sodium audit after draining with specific tools, or in order to determine if drainage (or treatment) is necessary.

The same equipment is also used during the inspection when in service of the FBR (ISIR).

These tools must satisfy the following from the design phase to implementation:

- the management of the different risks (sodium, radiological, anoxia, etc.),
- the requirements of the operator (schedule, performances, availability, adaptation to existing utilities, etc.)
- regulatory and safety requirements,
- highly limiting implementation conditions (temperature, pressure, irradiation, access, etc.).

### Solution

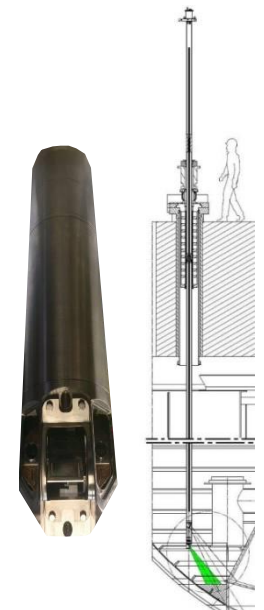
When the main limitations are irradiation, temperature or limited access, Framatome has developed two types of tools.

The first type comprises a long "rod" tool, combined with a "hardened camera", if access is easy and the visual appearance is critical to quantify the volume of sodium. This type of tool was particularly used to inspect the bottom of the reactor vessel or the double bottom of the recovery system (after drainage) or the core support structure, but also for many sodium retention devices (after drainage),

The second type is an "intrusive" tool fitted with a long flexible endoscopic video (or fibroscope) introduced using a mechanical assembly, and controlled in a glove box if access is extremely difficult. This type of tool was particularly used to inspect the thermal protection area under the reactor slab, or the PCDR (reactor unloading and loading station).



Bottom of the primary vessel before complementary draining



Bottom of the primary vessel after complementary draining



Remote visual inspection of the retention devices at the bottom of the vessel at Creys-Malville (Super-Phenix)

### Customer benefits

Unique experience worldwide

Framatome can boast two types of experience acquired in the field (Inspection when in service and Dismantling):

By providing solutions for the condition of the Phenix reactor after years of service (ISIR).

By specifying the sodium audit as part of the Super-Phenix vessel drainage operations,,

**Your performance  
is our everyday commitment**

## Technical information

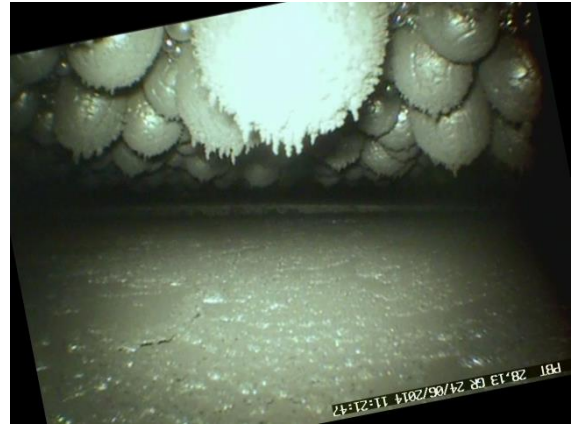
### Examples of inspections

#### Remote visual inspection of the reactor slab heat baffles:

- Limited reactor access (diameter: 40 mm)
- Access to the limited inspection area: 10 mm x 20 mm light;
- Maximum dose rate: 300 mSv/h
- Temperature of 40 °C

#### Remote visual inspection of the Phenix core

- Dose rate: approx. 500 Sv/h
- Temperature of 180 °C
- Length of the inspection tool: 12 m
- Lighting power: 1000 W



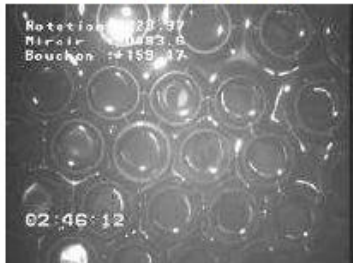
Remote visual inspection of the heat baffle in the SPX reactor (DEM) – Views of baffle access and the inside of the baffle with solidified sodium drops



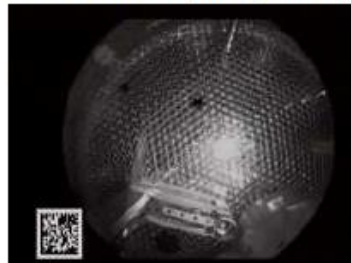
Tête de la perche panoramique



Détail de la tête de la perche panoramique



Vue des assemblages dénoyés



Remote visual inspection of the Phenix reactor (ISIR)  
Views of the assembly heads and lateral neutron shields

## Key figures

Over **10** inspections in FBR vessels

**360°C** panoramic inspections with hardened cameras

Punctual inspections with access limited from **10 to 20 mm** by fiberscope

## References

### EDF Creys-Malville reactor (Super-Phenix):

- Reactor vessel: inspections of the reactor vessel; inspection of the retention trays
- Revolving plug, miscellaneous inspections of the revolving plug
- Rotating transfer airlock: inspection of the primary ramp

### CEA PHENIX reactor:

- Remote visual inspections of the reactor vessel when deflooding the core
- Rotating transfer airlock: inspection of the inside of the airlock

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