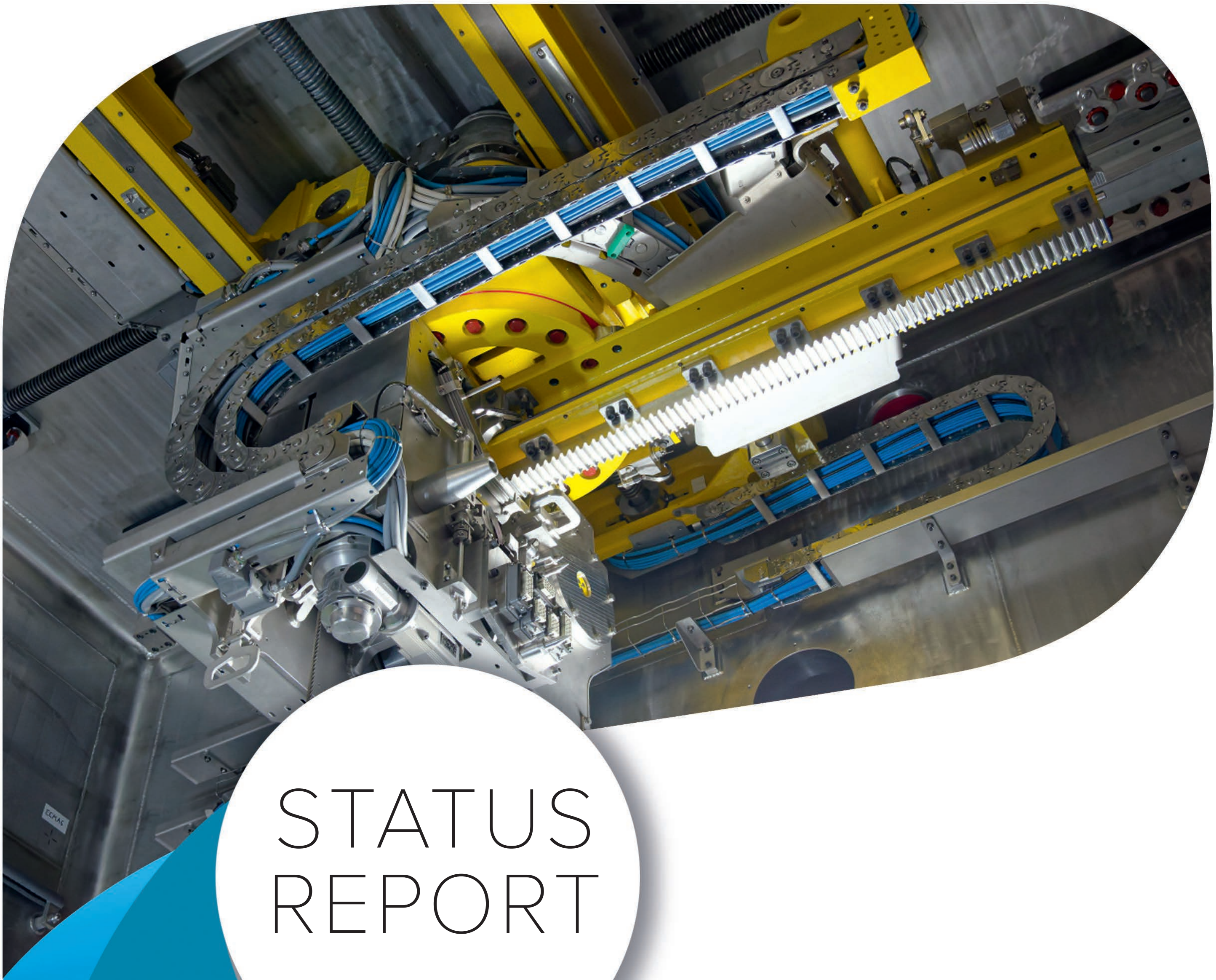

STATUS REPORT

2025

Jules Horowitz Reactor

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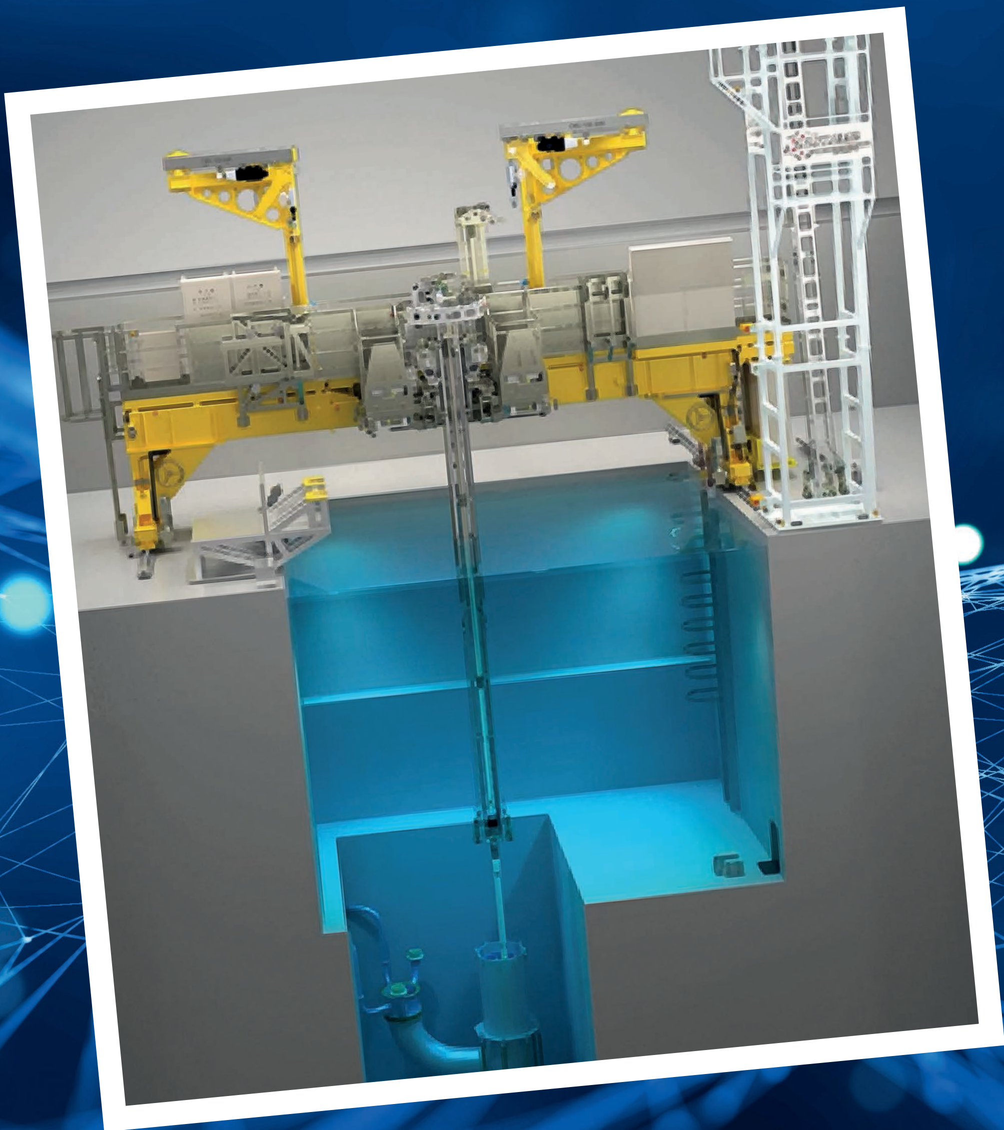
Cover photo © Véronique Paul

FOREWORD 1



Jonathan HYDE
JHR Governing Board Chairman

Last year we reported on the significant progress made implementing an improved methodology to assess construction progress. The plans are challenging, but progress in 2025 has been good. The schedule has largely been adhered to and the minor delays have no impact on the critical path. Completion of the JHR remains on track with fuel loading and first criticality expected in 2032.

The increase in on-site activity has resulted in some logistical challenges. There are now more than 1200 on-site workers, a near doubling since 2023. The governing board (GB) members are encouraged by the priority being given by CEA to ensure all involved in construction activities remain safe whilst delivering to the schedule. Given the increasing complexity of operations, continued safety vigilance will be essential. Critical activities in 2025 included work on the primary circuit (primary heat exchangers & primary pumps), reactor building hall and auxiliary building. Repair of the primary heat exchangers is going well - the tube bundles have been replaced, and repairs will be complete in 2026. Installation of the primary pumps is ongoing although pump '3' has been delayed. Cable pulling activities have begun in the reactor hall building, but with 1600 km of cables to pull this will not be a quick task! Excellent progress has also been made on the hot cells (in-kind contribution from CVR/NRI). Final installation is dependent on prior installation of cranes by NUVIA, but all indications are that this in-kind contribution will be completed in 2026.

Fleet 1 devices (ADELINE, OCCITANE and MADISON) have now been expanded to include FUICA (fuel irradiation capsule for fuel screening tests) and CLOE (in-kind contribution from BARC in collaboration with CEA). In addition, MICA will have additional capability to enable irradiation of pressurised samples. The proposed increased capability at reactor start is very welcome.

In October the 2nd JHR Advanced School was hosted at Aix-Marseille University. It was a resounding success with young researchers given the opportunity to learn about the JHR and other MTRs, as well as to interact with members of three JHR working groups. As usual, there were two formal meetings of the working groups, firstly in June at Cadarache and then in late October in the UK. Members of the fuels WG debated future needs including the potential for developing a new capsule for testing innovative fuels under gas or NaK conditions. The Materials WG focused on engagement with international programmes and the Technology WG discussed instrumentation updates and the publication of an Instrumentation Catalogue in support of JHR devices.

In addition to the main GB meeting in June, an extraordinary meeting was held later in the year. The robust discussions provided a good platform for development of the new consortium agreement. The GB approved the proposed governance arrangements for JHR operations and provided useful feedback on the financial model. The International Advisory Group met twice. The terms of reference for the period to the end of 2027 were approved and the discussions on the life cycle flowcharts of MADISON and MICA experiments provided a much-improved understanding of the experimental complexities involved.

The GB looks forward to continued good progress in 2026.

David EMOND
JHR Project Director

In 2025, the JHR project reached major milestones and continued to gain momentum. Safety performance showed a renewed improvement compared with 2024: although the site has not yet achieved its "zero-accident" objective, with 8 accidents recorded including 2 with lost time, this goal remains a strong and shared commitment for all teams.

Electromechanical installation progressed across all buildings and all levels, reaching 50% completion by the end of 2025. The ambition for 2026 is to reach 75% completion and to prepare for the large-scale rollout of cable pulling by 2027.

A key milestone will be reached in 2026 with the start of installation of the primary circuit and safety systems, marking the beginning of work on the very heart of the JHR process.

As a result, 2026 will be a year of full-scale installation activities, bringing the project to a level of maturity that will allow the transition to the testing phase from 2027 onwards.

In anticipation of this next step, the project team has already tested three systems in 2025, helping to fine-tune procedures and capitalize on lessons learned.

For experimental devices and radioisotope production facilities, the JHR is now entering the execution phase, with supply and installation contracts being awarded.

Sixty years ago, the Osiris reactor began five decades of experimental activity and radioisotope production.

Today, the JHR is becoming increasingly tangible and is clearly looking ahead to its upcoming testing and start-up phases. It will then take over from Osiris, ensuring decades of high-performance experimental capabilities and the production of radioisotopes serving nuclear medicine.

TOWARD A ZERO-ACCIDENT CONSTRUCTION SITE 2

Guillaume VILLARD
Safety and Construction Site Manager

The JHR Project team values the health and safety of its employees, contractors and third parties involved in the JHR construction and commissioning activities. Preventing accidents, injuries and ill health while protecting the environment is one of the JHR Project's primary concerns. This is why all the work during construction and commissioning has and will continue to be carried out under the safest possible conditions. All the project's contractors, including CEA, have signed the industrial safety policy and are committed to making industrial safety their main concern.

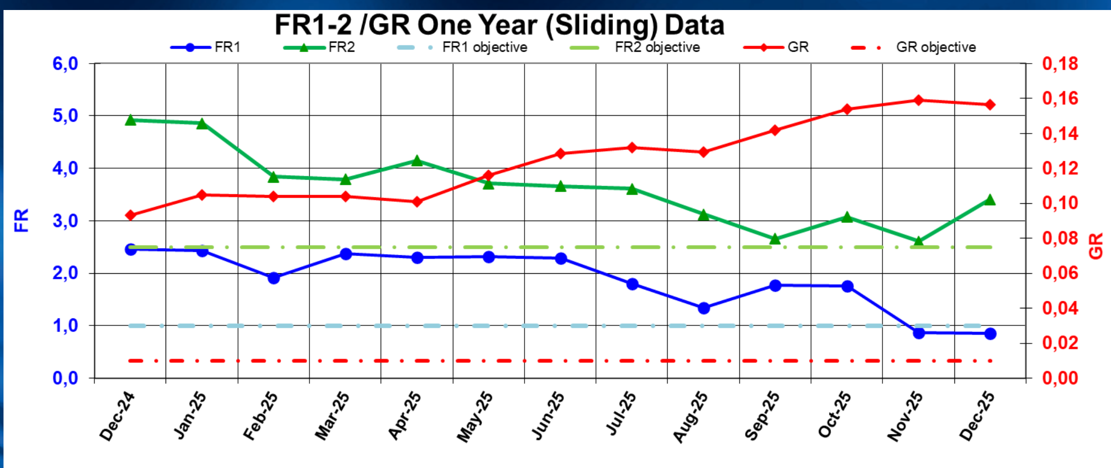
The JHR Project strives to provide a safe and healthy working environment for employees and contractors alike; its managers, supervisors, engineers and operatives, as well as its contractors, are all encouraged and expected to proactively contribute to improving JHR health and industrial safety indicators.

All health, safety and environmental risks are systematically managed as an integral part of the project; accordingly, the behaviour of employees and contractors must reflect the highest industrial safety standards when going about their daily activities.

2.1 OCCUPATIONAL SAFETY

2.1.1 Indicators

The figure hereafter shows the main JHR safety key performance indicators for 2025.



- *TF1 (frequency rate 1) defines the number of occupational accidents with lost time over a 12-month period per million hours worked.*
- *TF2 (frequency rate 2) defines the number of occupational accidents with and without lost time over a 12-month period per million hours worked.*
- *TG (severity rate) defines the ratio between the number of days lost multiplied by 1,000 and divided by the number of hours worked over a 12-month period.*

end of déc-25
FR1 : 0,9
FR2 : 3,4
GR : 0,16

The following table describes all lost-time accidents (LTA) and without-lost-time accidents (WLTA) for 2025.

11 December	WLTA | Slip, trip and fall while walking on an unsecured floor protection plate
08 December	WLTA | While working on the top of a secured ladder, the worker dropped his wrench. The wrench hit the hand of another worker located at ground level
06 September	WLTA | An office worker twisted her ankle walking on a floor cable duct
28 October	WLTA | Sudden closure of the toolbox lid on the operator's hand
08 September	LTA | A worker felt back pain while handling a hoover
23 July	WLTA | While drilling concrete in the ceiling, the worker received splinters in the eye. He was wearing non-sealed safety glasses (wrong PPE)
02 April	WLTA | During jackhammer slipped on the edge of it. While trying to hold it back, the worker felt pain in his neck
26 Mars	LTA | The worker received a metal plate on the back of his hand, causing pain.

In 2025, there was an improvement of occupational safety, launched by the safety action plan of October 2024. Significant progress was made regarding:

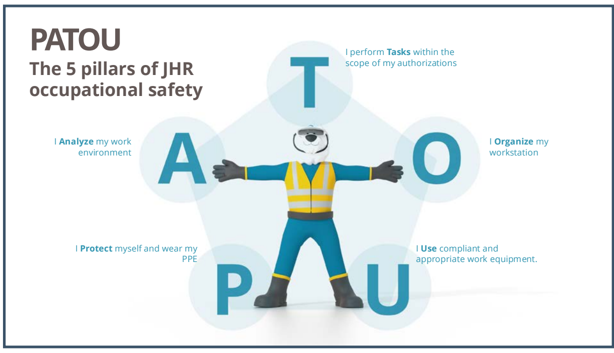
- Lost Time Accidents: 2 LTA in 2025 against 5 LTA in 2024;
- Safety improvement reports: 1371 reports against 974 in 2024;
- Safety behaviour and especially pre-job briefing implementation.

Some work remains to achieve 0 accident: WLTA remains over JHR target and HIgh POtential events (HIPO) must be eradicated: 15 were identified on site in 2025.

2.1.2. Actions

❖ *PATOU – Environment Health and Safety online tool*

In 2025, JHR developed its own online tool, PATOU, enabling the following:



- **Environmental and safety reports (RISE).** The "RISE" application has to be used by JHR workers to raise any best practice or safety concerns, to define action and owners until closure. 1371 RISE have been raised in 2025, the target is 1500 RISE for 2026.
- **Industrial safety behavior visits (VCS).** The JHR project has implemented informal inspections to observe the industrial safety behaviour in the workplace. This involves observing employees (JHR project personnel and contractors) in the field to find solutions that can improve occupational safety and working conditions. Employees are asked to think about the situation themselves so they can solve their own industrial safety issues and improve their workplace conditions. This approach actively engages employees in the implementation of actions that have been decided together. A total of 146 visits were carried out in 2025 (103 visits in 2024), which contributed to highlight 156 good practices and correct 1302 hazardous behaviours.
- **Inspections on the field (VHSE)**. VHSE is the tool for generating, completing, and tracking compliance checklists in terms of Environment, Health, and Safety with each subcontractor working on site. A total of 114 EHS inspections has been conducted in 2025.

❖ *Occupational Safety Day*

JHR Occupational Safety Day took place on 30 September 2025 at the construction site. This day was dedicated to safety training and risk awareness, including a very impactful conference on Civil and Criminal Liability in Security Matters. All the project contractors were invited to participate in this event, some of whom led workshops, e.g. scaffolding team or lifting team.

The following workshops were held:

- Conference on Civil and Criminal Liability: **545 participants**
- Understanding cognitive biases to improve our communication skills: **72 participants**
- First aid actions training: **64 participants**
- How to use a fire extinguisher: **148 participants**
- Addictive behaviours (led by policemen): **87 participants**
- Resitting the driving theory test: **125 participants**
- Phone risks awareness: **56 participants**
- Check your car before driving: **76 participants**
- Lifting activities: **47 participants**
- Electrical risks: **53 participants**
- Scaffolding safety: **51 participants**
- Work-at-height risk: **56 participants**
- Test your reflexes: **36 participants**
- Slinging and rigging operations: **42 participants**
- How old are your arteries: **120 participants**
- Ability to respond to adverse events: **87 participants**

❖ *Back-to-work journey*

Every January, JHR Project organizes a back-to-work site visit to ensure that workers will start the New Year with safety as their top priority. Together with their managers, workers walk around the construction site to specific spots where safety information is provided, such as:

- 2025 safety events
- Dropped object hazards
- Authorization to Work, Lock-Out/Tag-Out
- Risk-hunting on the construction site
- Ability to respond to adverse events

2.2 SITE SAFETY COMMUNITY

2.2.1 Company industrial safety award

At the contractors' "health and safety at work" coordination committee, the JHR project awarded four companies for their implementation of good practices, deployment of new industrial safety initiatives, and ownership of industrial safety issues.

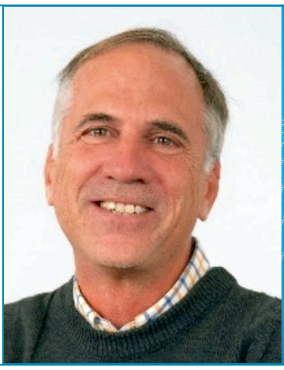
2.2.2 Employee of the month

In 2025, twelve staff members were given the 'safety employee of the month' award for the following reasons:

- Zero industrial safety non-conformity events over a period of 3 months (compliance with the JHR safety fundamentals)
- Model behaviour with respect to the industrial safety rules (wearing safety equipment, following procedures, etc.)
- Good safety initiatives and safety proposals
- Open communication in safety and environmental matters
- Proactive warnings about hazardous situations.

2.2.3 Emergency drills

A total of 29 emergency drills were organised in 2025 to train staff to react correctly in the event of an accident and to benefit from lessons learnt. Hazardous situations were analysed and 'victims' were evacuated from areas considered difficult to access in order to test the emergency response procedure in place. Many visits were organised with the CEA emergency response team to make sure they were able to find their way into buildings and reach difficult areas during working and non-working hours.



Eric HANUS
JHR Consortium Manager

3.1 CONSORTIUM ORGANISATION

The JHR Consortium brings together 14 partners. The European Commission is associated with the consortium activities. The consortium agreement states the rights and obligations of each member, providing a model for governance during both the construction and operation phases. The consortium is managed by a governing board. Each member of the Consortium appoints a representative to attend the governing board meetings.

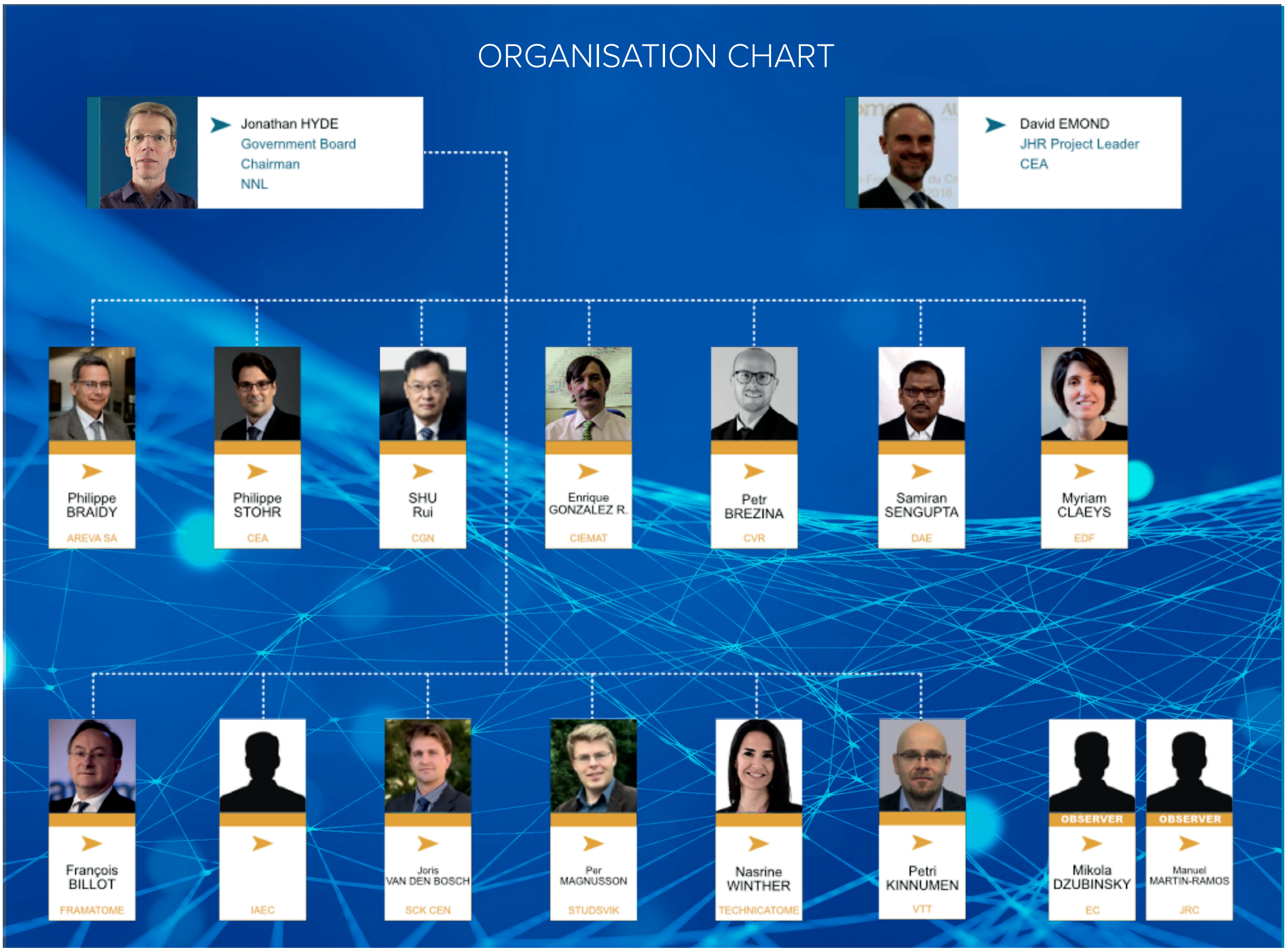
Jonathan HYDE
JHR Governing Board Chairman

The governing board is responsible for defining the policy and strategic orientations of the consortium. Its members appoint a chairperson to manage the meetings and duties for a period of four years. In June 2024, the board endorsed Jonathan Hyde from the UK National Nuclear Laboratory (NNL) for the next 4 years.

David EMOND
JHR Project Leader

Appointed by CEA and approved by the governing board, the project leader is responsible for the construction phase. David Emond manages the day-to-day activities associated with JHR construction.

CONSORTIUM ORGANISATIONAL CHART



3.2 GOVERNING BOARD ACTIVITIES

The yearly governing board meeting was held in Cadarache on the JHR site on 5 to 6 June. Consortium members were given updated information on the project: operational safety, progress on construction site, development of experimental capacity, safety roadmap and forthcoming milestones and associated schedule.

JHR governing board members visiting JHR construction site

3.2.1 Enlarging the consortium

CEA is mandated by the governing board to further develop the JHR international consortium by accepting new members. In 2025, CEA continued exchanging with potential stakeholders / customers having shown interest in joining the JHR international consortium. So far, CEA is focusing efforts on Japan and South Korea with regular contacts and meetings with the organisations concerned. In 2025, CEA has also initiated contacts with Canada representatives.

3.2.2 Renewal of the consortium agreement

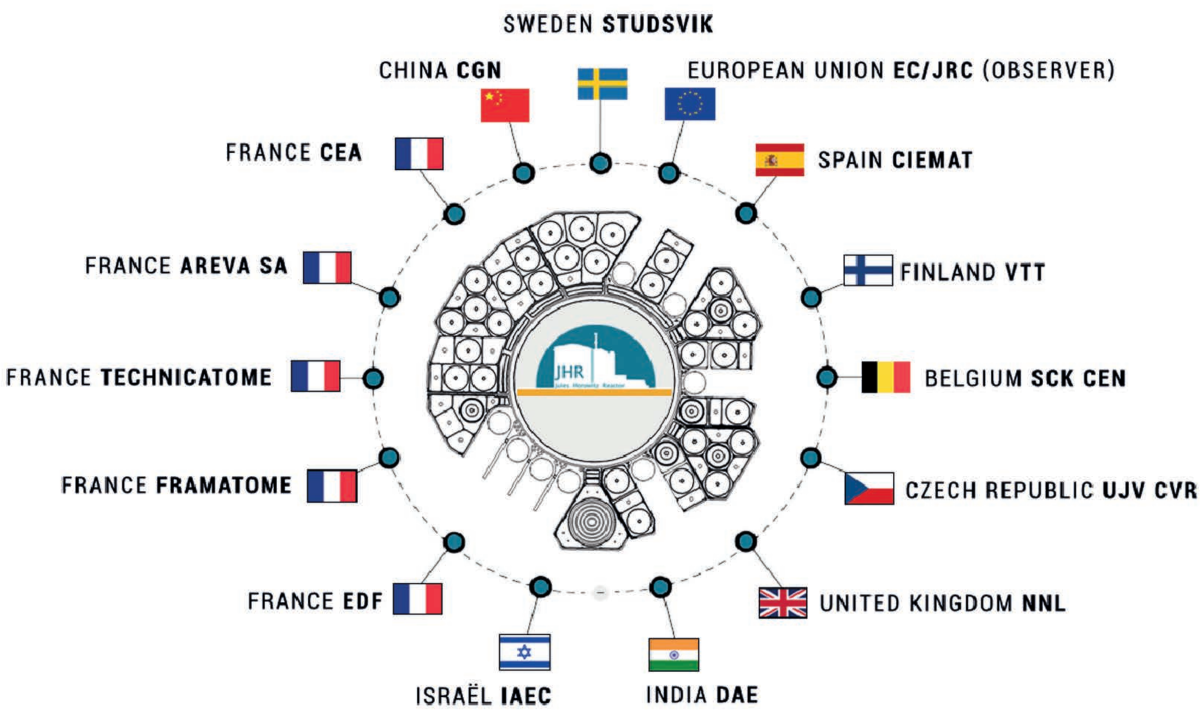
The French government approved further investment in the JHR project in July 2023 under specific conditions. One of the resulting actions is the revision of the original consortium agreement of 2007, which regulates the rights and obligations of each consortium member. This revision is focusing on five key points:

- Introducing a review clause,
- Specifying the roles of the consortium and CEA under JHR operation
- Modifying voting rules to facilitate decision-making
- Considering a yearly contribution to part of JHR operating cost
- Considering additional contribution to JHR completion cost

During the yearly governing board meeting, the JHR team presented a summary of all bilateral discussions that CEA had with the members in 2024 and 2025. A consensus was found for regularly reviewing the agreement. CEA presented a proposal of governance clarifying, on one hand, the role of CEA and, on the other hand, the roles of organizational bodies covered by the consortium: governing board, programme manager / operation committee and international advisory group. CEA proposed some detailed evolutions of the voting rules. Finally, CEA reminded members of its expectations regarding the economical JHR business model.

An exceptional governing board meeting was organised in Paris on 10 October. During this very constructive meeting, the governance proposal was agreed, a methodology relative to the yearly contribution was found and the constructive discussion on voting rules made it possible to identify a proposal.

Thanks to these two governing board meetings, CEA is in a position to propose an updated version of the consortium agreement in 2026.



3.3 CONSORTIUM ACTIVITIES

3.3.1 JHR working groups

The three JHR Working Groups, i.e., Fuel (FWG), Materials (MWG) and Technology (TWG), met twice in 2025:

- At the 14th scientific and technical seminar in Aix-en-Provence (France) in June
- During dedicated meetings in Culham (UK) organised by colleagues from UKAEA in October. The groups had the opportunity to visit JET (Joint European Torus), RACE (Remote Applications in Challenging Environments) which is a centre for robotics and autonomous systems and MRF (Materials Research Facility) with hot cells for preparing and examining materials developed for fusion power stations.

In 2025, the main activities of the three working groups were:

- Providing information to update the expected performance levels of the experimental devices under development (fleet 1 and fleet 2)
- Exchanging on several key topics strongly linked to the JHR experimental devices:
  - The FWG discussed about the recommendations from utilities and fuel manufacturers regarding LORELEI needs, the device to simulate loss-of-coolant accidents (LOCA). A methodology was presented and CEA proposed a feasibility study to determine what evolutions could be envisaged. The FWG also addressed the opportunity of developing fuel gas or NaK capsule. CEA proposed a preliminary design study and asked consortium members for secondees to work on this topic.
  - The MWG shared the recent developments on characterisation and irradiation of JHR archive material (JAM) samples, see next section. The MWG also discussed irradiation needs. It was agreed that CEA will prepare information on JHR irradiation capabilities for the first fleet of experimental devices, also including fuel devices. Consortium members will then be able to present realistic needs.
  - The TWG presented an update on different sensors / equipment development: neutron detectors, flow measurement, calorimeter, sample holders, MELODIE-2 experiment. Regarding LVDT supply, significant progress was made at CEA where technology is under development with a first prototype expected by end of 2025.

JHR working groups meeting at UKAEA, Culham, UK

The working group activities also underpin the importance of launching the 'pre-JHR' phase through several joint research programmes in operating MTRs (see section relative to OECD/NEA FIDES framework and EURATOM projects) in order to collect feedback and optimise the experiments to be performed in JHR.

Note: following approval from governing board in 2023, participation in these working groups (and scientific seminar) was extended to non-members of the consortium such as US NRC, US DOE, NRG in the Netherlands, JAEA-CRIEPI in Japan, CAEA in China, etc.

3.3.2 JHR archive material (JAM)

Over recent years, the Materials Working Group has been developing an important topic linked to the specific neutron spectrum in JHR. The group is studying the behaviour of reference materials (stainless steel) in different neutron spectra. At first, it is conducting studies in operating MTRs such as HFR in the Netherlands and LVR15 in the Czech Republic. Later, it will continue research in JHR in order to build a data bank on these reference materials that will be used for the entire JHR lifetime.

In 2025, continuous progress was made with respect to the detailed characterisation of cold samples which inventory is managed by CEA Saclay centre. The first round-robin results concerning hardness show a very good consistency between the different laboratories. Microanalysis is ongoing and further work has been identified which will involve participation of **UKNNL, UKAEA, CVR/UJV, CIEMAT, CEA, JRC and VTT.**

Thanks to UKNNL, a first irradiation experiment on JAM samples was performed in the High-Flux Isotope Reactor (HFIR) at Oak Ridge National Laboratory (ORNL) in 2023-2024. In 2025, post-irradiation examinations (PIE) have started at ORNL. Discussion allowed sharing of the ongoing and future PIE programme at both ORNL and UKAEA.

In Culham, UKAEA mentioned the possibility of participating in 2026 to an irradiation in BR2 at SCK-CEN. Although the information arrived at short notice, the group demonstrated great responsiveness to define and prepare appropriate samples.

Finally JAM samples will also be irradiated in both MITR at the Massachusetts Institute of Technology (USA) and in the High Flux Reactor (HFR) in Petten (Netherlands), giving us access to PIE data from different test reactors. These irradiation programmes are part of the INCREASE joint programme under the FIDES2 framework (see specific section).

3.3.3 Scientific seminar

In 2025, the 14th scientific and technical seminar on JHR experimental capacity was held from 2 – 4 June in Aix-en-Provence. The seminar was open to some non-members: US-NRC, US-DOE, NRG, JAEA, CRIEPI, CAEA, Aix Marseille University, Bologna University, ASNR, etc.

Around 85 people attended the seminar (around 60 in person and 25 remotely), during which the JHR community was given a progress report on:

- JHR project
- Design of the experimental devices (fleet 1 and fleet 2&3)
- In-kind contributions for experimental devices: CLOE loop from BARC but also experimental devices developed by JHR partners: RISHI loop from IGCAR, LEBICA capsule from CGN and MELODIE-2 from CEA-VTT-CVR.
- Work completed by secondees from BARC (6061 aluminium alloy) and UKAEA (FUSERO devices).
- Preparation of international joint programmes: OECD/NEA/FIDES, EURATOM framework with CONNECT-NM project and OFFER proposals.

JHR community participating to the scientific seminar

Some specific time slots were allocated to the different working groups and a technical visit of the JHR construction site was organised in three groups and greatly appreciated by the participants.

3.3.4 JHR school

In 2025, 2025, the second edition of the JHR school was held in Marseille from 13th to 17th October. The school was co-organised by Aix-Marseille University, Bologna University, European CONNECT-NM project and CEA.

The programme included 28 lectures with experts coming from 8 different countries, covering different domains such as:

- Materials Testing Reactors (MTR) their evolution and description of the JHR project
- Nuclear materials and fuel qualification, their behaviour under ageing and incidental conditions
- Irradiation devices from different MTR and related instrumentation

In order to develop interaction with lecturers, the students participated in small groups to two case studies. The first one about data management and the second one about irradiation devices during which the students were able to apply their course contents to sketch either a new experimental device, sample holder or experiment to be implemented in an MTR.

20 students attended the school with a large representation from JHR consortium members and a complement from Europe.

JHR school: students and teachers (top). Students working on their study case (left) and presenting new experimental setups (right). Students visiting JHR reactor building (bottom).

3.4 JHR AS AN INTERNATIONAL FACILITY

3.4.1 IAEA ICERR

CEA was named International Centre based on Research Reactors (ICERR) by IAEA in 2015 for 5 years. In late 2019, CEA decided to submit its application for another 5 years with a new scope of activities including CABRI research reactor, MADERE dosimetry platform and JHR. After a rigorous assessment process carried out by IAEA in 2020, CEA and its partner IRSN were labelled ICERR for another 5-year period, ending in December 2025.

Such international recognition has led to successful collaborative actions with several IAEA member states. The main highlights in 2025 with respect to work completed under the ICERR framework were:

- regarding R&D projects, ongoing discussions with KACARE from Saudi Arabia on their multi-purpose reactor project. Still in R&D, CEA had regular exchanges with the Josef Stefan Institute for the development of a new research reactor in Slovenia. One possibility would be to build a facility with two reactors: a zero-power unit and a multipurpose reactor for training, instrumentation testing, radiography and neutron physics
- for education and training, the organisation every two years of the IAEA Research Reactor school, the next edition of which is in preparation and planned for 2026.

CEA is currently preparing the progress report for the 2020-2025 period and, in parallel, is in discussion with IAEA for renewing the label on a slightly modified scope.

3.4.2 OECD FIDES framework

After the phase-out of Halden reactor in 2018, OECD decided to launch a new initiative called FIDES, Framework for IrraDiation ExperimentS. It federates a broad scientific community around Materials Test Reactors to propose several joint R&D programmes on fuel and materials behaviour under irradiation.

CEA and its partners from the JHR consortium have been actively preparing the first joint experimental programmes based on topics proposed by the JHR working groups. FIDES legal framework came into force in 2021 with 27 organisations representing nuclear operators, fuel manufacturers, R&D organisations and technical safety organisations.

In 2022, following the suspension of Russian members by the OECD council, a new framework called FIDES-II was created. United Kingdom officially entered FIDES-II in 2023 and South Korea in 2024. The second triennial of FIDES-II was officially launched in 2024. Nine joint programmes have been endorsed, doubling the number of programmes compared with the first triennial.

The JHR consortium members are particularly involved in three projects:

- P2M, Power-to-Melt and Manoeuvrability, that sets out to perform slow-power transients to reach partial fuel melting, led by CEA and SCK-CEN
- INCA, In-Core Creep studies of Accident-Tolerant Fuel cladding, led by CVR
- INCREASE, In-Core Real-Time Mechanical Testing of Structural Materials, led by the Idaho National Laboratory (INL) in the USA for the first phase, and by the Nuclear Research and Consultancy Group (NRG) in the Netherlands for the second phase.

In 2025, OECD organised two meetings to report on the progress of the different joint experimental programmes and to prepare the next triennial to be started in 2027.

3.4.3 Conferences

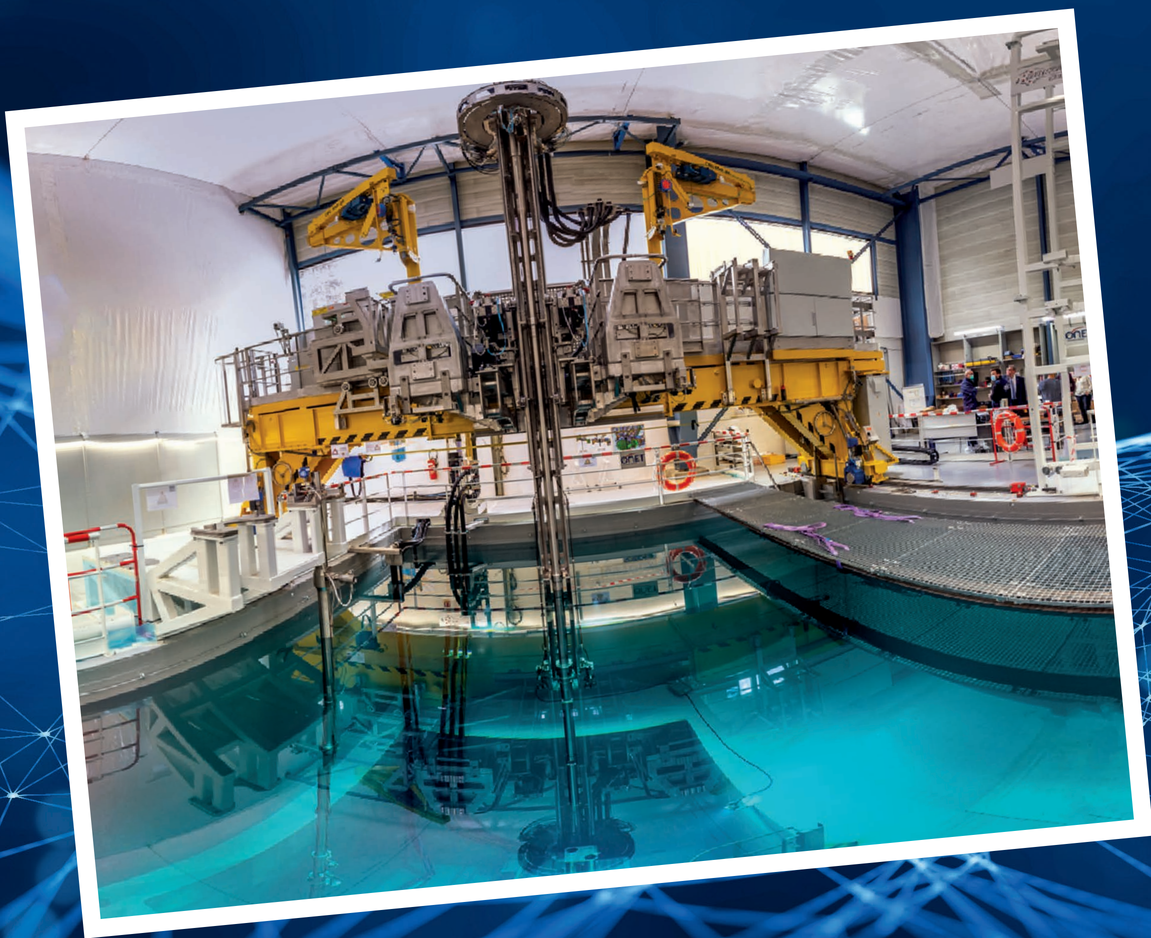
JHR and CEA teams have attended several international and European events on fuel and material experiments, as well as on material and test reactors. **During these events, they have given presentations on the JHR project and its progress, in the preparation for operation and the experimental devices under development:**

- European research reactor conference (RRFM) in Aix-en-Provence, France
- International group on research reactor (IGORR) in Mito, Japan

CEA also participated in many events around the production of medical radioisotopes, during which it was able to communicate on the JHR construction progress.

3.4.4 Communication

JHR project team was delighted to welcome the famous influencer Monsieur Bidouille who produced a video report on JHR project, available online at: https://www.youtube.com/watch?v=MZkmz24Nwbs.



DELIVERING THE JULES HOROWITZ REACTOR AND EXPERIMENTAL DEVICES 4

David EMOND
JHR Project Director

4.1 PROJECT ROADMAP AND OVERALL SCHEDULE

During the Nuclear Policy Council on 19 July 2023, the French government decided to continue investing in the project with the objective of finishing reactor construction by 2032-2034. **To do so, the CEA is following the validated roadmap that focuses on the following areas:**

- Maintaining good results in occupational safety
- Erecting, installing, commissioning and starting up the reactor according to schedule and in line with quality and safety objectives
- Signing variation orders and new purchase orders to meet site needs
- Planning ahead to ensure a smooth licensing process
- Continuing to deploy best project management standards
- Securing resources
- Preparing for technical and commercial operation.

Regarding the project completion schedule, the project management team and its contractors are working to reach JHR start-up by the end of 2032.

The main milestones of this new schedule are as follows:

2025	End of the detailed preliminary design phase for the first experimental devices, and ramp-up of electromechanical assembly in the Reactor Building
2026	Start of assembly activities in the experimental area
2027	End of assembly activities in the Annex Building
2028	End of primary system assembly
2029	Commissioning of electrical distribution system and start of functional tests
2030	Filling of the Annex Building pools
2031	Filling of the Reactor Building pools
2032	Fuel loading and first criticality (start-up)

Reflector

Valentin DALLAPORTA
Technical Director

Tarik CHERIFI
Engineering Director

4.2 TECHNICAL DESIGN

MAIN ACHIEVEMENTS IN 2025

In 2025, work on the digital mock-up of JHR continued with the convergence of the lower levels of the CEDE area in the BUR. The layout has now reached 96% convergence, with only the upper levels of the CEDE area to be finalised.

2025 also saw significant progress on the conceptual design studies of systems still to be designed:

- Basic design of the building containing the hardened safety core equipment (BND). For memory, the BND safety building is a post-Fukushima requirement from ASNR so that JHR can safely face extreme natural hazards
- Basic design of the cooling system for the pools in the BUA in the event of a BND activation
- Final design review of the MOLFI system
- Mid-basic design review of the effluent treatment system (ELT). This system is used to:
  - Recover effluents from the ADELINE loop (and potentially from MADISON-FUICA-LORELEI in incidental conditions)
  - Filter very-high-level effluents so they are compatible with liquid effluent treatment plants
- Preliminary design of the contaminated equipment storage building (BAE) and the truck access airlock extension
- Completion of fire stability studies for the engineered structures of the nuclear unit, continuing to define the fire compartmentation strategy and the additional fire extinguishing means

KEY MILESTONES IN 2026

- Harmonization of electrical connection interfaces across the different work packages in order to enable cable installation in the BUA
- Convergence of the upper levels of the CEDE area which gathers all out-of-pile parts of the experimental devices
- Completion of the basic design of the effluent treatment system (ELT)
- Basic design of the gaseous effluent system
- Further basic design studies for the experimental devices (see Chapter 4.4.2)

Remy POMMIER
Delivery Manager

4.3 CONSTRUCTION STATUS AND PERSPECTIVES

MAIN ACHIEVEMENTS IN 2025

The "Plateau Projet Intégré (PPI)" became a daily effective collaborative workspace that allowed CEA and its main contractors to increase responsiveness and efficiency in the execution of the remaining JHR design and assembly tasks.

First focus: **The integrated technical platform (PTI)** (workspace focused on digital modelling): In 2025, work on the digital mock-up of JHR continued with new convergence (lower levels of the CEDE area in the BUR) and also smooth integration of new reference configuration for the electrical contractor.

Second focus: **Definition and development of interfaces:** The PPI mobilised itself in defining the electrical interfaces required to complete cable pulling, cable connections and earthing of the refrigerating Building Systems.

Third focus: **Specific working sessions:** On CEA's request, two subcontractors were mobilised to complete a specific action plan driving a new fire extinguishing system to be defined and set in the digital mock-up in parallel with the PTI actions with strong mitigation of side effects on construction sequences.

Fourth focus: **Management of the implementation schedule:** The PPI worked successfully in preserving the common milestones of the general schedule and de-risking the assembly phases through the best possible assessment of coactivity.

KEY ACTIONS IN 2026

The "Plateau Projet Intégré" will remain a key player on all of its missions.

The integrated technical platform : 2026 will see the conclusion of initial convergence for the last levels of the nuclear unit by finalising the upper levels of the CEDE area in the BUR. It will also secure smooth integration of changes.

Definition and development of interfaces: The PPI will focus on addressing the electrical interfaces required to complete cable pulling, cable connections and earthing for Diesel Buildings and Nuclear Unit Systems.

Specific working sessions: Working groups are already forecasted:

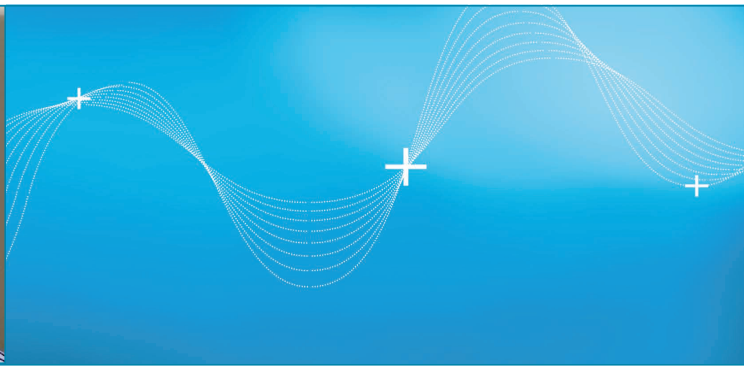
a) to deal with the review of fire management requirements and its possible impact (fire sectorisation and firefighting organisation).

b) to work on an update of the RJH baseline to reorganize the sequences in accordance with new configuration requirements and necessary acceleration for the reactor building equipment manufacturing and installation.

Management of the implementation schedule: The PPI will continue to secure the assembly phases through the best possible assessment of coactivity. As such, a gate review is planned to express an opinion on the project readiness to launch full scale cable pulling in the BUA building by end 2026 considering this coming activity as a non-return point with regards to the possibility for considering future large mechanical modifications.

Guillaume Villard

Safety and Construction Site Manager



4.3.1 Site activities

MAIN ACHIEVEMENTS IN 2025

In 2025, 92% of the on-time delivery milestones relating to the preparation of site activities and construction were achieved, including the end of civil work preparation activities in BUA and erection of 20.000 mle (equivalent meters) of piping.

Cable pulling started in BMR and lessons learned after commissioning of the 3 first piping systems.

All of these milestones were achieved thanks to the strong commitment of CEA and contractor site teams, including tight follow-up of the schedule, and several technical and organisational improvements.

Extra support was assigned to drawing up the 6-month schedule for the JHR project and the follow-up of procurement needs. This was needed to enhance our capacity to plan ahead and to manage site erection activities in line with the project schedule. Improvement shall be made in 2026 in order to integrate more subcontractors into schedule prerequisite construction.

The entire JHR project team works hard to ensure that all installation activities comply with the industrial safety and quality requirements.

KEY MILESTONES IN 2026

In 2026, thirteen milestones were assigned for site activities: seven concern on-time delivery milestones, and six correspond to erection quantities to be achieved by electromechanical subcontractors at the end of the year.

These milestones reflect the following objectives:

- Be ready to start cable-pulling operations in BUA 2026 (second semester)
- Install the equipment on the Reactor Building's critical path (primary cubicles), including reintroduction of the primary exchangers
- Achieve installation of HVAC systems in safeguard buildings
- Start construction of the BND.

The main issues involved in reaching the schedule objectives are:

- Maintaining high safety standards and reinforcement of task preparation
- Maintaining a high level of installation follow-up to ensure quality at each step and to foresee any site hazards
- Strengthening the project's capacity to ensure equipment supply and manpower staffing in line with the operational schedule.

4.3.2 Reactor block and radioisotope production

Pierre PASCAL
Reactor Block and
MOLFI System Manager

replaced in December 2025 by

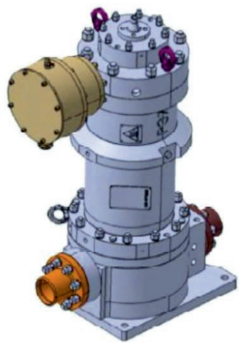
Christophe Baylard

The main activities completed within the scope of the reactor block project are detailed in the sections below.

❖ *MOLFI displacement system*

The MOLFI system refers to the four devices involved in the production of molybdenum. The new configuration of the MOLFI system (cooling circuits and irradiation devices) was approved in June 2025.

The supply of the circuit equipment is being launched. The call for tender to secure production of the irradiation devices is under progress.



MOLFI cooling pump

MOLFI irradiation system

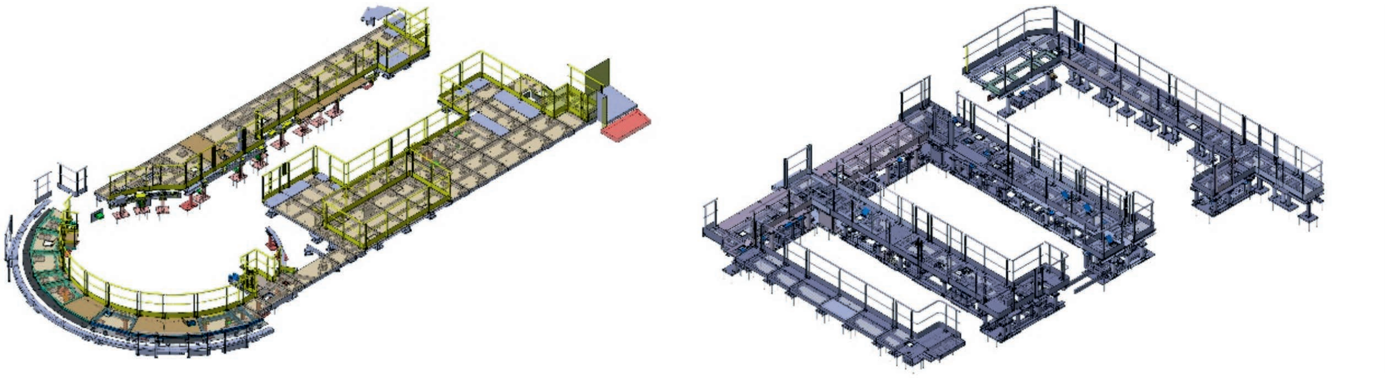
❖ *Block Reactor*

MAIN ACHIEVEMENTS IN 2025

Pile block unit

Testing and redesigning of certain displacement system equipment continued in 2025. The final design will be frozen in 2026 so that endurance tests can continue in order to qualify the equipment.

The pool coping structure (BUR and BUA pools)



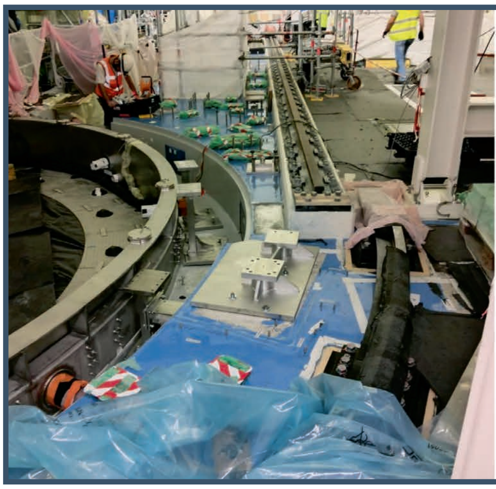
Sketch of pools coping structures in the reactor building (left) and in the auxiliary building (right)

These structures fulfil the following purposes:

- Securing the circulation of staff around pools.
- Allowing operations at pool level
- Receiving and supporting electrical cable pathways
- Receiving and supporting fluid circuits in gutters and their diving portion in the pool.
- Supporting fixed and operating loads (cabinet, ...).

In 2025, all the structures surrounding the pools of the BUR (REE and RER) were manufactured and delivered on site. The first on-site operations consisted of checking through a blank assembly of the structures their correct positioning and their ability to be assembled.

At the end of 2025, the manufacturing of the BUA pool coping structures began in factory (see picture). In 2026, all the structures of the BUA pools will be manufactured and delivered on site for blank assembly.



Blank assembly of structures

Structures at manufacturer's site

Classified equipment

In 2025, the factory manufacturing of classified equipment for the reactor core continued, e.g. the assembly of DN 400 non-return valves for the primary system and the butterfly valve delivered onsite.

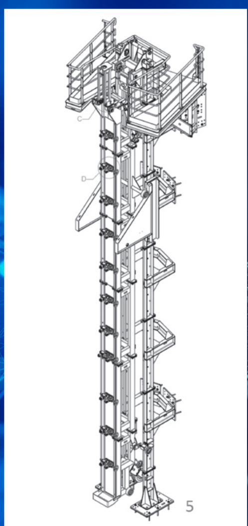
The on-site installation of certain equipment has begun, e.g. one of the DN600 valves on ventilation system or exchangers. On-site installation activities will increase in 2026: pumps, valves, etc.

Valve assembly

In-pool equipment

In 2025, the following equipment was accepted and delivered onsite.

- Experimental device rack
- Pole tilter



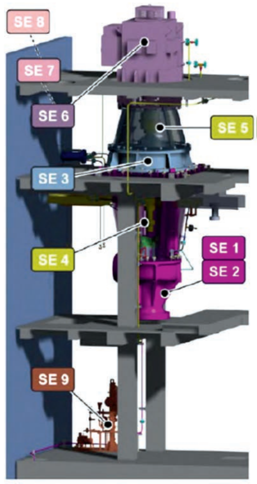
Schematic view of the experimental rack

Primary system pumps

Pumps 1 and 2 were mounted during year 2025 in order to validate the interfaces.

The motors and flywheels will be dismantled at the beginning of 2026 to allow for the dynamic rinsing of the primary circuit.

Pump 3 is affected by non-conformities detected in factory. Some redesign work is ongoing and new tests are scheduled for late 2026. To validate the interfaces, the volute and the pump support will be mounted early 2026 and then disassembled for testing.



Overview sketch of a motor pump group

Primary pump motor

Primary system

In 2025, some N2-classified and non-classified DN400 elbows on the JHR primary system had to be manufactured again after detection of a dimensional non-conformity. The parts were delivered in July.

The two "fixed points" steel structures were manufactured and assembled on site. Their purpose is to create referenced positions for each primary pool crossings referred to as "zero load". In order to carry out the positioning, specials tools were designed and manufactured to fine tune the accurate positioning of each crossing.

Skid sub-assembly of a primary pump

Handling of a pump volute and positioning in the cubicle

First fixed points structure

Second fixed points structure

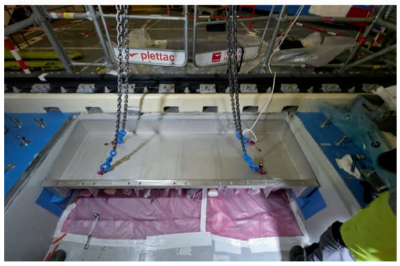
Safety systems

The activities completed in this field in 2025 were:

- Design studies: Adaptation of the studies regarding pipes and supports taking dimensional measurements and execution studies into consideration.
- Factory activities: Factory welding of tools for installation and adjustments of penetrations between safety casemates.
- Major on-site activities: installation of tools and adjustments of penetrations and installation of radiologic protection.

Tool installation

Penetration adjustments



Installation of radiologic protection

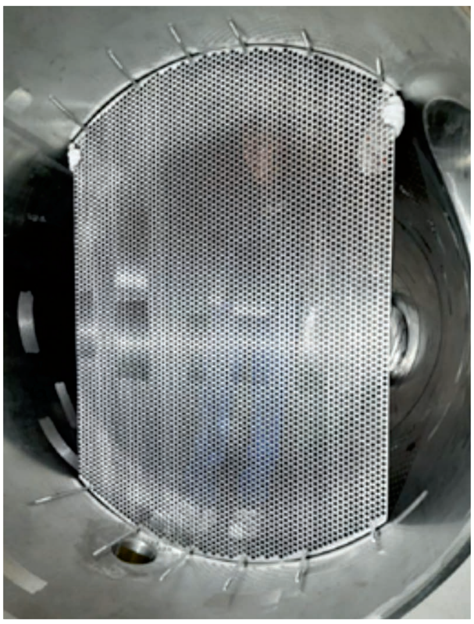
Heat exchangers (Spanish in-kind contribution)

The forgings for the tube plate as well as all the primary circuit tubes were manufactured and delivered to the repairer during 2025

The main operations completed by the repairer in 2025 were:

- Reintroduction of the skeleton (baffles, tie rods, deflecting tubes)
- Machining and welding of tube plates
- Tubing
- Tube/plate welding
- Start of the hydraulic expansion tube/plate

2026 will consist of completing the tube/plate assembly on the 3 exchangers, closing the grid by assembling the 2 water boxes, and doing the finishing work, meaning that hydraulic testing can take place to check the correct mechanical pressure resistance, as well as the final cleanliness operations. In parallel, CEA has initiated the on-site reintroduction of exchangers scheduled for mid-2026 with a service provider. The studies will be finalized by end of 2026 and the tools after the manufacturing of the 3 exchangers.



Heat exchanger grid

Surfacing of heat exchanger

Tube plate

❖ *Internal component stabilisation*

MAIN ACHIEVEMENTS IN 2025

Design:

- Finalization of the definition of the refrigeration tube
- New definition of the dummy fuel element
- Study of the test method for robustness to geometric defects in the TSTG
- Integration of test feedback on large-diameter refrigeration tubes.

Testing:

- Exploratory testing campaign for the redesigned dummy device
- Testing campaign to select two versions of Delta P
- Exploratory testing campaign for large-diameter refrigeration tubes
- Realistic tribological testing on the interfaces between the guide tube mechanisms and the fuel element.

Manufacturing:

- Manufacture of a feasibility demonstrator for the redesigned guide tube and start of manufacture of the Zircaloy guide tube prototype
- Manufacture of a Delta P prototype
- Start of advance procurement of Zircaloy 4 for the remanufacture of redesigned series components.

Assembly:

- Delivery and installation of the main pump for the hydraulic loop and its motor
- Completion of civil works outside the BMM: technical trench, slabs for electrical and fluid utilities and hydraulic loop building envelope.

KEY MILESTONES IN 2026

- Estimation of the service life of the guide tube for the redesigned mechanisms
- Assembly of the main line of the hydraulic loop
- Completion of civil works inside the BMM.

- *Experimental test section (left) installed in BMM (pump to be installed) with its water tank (center)*

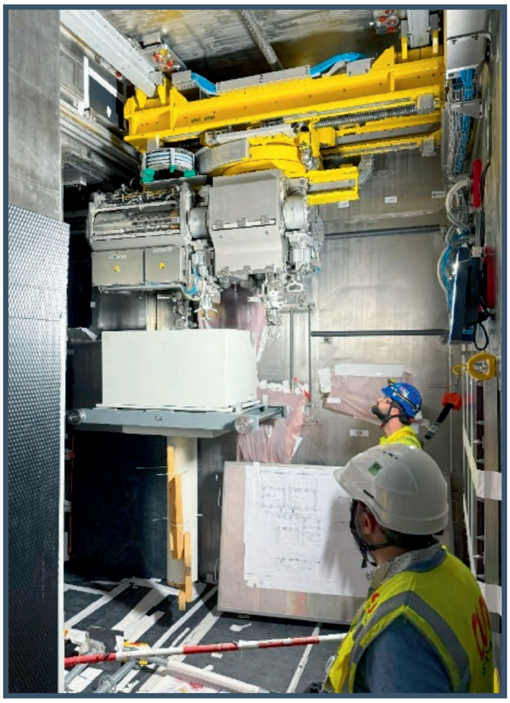
New guide tube with optimised design available for testing

Antoine DEWAVRIN
Building, Pools & Cells Manager

4.3.3 Buildings, pools and hot cells

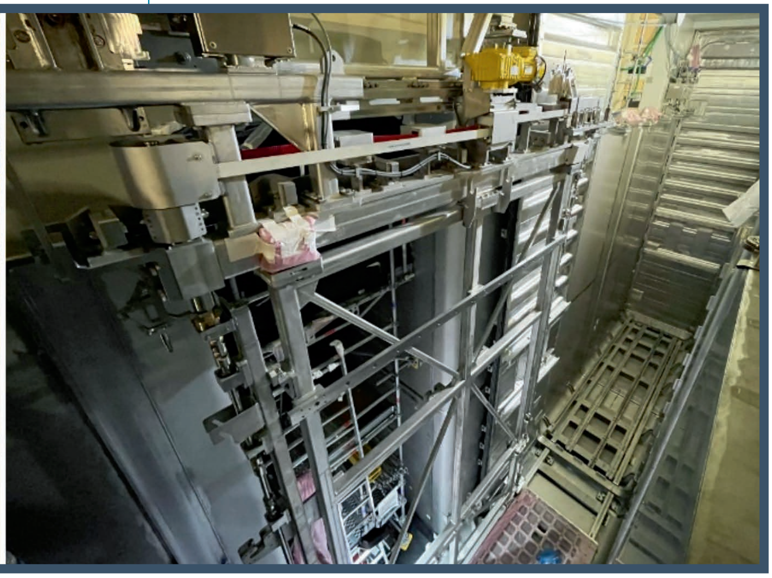
MAIN ACHIEVEMENTS IN 2025

- Civil works: creation of openings and preparation of these openings for the assembly of the HVAC and electrical systems in the Nuclear Reactor Building (BUR), in the Nuclear Auxiliary Building (BUA) and in the Safeguard building (BAS).
- Tests of the underwater transfer conveyor and isolation doors system between the BUA and BUR pools:
- Erection and test of all hot cell lifting units
- Installation on site of all hot cell lifting units



Lifting unit in hot cell

Underwater conveyor



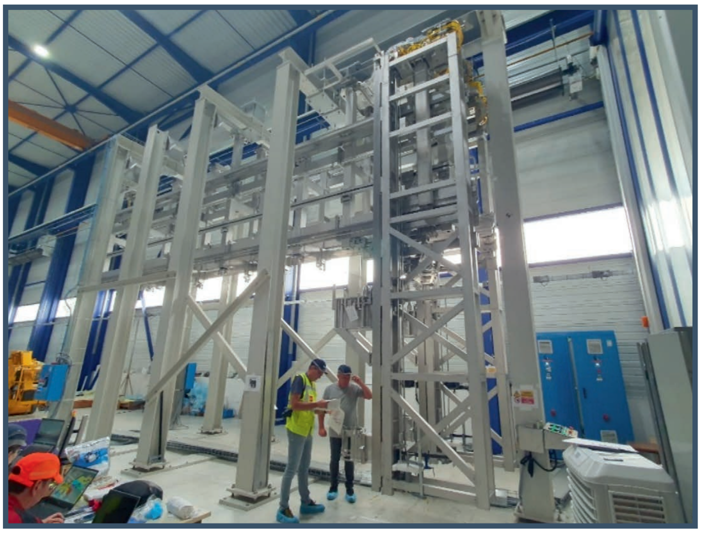
Water channel and isolation doors

Engineering activities

Design and layout of additional anchors in the cells.
Support for the mechanical strength of the new anchors and hot cell lining.

Factory activities

- Manufacturing for hot cell and hatch doors adjustments in accordance with as-built features.
- Manufacturing of additional anchors in hot cells. Support for the mechanical strength of the new anchors and hot cell lining
- End of factory test of the underwater conveyor in EPO pool
- Hot cells equipment: Factory acceptance of the trapdoors providing access to channels and the lifting platform for large hot cell investigation pits.

Onsite activities and acceptance procedures

- Civil works:
  - creation of openings and preparation of these openings for the assembly of the HVAC and electrical systems in the BUA and BUR buildings
  - creation and modification of concrete basement on the BUA rooftop for HVAC structures
- Hot cells (*Czech in-kind contribution*): Installation and tests of the 9 lifting units in hot cells
- Ongoing installation of additional anchors in hots cells. Support for the mechanical strength of the new anchors and hot cell lining
- Hot workshop and MDS process: installation and test of four cranes
- Site acceptance of BUA building's cranes
- JHR pools: Tests of the underwater transfer conveyor and isolation doors system between the BUA and BUR pools.

David DELESVAUX
Fluids Manager

4.3.4 Fluid systems

❖ *Engineering*

MAIN ACHIEVEMENTS IN 2025

The main engineering activity in 2025 involved finalizing the functional design of the gaseous effluent circuits in the CEDE zone and the detailed design of the fluid systems in the BUA and BMR buildings in assembly configuration changes in 2024

KEY MILESTONES IN 2026

The main engineering milestones identified for 2026 are:

- Finalisation of the detailed design for the fluid systems on the different levels of the reactor building in assembly configuration, which was validated during the design maturity reviews in late 2022 and supplemented by changes in 2023-2025.
- Implementing fire suppression system requirements for nuclear island

❖ *Manufacturing*

The main component fabrications for the fluid systems were:

- Key components for the BMR et BAS, i.e. pumps, fabricated equipment and valves, which were delivered
- Prefabricated piping and support structures for the BAS, BUA and the BMR

Reservoir for the safety cooling system devices

Water tank for experimental

KEY MILESTONES IN 2026

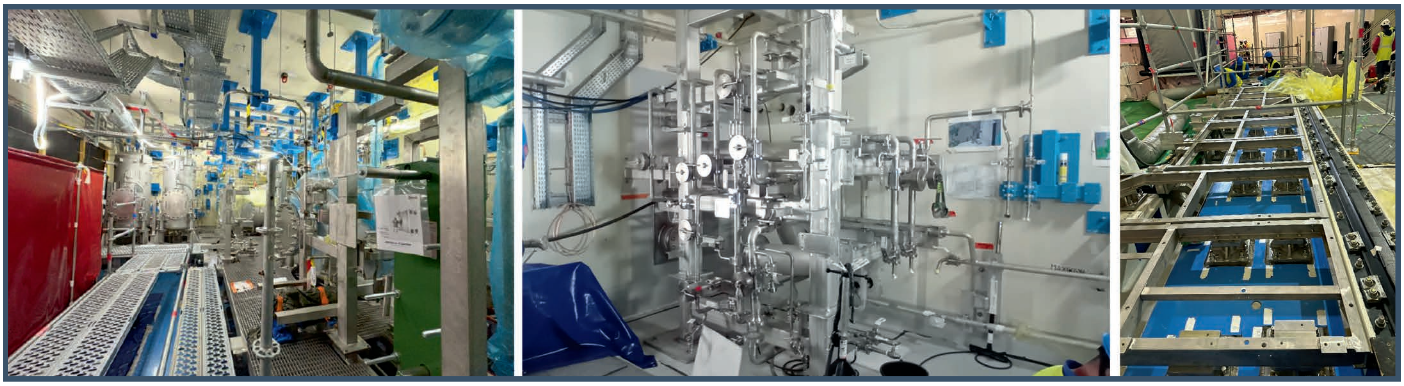
- Continue the delivery of key components and equipment for the BUR and BUA
- Ensure the prefabrication of piping and support structures for the BUR and BUA

❖ *Assembly*

MAIN ACHIEVEMENTS IN 2025

The year 2025 for onsite assembly operations was marked by:

- Significant progress in the installation of pipes in several buildings
- Functional tests on the compressed air system, the demineralised water system, and the mains water system on level +1 of the BMR building
- Full installation of the systems for the two BAS and the galleries connecting to the nuclear unit
- Assembly of the metal platforms for the fluid systems of the BUR pools
- Finalisation of system equipment installation on levels -2 and -3 of the BUA



KEY MILESTONES IN 2026

In 2026, the key milestones for the fluid systems are:

- Functional tests on the all-utility fluid systems of the BMR building
- Assembly of the metal platforms for the fluid systems of the BUA pools
- Finalisation of system equipment installation in most of the BUA rooms
- Installation of pipes for BUR pools
- Progress in the installation pipes, supports, and radiological protections, for BUR level-3

Jean-Pierre MUNOZ
HVAC Manager

4.3.5 Heating, ventilation and air-conditioning systems

❖ *Engineering*

◗ HVAC (excluding the emergency diesel generator building, BAS)

MAIN ACHIEVEMENTS IN 2025

The main achievements for the HVAC systems are the freeze of the JHR erection references 3D model on all levels of the BUA and of the BUR. Detailed design documentation production was launched accordingly.

KEY MILESTONES IN 2026

The following main tasks planned for the coming year are:

- Update of the functional system files and 3D model for the lower levels and upper level of the CEDE experimental area
- Production of the detailed design documentation to secure the erection phases schedule

◗ HVAC safeguard building (BAS)

MAIN ACHIEVEMENTS IN 2025

For the HVAC safeguard building (BAS), the completed design review allowed the finalisation of the 3D model arrangements. The freeze of the 3D model erection reference made it possible to launch the detailed design documentation.

The main activities will be to finalize the design and go through the on-site installation.

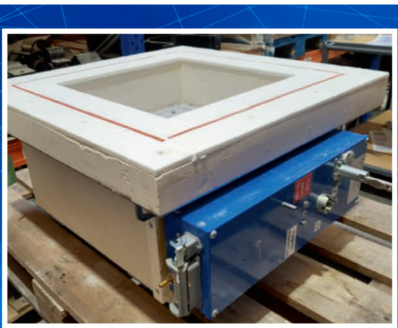
❖ *Manufacturing*

◗ HVAC (except the emergency diesel generator building)

MAIN ACHIEVEMENTS IN 2025

The main manufacturing achievements of the year are:

- Manufacturing of components and equipment to be installed on the upper floors of the BUA building and the BUR reactor hall.



Delivery of fire dampers

Delivery of brackets/ductwork BUA+0

Delivery of ductwork BUA+1

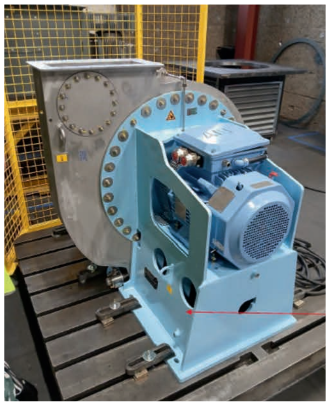
Delivery of electrical heaters

Factory acceptance of Air Handling Units

Filter boxes

Delivery of 14 water pumps

Factory acceptance of 2 electrical cabinets



Delivery of 4 exhaust fans

- Qualification tests on prototypes and launch consequent "in-series" manufacturing processes of various HVAC equipment.

Seismic test for Prototypes of safety-relevant Local Air Coolers

Seismic test for Prototype of fire dampers cubicle

Seismic test of ductwork fire protection

KEY MILESTONES IN 2026

The key milestone for 2026 will be to continue delivering key components for BUA and BUR.

- **HVAC safeguard building (BAS)**

MAIN ACHIEVEMENTS IN 2025

The main manufacturing achievements of the year were some major components such as the registers for fresh air intake.

Registers for fresh air intake

KEY MILESTONES IN 2026

2026 will secure the finalisation of all major equipment qualifications and execute the site deliveries of the components and equipment in accordance with erection schedule requirements.

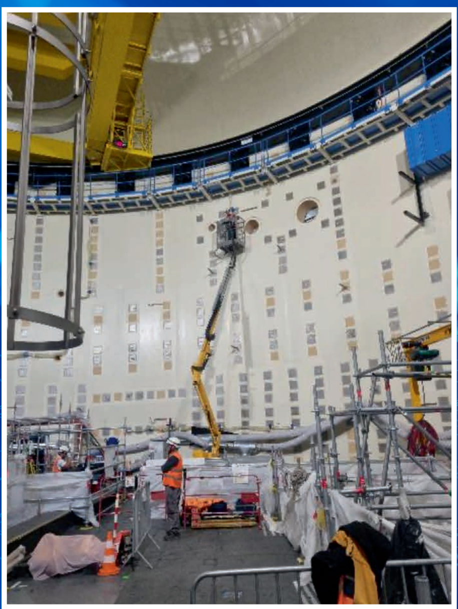
Assembly

- **HVAC (except the BAS buildings)**

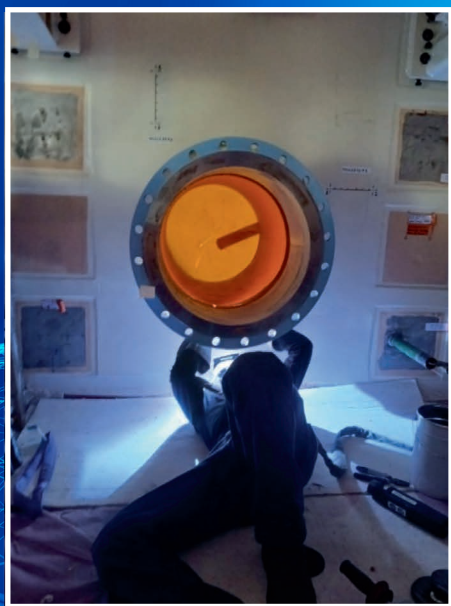
MAIN ACHIEVEMENTS IN 2025

In 2025, installation work was focused in BUR reactor hall and in upper levels of BUA.

REACTOR BUILDING HALL


Tracing operations


Installation of ducts in mezzanine


Assembly of penetrations

UPPER LEVELS OF AUXILIARY BUILDING

Assembly and installation of chassis module networks

Lifting of modules onto the roof of BUA using a 450-ton crane

Installation of networks and equipment (terminal unit) at BUA

KEY MILESTONES IN 2026

In 2026, the team will focus on:

- Continuing to install ventilation and air conditioning systems at BUA upper levels in order to begin cable pulling and installation work in BUR.
- Starting ventilation testing in BMR.

HVAC safeguard building (BAS)

MAIN ACHIEVEMENTS IN 2025

In 2025, installation of registers for fresh air intake, detection/tracing/drilling activities for the installation of supports for conduits, equipment, and cable trays for electrical connections.

Installation of fresh air intake registers in BAS A and B

Installation of ducts and cable trays in BAS A and B

KEY MILESTONES IN 2026

The main key milestone for 2026 will be to install the components and equipment in accordance with erection schedule requirements.

Pierre Yves BOIVIN
Electrical Systems Manager

4.3.6 Instrumentation and control systems

❖ *Engineering*

MAIN ACHIEVEMENTS IN 2025

2025 was a significant year with several qualification milestones achieved and an acceleration in the launch of electrical equipment manufacturing.

Equipment design

Execution studies were conducted on various non-experimental electrical distribution systems before launching different manufacturing or qualification processes.

Cable routing and mock-up

Following the redesign of the electrical distribution architecture and the control system of the experimental devices, critical layout issues were addressed, allowing for the convergence of the lower CEDE experimental zone in the mock-up.

Qualification

Qualification activities were sustained, including:

- Qualification of high-voltage (HT) switching cells
- Qualification of HT/LT transformers
- Additional underwater qualification of K1/K2/K3 cables used in EDF reactors
- Start of tests on ultimate backup inverters
- Continuation of ageing tests on open lead batteries
- Tests on LT/LT transformers

Regarding safety electrical panels, the manufacturing of the first series was initiated. The qualification approach, including numerical modelling of the electricals panels to reduce the number of tests, was validated. The manufacturing of a prototype optical fibre cable, with a requirement for radiation resistance and a 50-year lifespan, was also initiated in 2025.

KEY MILESTONES IN 2026

Equipment design

Equipment studies will be updated in 2026 with a series of additional developments in the project configuration. The completion of studies on the distribution and electrical sources of the DEXP is also planned for this period.

Cable routing and mock-up

Cable routing will be updated to incorporate marginal developments in the 3.2F configuration on the BUA, as well as the overall update of the CEDE zone, including the upper CEDE. The goal of final convergence for the entire CEDE zone is scheduled for the end of 2026.

Qualification

Qualification activities will continue, primarily including:

- Qualification tests on safety electrical panels
- Pre-qualification tests on sealed feedthroughs
- Completion of qualification tests on inverters
- Start of additional qualifications on enclosure feedthroughs

❖ *Manufacturing*

MAIN ACHIEVEMENTS IN 2025

All enclosure feedthroughs were launched into production, with the first six feedthroughs received and installed in 2025.

74 safety electrical panels and 642 drawers were launched into production, along with various classified and non-classified inverters outside of DEXP. These inverters are kept at the supplier site until the end of qualification to make any necessary adjustments following the tests.

The delivery of supports continued, with 130 tons of seismic supports delivered in 2025.

14 non-safety classified electrical panels were delivered, with installation planned for 2026.

Several mechanical fabrications were initiated:

- Non-classified raised floor of the BAV, delivered in 2025
- Seismic false floors, particularly in the BAS
- Battery supports and supports for ultimate backup inverters

KEY MILESTONES IN 2026

The acceleration of manufacturing will continue in 2026, with major points including:

- All supports and pathways (excluding supports under false floors) of the BUA for the first part of 2026
- Additional cable orders for the BAV/BAS/BUA perimeter, totalling 410 km added to the 750 km already received
- Launch of transformer qualifications following qualification tests
- Continuation and completion of manufacturing initiated in 2025 on non-classified cabinets, inverters, and HT cells
- Delivery of 37 feedthroughs during the year

❖ *Construction*

MAIN ACHIEVEMENTS IN 2025

The first six enclosure feedthroughs were successfully installed.

The installation of supports and pathways continued across the entire perimeter, incorporating configuration changes.

Cable pulling began in the BMR, enabling the testing of the building's ventilation equipment.

KEY MILESTONES IN 2026

2026 is a pivotal year preparing for massive cable pulling scheduled from 2026 until the industrial commissioning in 2026.

The rates of support and pathway installations in 2026 will be significantly accelerated, with a target of 24 km of seismic pathways installed by November 2026 (70% of the pathways in the BUA and BAS).

Cable pulling will also accelerate, with a target of 80 km of cables by November 2026.

The installation of the first electrical equipment is also planned for 2026:

- For non-classified equipment in the BAV/BUA
- For inverters in the BAS and BUA
- And the first backup panels in the BAS

The installation of feedthroughs will also continue as deliveries are received.

Michel TREVISIOL
Instrumentation & Control Systems Manager (including emergency diesel generators)

4.3.7 Heating, ventilation and air-conditioning systems

❖ *Engineering*

MAIN ACHIEVEMENTS IN 2025

The the engineering's functional studies file, enabling the start of control software developments in their final configuration for on-site testing, as well as the delivery and installation of the training simulator enabling validation of the operation of the main JHR circuits and also the thermal qualification of the ultimate emergency diesel generator.

JHR simulator will be used to model the physical phenomena of main circuits, to define reactor operating procedures, and to train future operators

Thermal testing of the emergency diesel generator

KEY MILESTONES IN 2026

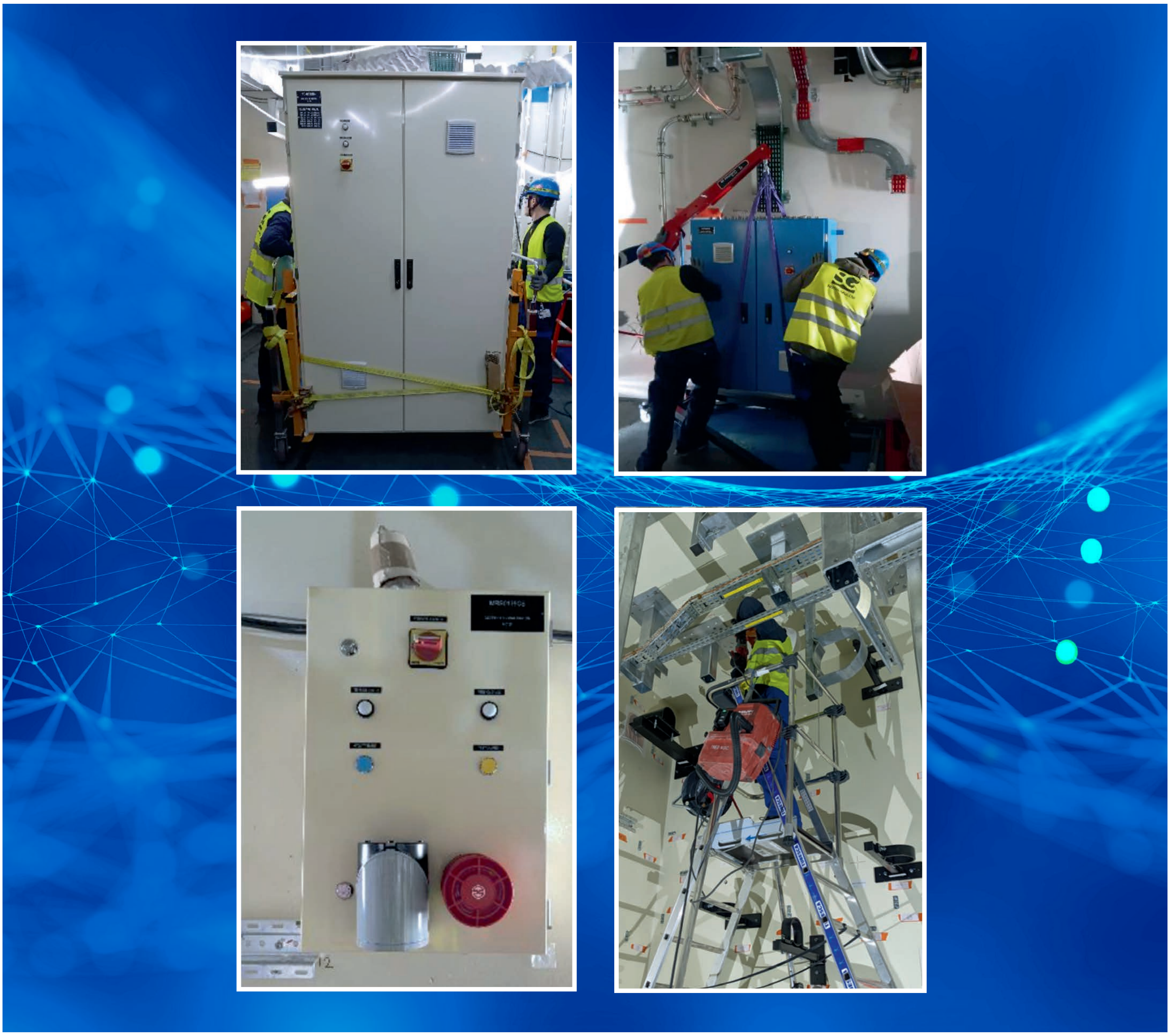
The year 2026 will also present many challenges, including:

- Preparation of the characterization of neutron and gamma detectors in the CEA CABRI experimental reactor.
- End of the qualification of the ultimate emergency diesel generator.
- End of I&C software developments in the configuration for on-site testing.

❖ *Manufacturing & Installation*

MAIN ACHIEVEMENTS IN 2025

End of manufacturing and installation on JHR reactor of all radiation protection equipment (supports, RP equipment, cable trays)



KEY MILESTONES IN 2026

One oof the main objectives for the installation phase is to deliver the I&C cabinets in their configuration for on-site testing.

Jean-François VILLARD
Experimental Domain Manager

4.4 EXPERIMENTAL DOMAIN AND DEVICES

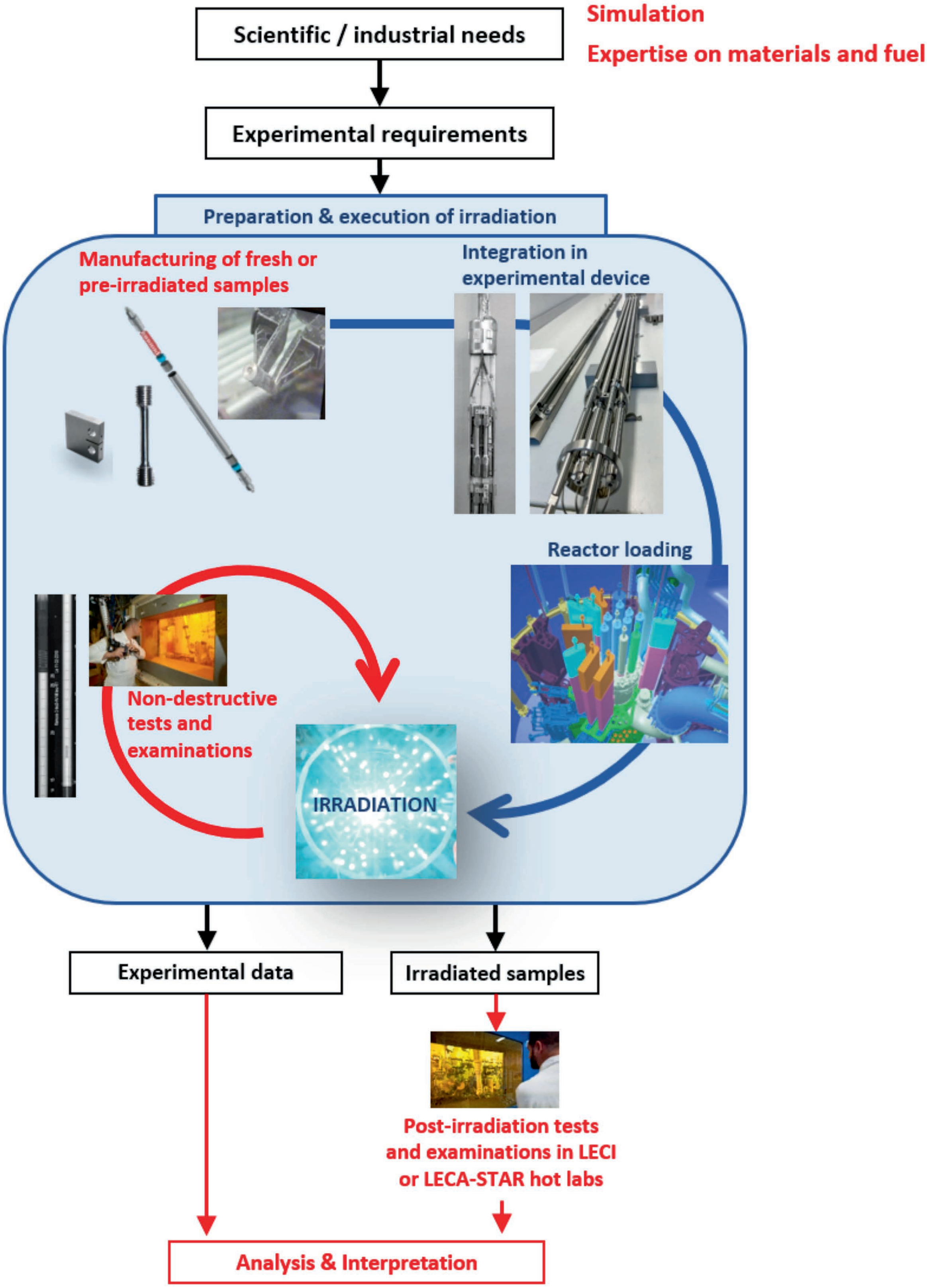
4.4.1 Experimental domain

2025 and 2026 will lead to the completion of the detailed design of first-fleet irradiation devices. This period also marks the actual start of activities dedicated to preparing the experimental programs expected during the first years of JHR operation. These programs will include the tests and qualification of irradiation devices, as well as the first material and fuel testing experiments conducted for JHR users. Preparing these experiments will require, in particular, the design and development of experiment-specific sample holders, in addition to the generic irradiation devices in which they will be implemented.

To support this phase, an exercise has been launched to define a realistic workload scenario for the initial experimental campaigns. In this context, future JHR users are invited to share their anticipated needs and intended use of the reactor during the first years of operation of the experimental domain.

As requested by JHR consortium members, a JHR service portfolio has been prepared and distributed. This catalogue provides an overview of the irradiation capabilities available at JHR start-up, their expected performance, as well as the broader service offering proposed by CEA in support of material and fuel testing. This extended service offering will include manufacturing capabilities of fresh or pre-irradiated samples, pre- and post-irradiation examination in hot cells, but also support for the definition and the interpretation of the experiments based on CEA's recognized expertise in nuclear materials and fuels.

A key objective of this approach is to anticipate the human and material resources required for JHR operation and for the implementation of experimental programs, including the sizing of the different teams. It will also enable the preparation and training of personnel to ensure the efficient start-up of technological irradiation activities and of artificial radioisotopes production from 2034 onwards.



Typical JHR irradiation process and related services
(Optional services in red will be proposed by CEA as part of an extended service offering)

Arnaud DOUVENEAU
Experimental Devices
Project Manager

4.4.2 Experimental devices

❖ *Experimental devices*

MAIN ACHIEVEMENTS IN 2025

2025 has been a transitional period for the experimental devices with the end of the detailed design studies and the launch of the tendering process to manufacture the systems. The engineering effort remains high, with many people involved in the design and project management activities, in addition to the support from CEA laboratories at Cadarache and Saclay centres, mainly focussed on the tests performed for design validation and equipment qualification.

KEY MILESTONES IN 2026

The main challenges and focuses regarding the experimental devices project are the following:

1. Interface management and integration of the experimental devices with the reactor
Experimental devices designs have significantly advanced in recent years, while the reactor is already under construction. For a successful integration, it is crucial that both domains perfectly understand each other in terms of layout, expected utilities, electrical supply if needed, etc.
JHR project already has well-mastered processes to address interface issues. However, the past year has highlighted that this remains a point of vulnerability regarding the experimental devices. Several topics have raised issues in converging interfaces: effluents produced by the experimental devices, seismic spectra to be considered, cooling performances.
In 2026, collaboration between both engineering teams will further be enhanced in order to improve interface management.

2. Successful transition from design to implementation
Experimental devices are on the verge of moving to a new phase, with the contracting of the construction of the first devices (SIN bench, ADELINE, MADISON…) planned for 2026. The activities of the project team will therefore evolve: choosing the right realisation partner, monitoring industrialisation studies in some cases, then monitoring manufacturing.
In 2026, a specific focus will be put on adapting the organization and our design in alignment with this evolution to secure the ability of manufacturers to provide the specified components.

3. Scheduling and cost management

In 2025, unforeseen events, particularly on the management of interfaces and the integration between systems, impacted the maturity of the design and the launch of contracts. Even though experimental devices are generally not on the critical path of the JHR project, the margin remains slim.

In parallel, a loss of industrial know-how on experimental devices, that are very complex and specific systems and have not been manufactured for years is also impacting the scheduling maturity. Uncertainties during the realization phase are expected; hence the importance of finalizing the design as soon as possible while maintaining good control over its conformity and feasibility. As a consequence of this loss of industrial knowledge of experimental systems, a certain level of uncertainties remains in the cost estimations. Only the launch into realization will give better visibility on this point.

4. Integration of FUICA and CLOE devices in fleet 1

In 2025, the decision was made to integrate MICA with pressurized samples (4 & 5), FUICA and CLOE in the first fleet of experimental devices scheduled to be operating at reactor start-up. The integration of these devices in the JHR project organization is already effective for MICA 4&5 and ongoing regarding FUICA and CLOE, with an adaptation of the project organization to be implemented early 2026.

5. Historical fleet 1 experimental devices

In 2025, the joint tender process for the ADELINE and MADISON loops was launched on schedule. The supply of materials with long delivery times, such as zirconium alloy bars, was also covered by a contract.

Tenders for in-pile components were rescheduled in order to anticipate manufacturability and secure the manufacturing phase through collaboration with industrial partners. The aim of this decision was to incorporate the results of these activities into the detailed design before launching the tenders and to reduce the risks associated with execution.

In 2026, we will continue the design process, with the launch of new calls for tenders and the reduction of risks associated with the manufacturing phase.

❖ *Development of devices and tools for radioisotope production*

According to prospective feedback, the demand for artificial radioisotopes is expected to increase in the coming years, especially for nuclear medicine where radioisotopes are used for examination purposes (diagnosis) and cancer treatment (therapy). The JHR has the following objectives:

- Producing radioisotopes for industrial and R&D purposes (e.g. non-destructive testing, sterilisation of equipment, etc.)
- Producing radioisotopes for medical applications with a commitment to secure between 25% to 50% of the yearly European needs for molybdenum-99 (about two to four billion patients diagnosed). This also concerns the production of radioisotopes to sustain R&D in the medical field (for pre-clinical and clinical trials), i.e. therapeutic radioisotopes such as for vectorised internal radiation therapy.
- Securing this medical production for the next fifty years is a key issue across the world. This is why JHR is looking to use the most versatile industrial production approaches. This activity is important in securing the worldwide supply of medical radioisotopes, ensuring French and European sovereignty, and helping balance the JHR business model.

MAIN ACHIEVEMENTS IN 2025

The main activities in 2025 focused on the conceptual design studies of the in-pile part of the core and reflector devices. Initial design studies of the tools associated with post-irradiation operations in hot cells were also carried out.

KEY MILESTONES IN 2026

The year 2026 will be dedicated to the completion of the basic design studies of the in-pile part of the devices.

Detailed studies of the devices including the irradiation containers are conditional upon the availability of sufficiently precise input data from future clients. In this context, the development and implementation studies of the shielded box required for post-irradiation operations related to the production of Lu-177 are suspended pending the receipt of client requirements for this production.

An estimated lead time of approximately five years will be required, following receipt of client data, to complete detailed and execution design studies, award the manufacturing contract, produce the devices, and perform testing to obtain authorization for reactor insertion. Future clients will be informed of this timeline for their production planning.

❖ *MICA*

The general objective of the MICA device is to monitor the evolution of the physical properties of non-fissile materials, as a function of parameters such as neutron flux, fluence, irradiation temperature… The physical phenomena can for example include the elastic limit, the elasticity modulus, creep, irradiation swelling, etc. Depending on the needs, dimensional measurements can be performed online or in hot cells during intermediate unloading of the samples.

MICA devices include: sample holder, capsule, underwater lines and out-of-pile equipment. **MICA** sample holders are specific to each experiment. **MICA** capsules, underwater lines and out-of-pile equipment are generic. Seven different locations are available for **MICA** devices in the JHR reactor. The neutron characteristics vary according to the chosen location.

The sample holder is immersed in liquid metal (NaK eutectic), which ensures optimal thermal homogeneity thanks to its high thermal conductivity. Special care will be taken to ensure the chemical purity of the liquid metal.

There are six heating elements integrated in a furnace, stacked to a total height of 600 mm corresponding to the height of the reactor core. These six heating elements can be independently adjusted to obtain the target temperature on the samples (between 250 °C and 400 °C) and to flatten the axial temperature gradient due to the axial neutron flux and gamma heating gradients. Several thermocouples and dosimeters can be integrated into the sample holder to monitor the temperature and neutron fluence at different locations.

MAIN ACHIEVEMENTS IN 2025

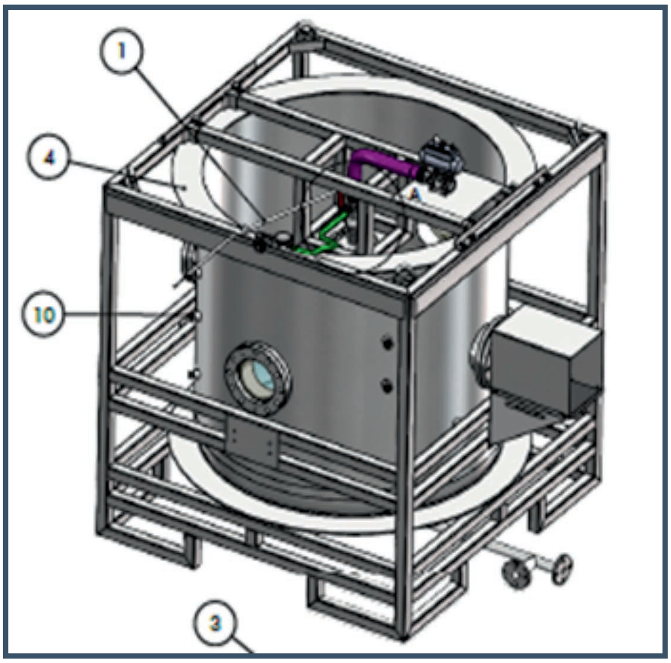
The main achievement for the MICA device in 2025 was the validation that the pressurized samples, used to add mechanical constraints to the sample, can be accommodated by MICA design.

Water-NaK interactions tests

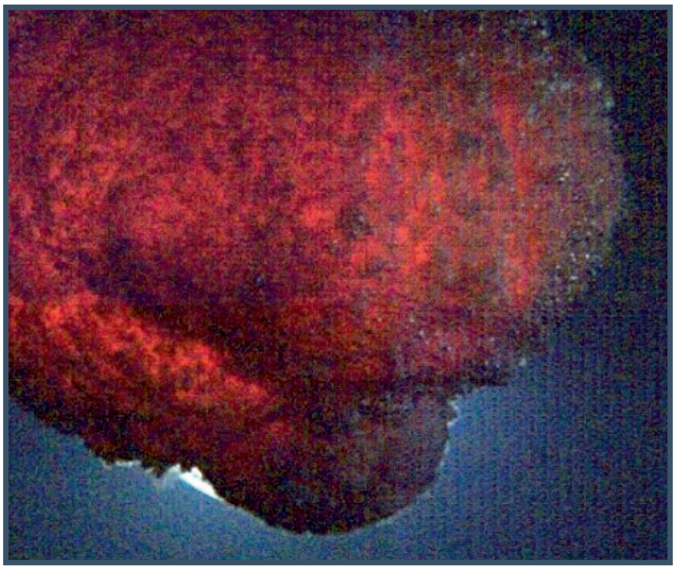
In 2025, tests were performed to support MICA development and to study the interaction of the NaK coolant with water in the event of a hypothetical fall and breakage of the MICA device in the pool during its transfer between the reactor hall and the hot cells area.

A specific test facility has been built to study these consequences, using a 2m3 open container with a gas injection system to inject a calibrated volume of NaK (50, 100 and 300ml) under pressure (few bars) into the water of the container. Pressure waves and interaction phenomena were monitored for a few seconds during the tests (fast instrumentation and videos used).

The results of these tests give an overview of the phenomenology when NaK and water interaction occurred.



NaK-Water interaction test. Experimental set-up



First phase of NaK-H20 interaction

KEY MILESTONES IN 2026

The main activities to be completed in 2026 are:

- Manufacture of the MICA furnace mock-up
- Finalize the basic design and hold the design review
- Progress on the safety demonstration regarding the fall of the MICA device into the pool.

❖ *OCCITANE*

The general objective of **OCCITANE** is to monitor the evolution of the physical properties of non-fissile materials, particularly pressure vessel steels, as a function of parameters such as neutron flux, fluence, irradiation temperature... The physical phenomena can for example include the elastic limit, the elasticity modulus, breaking strain, etc. **OCCITANE** offers a large irradiation volume. It is not re-loadable thus samples can only be unloaded at the end of the irradiation.

OCCITANE device include: sample holder, capsule, underwater lines and out-of-pile equipment. **OCCITANE** sample holders are specific to each experiment. **OCCITANE** capsule, underwater lines and out-of-pile equipment are generic.

Various types of samples (creep, tensile, Charpy and microstructure) can be irradiated in an inert gas and stacked on top of each other up to a total height of 665 mm. A multi-zone furnace controls the required irradiation temperature between 260°C and 330°C and compensates the axial thermal gradient due to the axial nuclear gradients. The related instrumentation includes at least thermocouples and dosimeters positioned as close as possible to the samples.

MAIN ACHIEVEMENTS IN 2025

In 2025, OCCITANE device design successfully passed the end of basic design review.

A mock-up of the OCCITANE furnace is being manufactured to demonstrate its manufacturability. Vacuum brazing technology has been chosen for the heating elements assembly.

Dimensional control of the prototype furnace (electrical discharge machining)

KEY MILESTONES IN 2026

The milestones planned for OCCITANE in 2026 are:

- Launch of the call for tenders for the manufacturing of the OCCITANE device
- Completion of furnace mock-up manufacturing (vacuum brazing), mock-up assembly and operability tests of the furnace

❖ *CLOE (Indian in-kind contribution)*

CLOE is a corrosion loop for the study of irradiation assisted stress corrosion cracking.

MAIN ACHIEVEMENTS IN 2025

During last year, various activities towards detailed design were carried out. BARC performed thermo-mechanical and seismic analyses for various envelope cases based on the results of safety analyses. The seismic methodology, pressure and safety classification were updated by CEA in 2025. Most of BARC's detailed design documents have been prepared.

The in-pile mechanical design was presented by BARC at a dedicated technical review in July 2025. The detailed design of the out-of-pile loop and the stress analyses of critical equipment were presented at another dedicated technical review in October 2025: the detailed design of the out-of-pile system is almost complete. CEA had very positive feedback from these two technical meetings.

The equipment specifications were prepared by BARC and reviewed by CEA for all items proposed in the call for tenders. Some components are in procurement readiness phase and assessment is going on.

Following the fruitful work of our colleagues at BARC, CEA is confident that CLOE will be ready for operation when the reactor is commissioned. JHR project has therefore decided to integrate CLOE as a new fleet-1 experimental device.

In December 2025, four days of technical exchanges took place between DAE/BARC-IGCAR and CEA to cover all items of collaboration between the two parties. In addition to reviewing the progress of CLOE project, these meetings provided an opportunity for in-depth technical discussions on:

- The RISHI loop developed to characterise materials in sodium environments (IGCAR)
- The innovative sample holder for MICA material capsules (BARC)
- The development of a specific device to measure properties of fuel (BARC).

KEY MILESTONES IN 2026

CEA and DAE will extend their collaboration and redefine the CLOE development roadmap in line with JHR major milestones.

BARC and CEA's JHR project team will organise joint working sessions from 2026 onwards to address specific topics related to the procurement phases: procurement strategy, manufacturing, inspection, on-site delivery and quality.

❖ *ADELINE*

ADELINE general objective is the irradiation of PWR fuel samples in thermohydraulic and chemical conditions representative of PWR conditions, including power transients, representative of normal operation and off-normal PWR conditions with possibility of fuel cladding failure and partial fuel melting.

ADELINE is a pressurized water loop operating under PWR conditions. It includes an in-pile section installed on a displacement system. This makes it possible to perform power transients on samples at constant reactor power. **ADELINE** device includes generic equipment: sample holder, pressure tubes, device holder, underwater lines and out-of-pile equipment.

MAIN ACHIEVEMENTS IN 2025

ADELINE out-of-pile section

Tendering process of the out-of-pile scope, including the shielded cubicle, pressurized water loop process and ground pipes, was launched in October 2025. The future contract covers the detailed design completion, manufacturing, erection and start-up.

ADELINE in-pile section

As for MADISON, a contract was signed with a manufacturer to secure a production slot for the main parts of the in-pile section that are made from specific Zirconium alloy bars.

Detailed design studies completion was achieved with the involvement of future manufacturers.

Test Section Repeatability tests

ADELINE flow amplifying module, composed of a set of injectors and diffusors, used to amplify the cooling flowrate in the test section, has been tested to verify its behaviour under representative thermohydraulic conditions (pressure and temperature).

Repeatability tests have been performed in 2025 using the CORAIL experimental loop located in Cadarache TOTEM Hall. These tests supplement the previous tests campaigns carried out in 2023-2024. The results will provide experimental data to confirm the performance of this critical component for ADELINE and establish a thermohydraulic simulation database.

Flow test section (without thermal shroud) & flow amplifying module

CORAIL loop & operating room

Manufacturing & Integration phase of SE-IT V2 test section

A new test section called SE-IT V2, representative of ADELINE device geometry, was designed and manufactured in 2025. It is equipped with thermal shroud located around the components and feeding lines to limit thermal losses at high temperature. As category 3 pressure equipment, its design and manufacturing have been successfully controlled by a notified body.

The experimental phase with the SE-IT V2 test section will start on CORAIL loop in 2026.

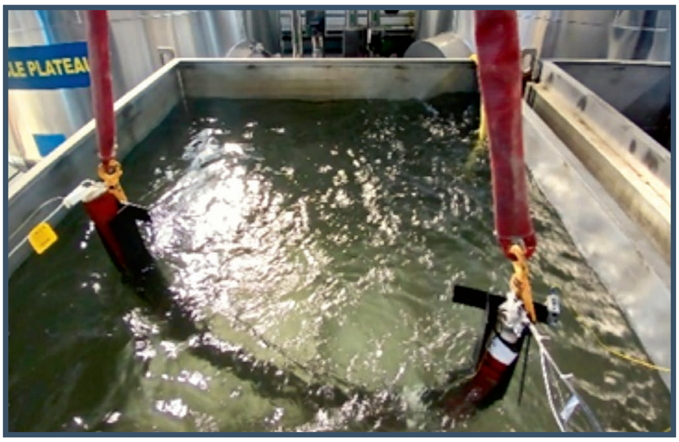
ADELINE *test section SE-IT V2 3D Mockup*

ADELINE *test section SE-IT V2 test device*

ADELINE & MADISON Cooling transfer lines thermal characterization

Experimental tests are being performed to verify the thermal insulation performance of the metallic lines transferring cooling flows between in and out of pile sections.

The tests will be used to define the thermal mapping (radial), the heat losses and the thermal coefficient of the shroud. They are performed in air and water with different bending geometries. For a good presentiveness, the lines had previously been tested on a fatigue test bench.

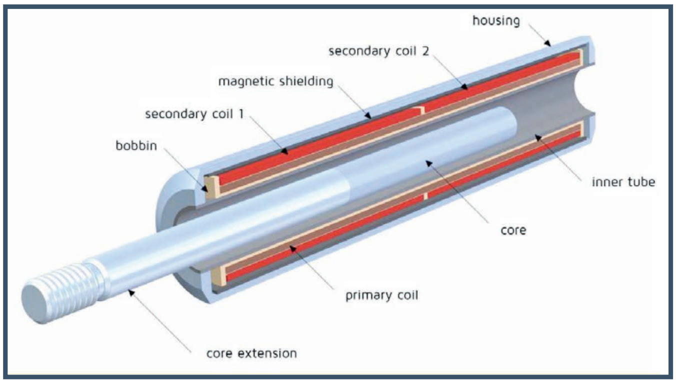


Experimental Bench equipped with a metallic line

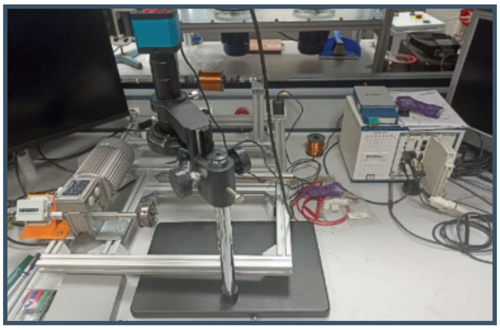
LVDT sensors prototype manufacturing

In 2025, a batch of LVDT (Linear Voltage Displacement Transducer) displacement sensors manufactured by IFE, were delivered to Cadarache for their future integration in first JHR devices.

In parallel, the CAD sensors Fab Lab, located in Cadarache, produced its first LVDT prototypes. This effort will be continued over the coming years with tests under representative conditions such as PWR conditions and under nuclear fluxes. The ultimate objective is to secure the availability of LVDT and DG (Diameter Gauge) sensors for future JHR experiments.



LVDT prototype processed in Cadarache



LVDT Coils Tool & Electronic Bench

KEY MILESTONES IN 2026

In-pile section

In 2026, the aim is to continue, with several identified suppliers, the derisking of the more complex parts of the in-pile section. The main objective is to ensure the manufacturability of these components, and if this is not the case, to implement relevant design modifications in close collaboration with the manufacturers.

Out-of-pile section

The objective in 2026 regarding the out-of-pile section is to start, with the selected supplier, the detailed design and the components manufacturing.

❖ *MADISON*

MADISON general objective is the irradiation of PWR fuel samples in thermohydraulic and chemical conditions representative of PWR conditions, including power transients, representative of normal operation PWR conditions, without cladding failure.

MADISON is therefore a pressurized water loop operating under PWR conditions. It includes an in-pile section installed on a displacement system, making it possible to perform power transient on samples while the reactor power remains constant. The device includes generic equipment: sample holders, pressure tubes, device holder, underwater lines and out-of-pile equipment.

The **MADISON** device incorporates experience feedback from both OSIRIS reactor (France) and Halden reactor (Norway). For this reason, CEA had contracted design activities for the development of the first irradiation rig (including instrumentation), the water loop and the I&C system to IFE Halden. This now completed contract also enabled the realization of a full-scale mock-up of the MADISON loop called THELIA.

MAIN ACHIEVEMENTS IN 2025

MADISON out-of-pile section

Engineering studies carried out in 2025 have highlighted the need to consider additional requirements. This work was in particular related to the clarification of interfaces with the water treatment system in order to address specific requirements. These studies have been included in an updated loop design and have allowed the launch of call for tenders for the out-of-pile section of MADISON. The future contract will cover the detailed design completion, fabrication, erection and start-up.

MADISON shielded cubicle

A substantial work has been done on fire requirements in order to complete the fire stability studies of the engineered structures in the nuclear unit, including the experimental devices area. These new requirements related to internal situations, such as fire conditions, impacted the design of the shielded cubicle. After examination, it appeared that keeping a steel structure was more complex than creating a concrete cubicle, due to the combined requirements for fire protection and resistance, radiation protection and overpressure resistance.

In 2025, the contract for the steel cubicle was therefore cancelled and the concrete cubicle was instead designed.

MADISON in-pile section

The main parts of the in-pile section are made from specific Zirconium alloy bars. As only few suppliers are able to manufacture these long lead time parts, a contract was signed with a manufacturer to secure a production slot.

In 2025, studies of the in-pile section of the device continued, notably with a preliminary phase concerning the industrialization and manufacturing feasibility study of the most sensitive components.

This activity will pave the way to the launch of the call for tenders for the manufacturing of the in-pile part.

MADISON sample holders

In addition to the definition of the four-rod sample holder, the requirements for the two-rod sample holder have been established. This sample holder must also be ready for the qualification of the **MADISON** device.

An expertise contract with IFE on specific items of the sample holders design is in place. The two technical bricks studied are the sample holder connectors and sample holder top seal.

This work will allow the JHR project to validate the final design of the sample holders and its implementation in the device in 2026.

MADISON underwater flexible hoses and connections

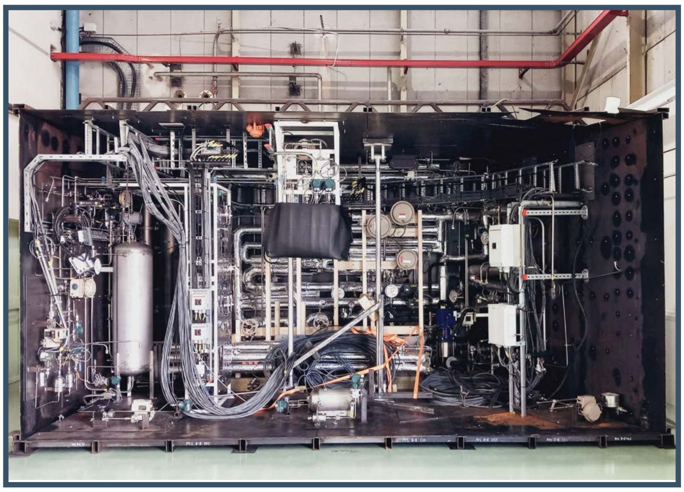
In 2025, additional tests were performed on the flexible hoses in order to verify the behaviour of the thermal isolation of the underwater lines in air and water environments, with different bending geometries. The procurement of the flexible hoses used for the validation and qualification campaigns of the MADISON metallic lines has been finalized and the hoses delivered to JHR site.

MADISON high-pressure pumps

In 2025, the procurement contract has been finalized with the supplier for the manufacturing of the high-pressure pumps.

THELIA experimental loop

The **THELIA** thermohydraulic loop located at IRESNE-DTN TOTEM hall at CEA Cadarache site, will be used to perform experimental tests under PWR conditions with a cooling flow of about 1kg/s. Initially, this loop was designed, built and tested by IFE (Norway) in support of JHR MADISON loop development during the preliminary design phase. In 2023 it has been transferred to Cadarache and is currently under adaptation to comply with European rules, in particular with the European Pressure Equipment Directive. The objective is to start the experimental loop in 2026.



View of the THELIA loop in CEA-TOTEM Technological Hall

KEY MILESTONES IN 2026

The actions planned for 2026 include:

- Receive bids for the out-of-pile part under the on-going call for tender, finalise contract negotiations with potential suppliers sign the contract with the selected supplier and start the detailed design and procurement phase of the contract.
- Continue manufacturing high-pressure pumps.
- Continue the expertise contract with IFE sensor laboratory on the design of sample holders.
- Continue the validation testing program for the underwater flexible hoses.
- Continue manufacturability studies to secure the manufacturing phase through collaborations with industrial partners.
- Start the THELIA loop.

❖ FUICA

The **FUICA** device general objective is the irradiation of PWR fuel samples in thermohydraulic and chemical conditions representative of PWR conditions, at constant power, without cladding failure.

FUICA is a pressurized water capsule working under PWR conditions. It includes generic equipment: sample holder, pressure tubes, underwater lines and out-of-pile equipment.

FUICA will provide limited functionalities compared to ADELINE and MADISON, with a simplified design. It was decided to equip FUICA with a capsule containing an instrumented fuel rod in order to ensure reliable cooking and enable:

- Fuel selection (screening test),
- Fuel characterization and behaviour studies (burnup accumulation)

The main design features are as follows:

- The fuel rod is passively cooled inside the capsule by direct boiling and condensation in the gap between the rod and the capsule wall,
- The capsule is cooled externally using the reactor's main feedwater,
- The device is equipped with small mini-tubes for monitoring water pressure and chemistry, as well as limited instrumentation such as thermocouples, pressure sensors, flow meter and calorimeter.

MAIN ACHIEVEMENTS IN 2025

During 2025, the conceptual design of the in-pile part and process unit was implemented based on a preliminary nuclear safety analysis.

KEY MILESTONES IN 2026

The key milestones planned for FUICA in 2026 are as follows:

- Implementation of a nuclear safety analysis,
- Review of the conceptual design,
- Start of basic design implementation.

❖ CARMEN

CARMEN is a multi-detector device for the acquisition of the neutron thermal flux and the specific power deposited by nuclear heating over the full height of the core and in different JHR experimental locations (core, reflector, displacement system).

MAIN ACHIEVEMENTS IN 2025

2025 was dedicated to optimizing the integration of the measurement cell within the device, in particular through the integration of cables and connectors into the device head. To facilitate integration operations, a self-powered neutron detector replaces the U-235 fission chamber. As a result, fast neutron flux and gamma flux measurements will no longer be performed by **CARMEN**.

The development of the radiation-resistant motor has been completed. The device intended to enable testing of the **CARMEN** measurement cell in BR2 reactor is currently under manufacturing.

KEY MILESTONES IN 2026

The main objectives for 2026 are:

- Finalization of the remaining studies, with a basic design review scheduled for October 2026,
- End of endurance tests of the motor under irradiation, scheduled for mid-2026,
- The irradiation of the **CARMEN** measurement cell in the BR2 reactor planned for Q4 2026.

❖ *Gamma and X-ray non-destructive examination devices*

Gamma and X-ray examinations systems will be implemented in JHR to examine experimental samples by quantitatively measuring the spatial distribution of gamma emitters and by high-resolution X-ray imaging.

Three benches were manufactured and commissioned:

- 2 underwater gamma spectrometry and X-ray imaging systems (UGXR) for the examination of samples in an integral device: one for the reactor pool, and one for the interim storage pool.
- 1 hot cell gamma spectrometry and X-ray imaging systems (HGXR) for in-air examinations of samples in a hot cell.

In parallel to the in-kind contribution provided by VTT, CEA has signed a contract to design and manufacture a 6 MeV linear accelerator, another contract to design and manufacture a prototype of a high-resolution X-ray camera and another contract to design and manufacture a structure (SAX) to support the accelerator and to align, collimate and shield the X-ray beam

MAIN ACHIEVEMENTS IN 2025

UGXR benches

After delivery at CEA Cadarache centre, the **UGXR benches** were installed in the TOTEM facility (one bench in the pool and one bench on an in-air test tower) and final acceptance was validated in late 2022, starting a 2-year warranty period.

Some tests were carried out in 2024 to repeat the site acceptance tests after the resolution of some non-conformities leading to modifications to the benches. As these tests were not fully satisfactory, it was decided in early 2025 to send the benches back to the manufacturer workshops for a complete diagnosis and the necessary repairs. The 2 UGXR benches should be back and operational in the TOTEM facility in mid-2026. This will enable the necessary tests and performance qualifications to be finalised under representative conditions (e.g. endurance tests), within the frame of an extension of warranty which is being prepared.

In parallel, preparatory work have been carried out in 2025 to install the benches in JHR. The assembly of the bench support structures in the reactor pool and storage pool is scheduled for 2026.

Disassembly of the UGXR bench in preparation for its return to the manufacturer (IDOM) workshop

HGXR bench

To address the specific nature of the remote handling operations required for the HGXR bench, a hot cell mock-up was delivered in the TOTEM facility at the CEA Cadarache centre in 2023. In 2024, it was equipped with remote handling systems and with various operational equipment (cameras, video systems, etc) to be representative of the JHR hot cells. At the same time, the different parts of the HGXR bench were installed and electrically wired in the mock-up, the in-cell part, the airlock and the feed-throughs.

During 2025, remote handling operations on the HGXR bench with the lifting unit were tested in the mock-up cell. For example, positioning the experimental sample on the bench mandrel, loading and unloading the X-ray camera station, etc. were tested and validated. Procedures to change the collimation parts of the gamma spectrometry station were also tested and validated. An Operations Manual documenting these procedures is currently being prepared.

Mock-up cell of JHR hot cell in TOTEM facility and remote handling tests on the HGXR bench inside the mock-up

Accelerator support and X-ray imaging system

Factory acceptance of the 6 MeV accelerator was completed in late 2022 and it was delivered to the TOTEM facility in 2023. A specific structure (SAX) is required to support the accelerator and to align, collimate and shield the X-ray beam. CEA launched a call for tender in 2023 for the design and manufacturing of this structure in 2024. The design was completed mid-2025 and the manufacturing is under progress.

The prototype of the high-resolution X-ray camera has been designed and manufactured. Factory tests using a low-energy source were completed in 2025 and produced very encouraging results. After delivery of the prototype X-ray camera, on-site tests were carried out in the TOMIS facility at CEA Cadarache centre using a 9 MeV accelerator and experimental conditions similar to those at JHR. The X-ray camera parameters have been characterized, showing satisfactory results, but not as good as during factory tests. Even though this topic is still under investigation, the first tomograms have been performed, which is very promising.

First tomograms using the prototype X-ray camera

KEY MILESTONES IN 2026

The main milestones planned for 2026 are:

- Return of both UGXR benches to the TOTEM facility in Cadarache and finalisation of the tests and the performance qualifications,
- Assembly of the support structures for the UGXR benches in the JHR pools,
- Writing of procedures for using and handling the HGXR bench inside the JHR hot cell mock-up installed in the TOTEM facility,
- Finalisation of the support for the accelerator (SAX) manufacturing and realization of factory acceptance tests,
- Finalisation of on-site tests for the prototype X-ray camera in TOMIS,
- Upgrading of documentation and equipment with regard to safety requirements: mechanical modeling and seismic studies of the UGXR bench; verification of regulatory compliance of the UGXR I&C system; compliance (EMC, earthquake) of the accelerator's electrical cabinets.

❖ *Neutronic Imaging System*

The SIN bench (**Neutron Imaging System**) is a non-destructive examination that will enable transmission imaging of nuclear fuel, before or after irradiation, using the thermal and epithermal neutron flux emitted by the reactor core as the “light” source. The minimum detectable defect size will be 0.35 mm.

MAIN ACHIEVEMENTS IN 2025

The year 2025 was dedicated to a sourcing phase aimed at identifying companies capable of designing and delivering the bench, as well as to the preparation of the tender documentation. The tender package was issued to bidders in September 2025.

KEY MILESTONES IN 2026

The year 2026 will be dedicated to the bid evaluation and negotiation phase. Bids are expected in March 2026.

❖ *JHR Surveillance Program*.

◗ PROSPERO, PROSPERI and PROSPECTIF devices

The **PROSPERO**, **PROSPERI** and **PROSPECTIF** devices will allow the aging monitoring of the core aluminium components by the irradiation of test samples placed inside these devices, and by performing destructive tests on these samples.

MAIN ACHIEVEMENTS IN 2025

Until 2025 the preliminary designs for these devices have been studied. In 2025, the first hydraulic tests have been carried out in the CEA Saclay center, with satisfactory results.

PROSPERO Device and hydraulic tests in CEA Saclay.

KEY MILESTONES IN 2026

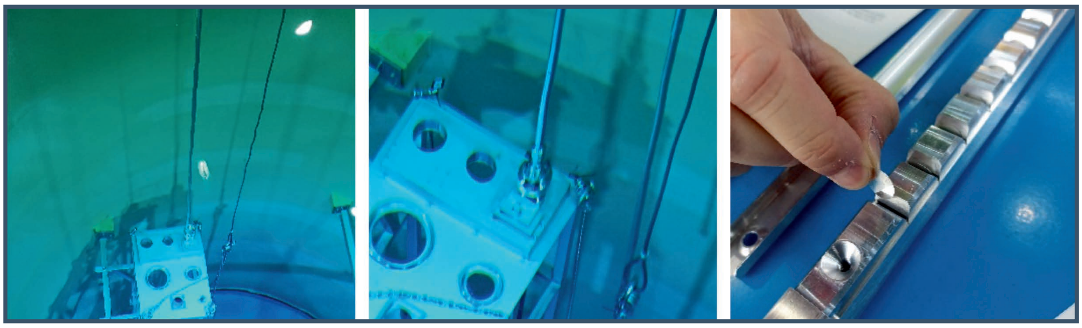
In 2026, a second series of hydraulic tests will be performed, along with assembly and disassembly tests in hot cells in order to finalise the basic design.

◗ DOSIS devices

The DOSIs devices will be used for the reactor start-up tests in order to characterize through various types of dosimeters the power distribution and the neutron flux in different locations and power rankings.

MAIN ACHIEVEMENTS IN 2025

Until 2025 the preliminary designs of two kind of devices (DOSI-LONG and DOSI-SHORT) have been studied. In 2025 handling and operating tests have been carried out with a prototype in the TOTEM facility in Cadarache, in order to consolidate the concept design.



DOSI test in TOTEM facility at CEA Cadarache

KEY MILESTONES IN 2026

In 2026 some modifications will be made to the preliminary design; the final design review is planned at the end of the year.

◗ MONITOR

MONITOR is an online measurement system for the thermal neutron flux at the mid-plane of the fuel. This system will be used to support the measurements performed by the DOSIS devices as part of the reactor start-up program, in order to provide the data required for the reactor performance acceptance testing and to support operation.

MAIN ACHIEVEMENTS IN 2025

2025 was dedicated to finalizing the system design, in particular the interface with the under-water line (device head).

KEY MILESTONES IN 2026

2026 will be dedicated to finalizing the basic design documentation and producing the detailed drawings.

A detailed design review is scheduled for June 2026.

❖ *Experimental devices mechanical means (MECADEX)*

The MECADEX work package is in charge of the design and manufacturing of the handling tools and operating equipment for the experimental devices in the different JHR buildings.

MAIN ACHIEVEMENTS IN 2025

In 2025 the manufacturing of the biological protections to be installed in the reactor building experimental area (CEDE) has been started. These biological protections will protect operators during the experiments.

Biological protection in manufacturing process

At the same time, the design of the handling tools used in the pools and the operating tools for works in hot cells have passed the end-of-basic design milestone.

KEY MILESTONES IN 2026

In 2026, works in the experimental area will continue, with the delivery of the first biological protection equipment to the JHR site.

Concerning the tools and operating equipment, a call for tender is planned for the final design and manufacturing of this equipment.

❖ *Experimental devices I&C systems*

The I&C systems for the operation and the safety surveillance of the experimental devices will be implemented through 3 packages:

- EX01: class 1 systems for the safeguard functions;
- EX02: class 3 systems for the safety functions;
- EX03: systems for the operation of the experimental devices processes.

MAIN ACHIEVEMENTS IN 2025

For the EX01 package, a call for tender was issued in June 2025 and a preliminary offer received end of 2025. This covers the automated systems for experimental devices and MOLFI safeguard functions triggering, the associated instrumentation, the post-accident monitoring console, as well as the uninterrupted power supply.

A large sourcing campaign was implemented to identify the I&C companies with the potential to propose a relevant offer for the EX02 and EX03 packages.

KEY MILESTONES IN 2026

In 2026, EX01 package is to be contracted mid-2026 and detailed system design initiated.

The calls for tender are to be published for the remaining packages.

QUALITY CONTROL 5

Thierry KARA
Quality Manager

5.1 SYSTEM QUALITY

The annual review of the integrated management system (IMS) was held in December 2025 with the JHR Project Director as chairman. This review included presentations of improvement actions issued after the 2025 internal audits and process reviews. An IMS improvement action plan has been defined and the process improvement proposals from the management teams will be used to build the 2026 master plan. All the objectives for conducting audits and process reviews by 2025 have been achieved.

2025 was also marked by the launch of a project to simplify our processes. It concerns in particular the updating of all of our project requirements and of the general monitoring plan for our suppliers.

5.2 OPERATIONAL QUALITY

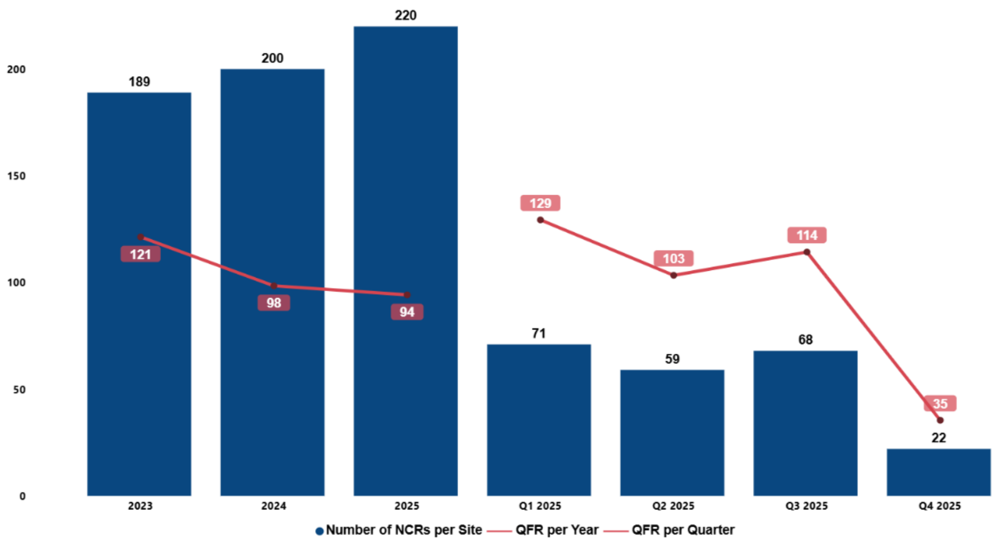
2025 was marked by the strengthening of quality management, notably with the establishment of a set of dynamic KPIs available to all users. **These KPIs concern the:**

- monitoring of non-conformities with their processing time
- monitoring of factory and on-site inspection reports

These KPIs are monitored weekly during team visual management meetings and monthly via a work package dashboard by project management.

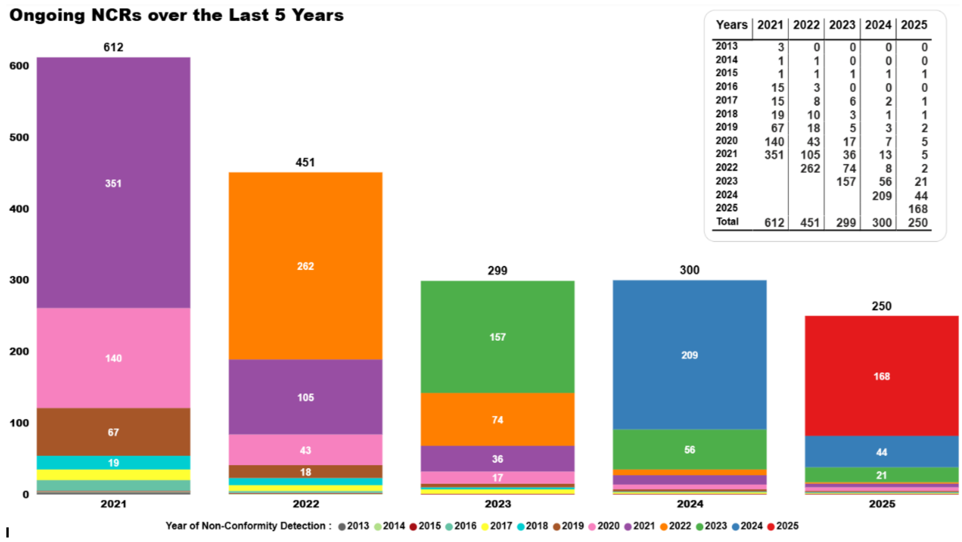
In 2025, the JHR site continues to improve the quality of equipment assembly. Indeed, the frequency rate of quality non-conformities continues to decline with a drop of -4% (see figure).

1- defined as the number of quality non-conformities per one million working hours



On site Quality frequency rate

Our non-conformity backlog is also down by 17% (see figure).



Years	2021	2022	2023	2024	2025
2013	3	0	0	0	0
2014	1	1	0	0	0
2015	1	1	1	1	1
2016	15	3	0	0	0
2017	15	8	6	2	1
2018	19	10	3	1	1
2019	67	18	5	3	2
2020	140	43	17	7	5
2021	351	105	36	13	5
2022		262	74	8	2
2023			157	56	21
2024				209	44
2025					168
Total	612	451	299	300	250

Ongoing NCRs over the last 5 years

5.3 SUPPLIERS OVERSIGHT

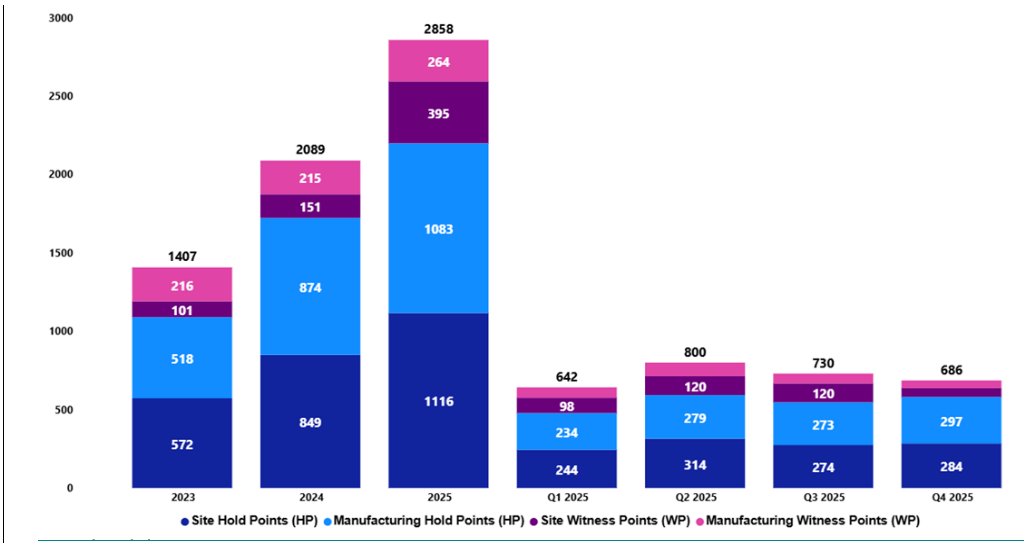
Our surveillance monitoring has been optimized in particular by making our suppliers responsible.

The provision of an almost full-time inspector over a period of 2/3 months to monitor the critical manufacturing operations relative to the primary circuit enabled this optimization.

The same scheme is planned for HVAC which the subcontractor in charge of the wall penetration pipes.

Inspection activity was very sustained in 2025 with a delta of +52% in the number of inspections versus 2024 due to a significant increase in on-site assembly and a delta of +22% due in particular to the launch of E01 batch manufacturing. It also resulted in a 36% increase in our checkpoints (hold points (HP) and witness points (WP)).

KPI	2023	2024	2025	Evolution vs 2024
Hold / witness points	1513	2094	2857	+36%
Hold points at factory	546	883	1083	+23%
Witness points at factory	215	217	264	+22%
Hold points at JHR site	648	853	1115	+31%
Witness points at JHR site	104	141	395	+180%



Hold or witness points at factory sites and at the JHR site

To adapt our oversight to reality, a comprehensive assessment of fifteen suppliers were conducted, resulting in the update of confidence indices. These indices resulted in the adaptation of our oversight programmes to their respective appropriate levels.

In the same way as in 2024, the current oversight was reinforced by specific technical visits of equipment deemed 'critical'. Priority was given to equipment for which a non-conformity would have an impact on the project (repair issues, long procurement times, safety-related classifications such as PIC 1, ESPN N1, etc.).

These technical visits were carried out by a group of production engineers, designers, quality engineers and inspectors. The reviews were carried out on manufacturing site and with the contractor or sub-contractor to assess the equipment in situ (condition of equipment, storage conditions, etc.). Twenty-one technical visits were carried out in 2025 (with a 2025 objective of sixteen).

In the field of counterfeit, fraudulent, and suspect items (CFSI), a specific inspection guide was developed and six inspections dedicated specifically to this issue were carried out. No major findings concerning this issue were noted.

6 TOWARDS LICENSING 6

Jérôme RABY
Nuclear Safety
and Licensing Manager

The Safety and Licensing JHR team works closely with the Nuclear Safety and Industrial Safety department (DSSN) of CEA and other CEA/Cadarache units. It has been tasked with the following responsibilities:

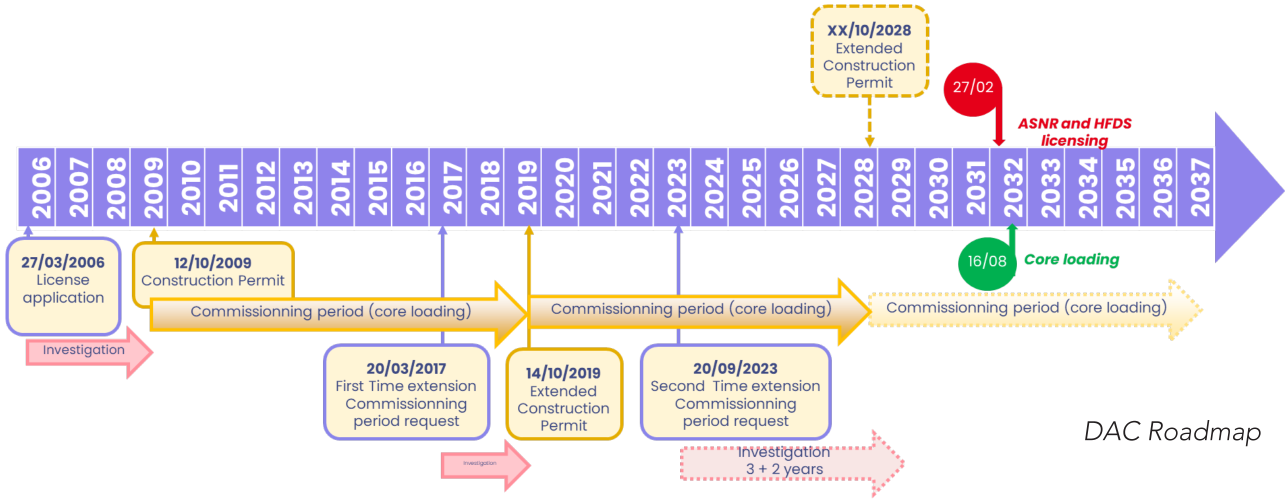
- Defining and implementing the JHR nuclear safety policy
- Elaborating regulatory files for assessment by the French Authority for Nuclear Safety and Radiation Protection (ASNR) for authorisation to commission JHR
- Liaising with ASNR and the French Ministry of Energy's Senior Defence & Security Official (HFDS)
- Defining and implementing the policy for monitoring external contractors, in compliance with the French ministerial order of 7 February 2012, which defines the general rules governing licensed nuclear facilities (known as the INB Order).

6.1 NUCLEAR SAFETY LICENSING

In order to obtain regulatory approval to load nuclear fuel, an application for an operating agreement must be submitted to ASNR. This application includes the JHR project's nuclear safety standard and associated documents.

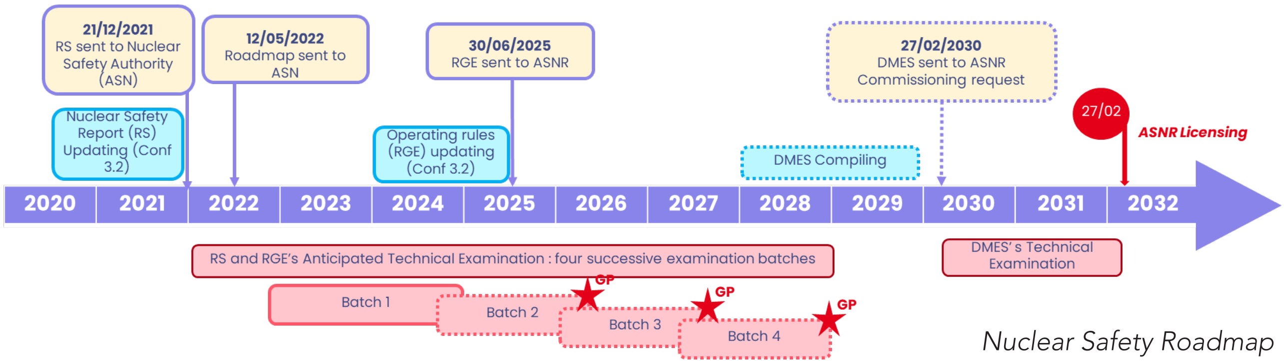
A request to update the licensing decree (DAC) was submitted to the Ministry of Energy Transition, as stipulated in the DAC Roadmap.

The investigation of this case is complete and has led the ministry to submit a preliminary draft decree.



DAC Roadmap

In application of the nuclear safety licensing roadmap established in 2022, an early assessment of the JHR Safety Report was proposed by ASNR based on four successive series of assessments (batches).



Nuclear Safety Roadmap

Batch 1 focuses on:

- RCC-MX mechanical code and its application to the reactor block chamber
- Post-Fukushima safety methodology and assumptions
- Fire risk prevention and management approach
- Design of safety and emergency cooling systems
- General approach to nuclear safety
- Specific primary pipe support structures to prevent guillotine breaks.

ASNR has sent CEA its conclusions associated with this first batch of preliminary investigation of the safety report. They do not lead to any particular difficulties for the continuation of the project.

Batch 2 focuses on:

- Reactor I&C systems
- BORAX accidents
- Nuclear fuel qualification
- Criticality risk analysis.

The assessments for the second batch, which began in 2024, continued in 2025 and will conclude in 2026. CEA responded to all questions submitted by ASNR on the four topics and technical discussions are ongoing.

Batch 3 focuses on:

- Studies on the operating conditions and emergency conditions
- Radiological consequences of a design-basis accident
- Internal and external hazards
- Generic nuclear safety design-basis assessments of experimental devices
- Emergency operating procedures.

Batch 4 focuses on:

- Equipment qualification procedures
- Nuclear safety design-basis assessments for the MADISON and ADELINE devices
- Interim storage and equipment maintenance
- Polar crane design
- General operating rules.

ASNR performed four inspections on the JHR site which lasted one day each.

ASNR *inspection*

ASNR was satisfied with the safety and cleanliness of the construction site and the JHR project, as evidenced by the ASN 2024 Report published in 2025.

Jules Horowitz Reactor project

CEA CENTRE

The Jules Horowitz Reactor (JHR – BNI 172), under construction since 2009, is a pressurised-water research

reactor designed to study the behaviour of materials under irradiation and of power reactor fuels. It will also allow the production of artificial radionuclides for nuclear medicine. Its power is limited to 100 MWth.

The year 2024 saw the continuation of the construction and equipment manufacturing activities of many work-packages of the JHR worksite, notably in the reactor building with the launching of the primary heat exchanger repairs, and in the nuclear auxiliary building with the finalisation of the storage pools and the channels, and the work on the hot cell equipment.

ASN conducted four inspections in 2024. The verifications focused in particular on the primary system, including the treatment of deviations on the three primary/secondary heat exchangers, components of the reactor pile block, including the "core inlet" natural convection valve and the reflectors and the control rod drive mechanisms of the core, as well as the chemically-sealed anchorings. The repair of the reactor pool liner also underwent inspections, as did the qualification process for various items of equipment involved in the facility's safety functions, the centralised instrumentation and control system and the fire protection of the electric cable raceways.

The thematic examinations of the facility's safety analysis report revision submitted in 2021, taking account of the modifications made since the start of construction, continued in 2024 in preparation for the future commissioning. The examination of the request to modify DAC 2009-1219 of 12 October 2009 to extend the commissioning date to 14 October 2037 at the latest, taking into account margins for the project, continued in 2024.

ASN considers the project organisation to be broadly satisfactory from the nuclear safety aspect, particularly in the handling of the deviations on the primary heat exchangers and the development of tools to ensure the application and traceability of the defined requirements. The project must ensure that the qualification process for protection important components is carried out conclusively for all the defined requirements. The formalising and application of certain processes must also be improved. Lastly, continued vigilance is required regarding the priority to be granted to the protection of interests, and to the constant efforts to improve the measures taken to protect these interests.

6.2 NUCLEAR PRESSURE EQUIPMENT

Heat exchangers and ESPN Order

In order to rectify corrosion non-conformities detected in the primary heat exchangers, the replacement of all their internal components was deemed necessary. Given that this equipment is classified ESPN N2, the regulatory impact of these repairs had to be analysed in depth. The study concluded that the primary heat exchangers were not subject to any specific requirements stipulated under Part III of the French Ministerial Order of 30/12/2015 amended (ESPN Order).

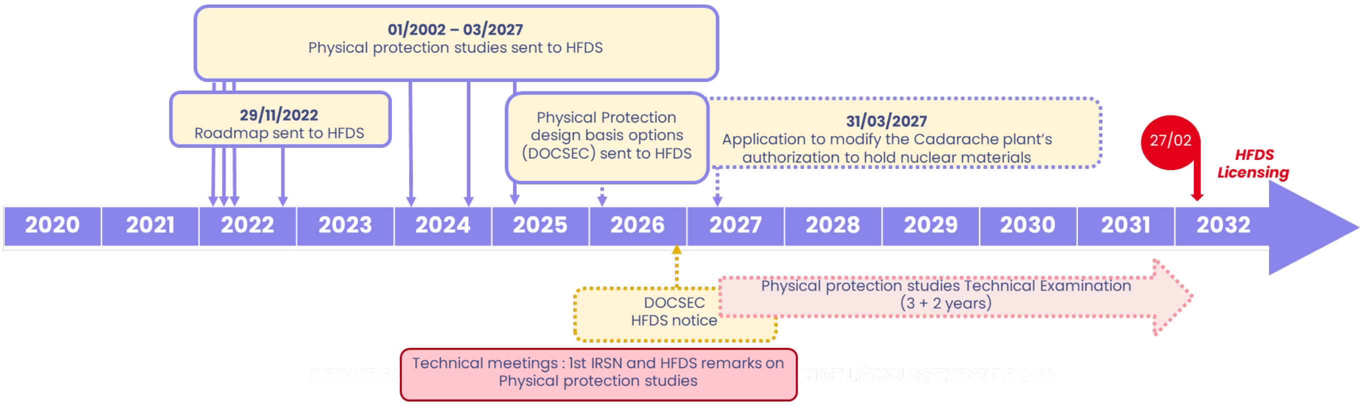
However, special assessment of the repair operations of the heat exchangers is done by JHR project out at the repairer workshops, in order to ensure that highest level of quality and control is applied to this equipment, identical to what would have been required for ESPN subjected to the requirements of the French Ministerial Order.

MADISON and ADELINE – CEA becomes a nuclear pressure equipment manufacturer

As experimental devices, MADISON and ADELINE represent a high level of risk and significant technical complexity. For this reason, CEA decided to qualify as a 'regulatory manufacturer' for some nuclear pressure equipment in 2024. Accordingly, CEA will be implementing an internal regulatory manufacturing process.

6.3 PHYSICAL PROTECTION LICENSING

Implementing nuclear materials in JHR requires approval from the senior defence and security official (HFDS). A roadmap for early assessment of the physical protection studies was discussed with HFDS.

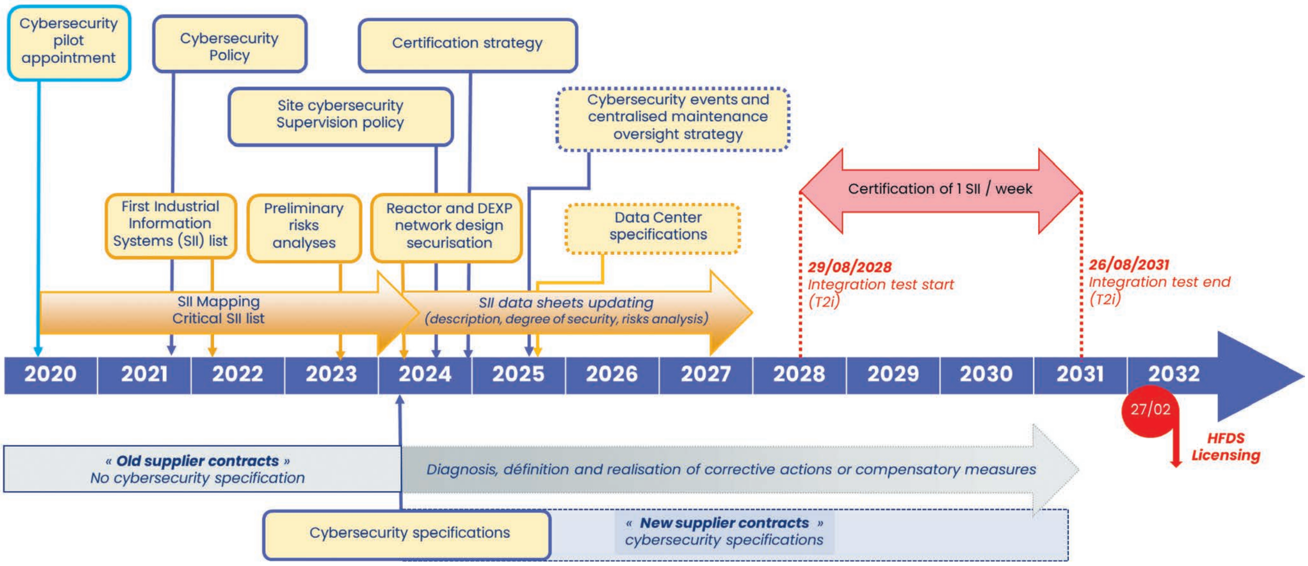


Physical Protection Roadmap

In accordance with this roadmap, preliminary technical discussions were initiated at three technical meetings in 2024 and continued into 2025.

6.4 CYBERSECURITY

In 2024, the cybersecurity team carried out further studies to ensure the security of the Jules Horowitz reactor in accordance with French regulations. In 2025, a cybersecurity roadmap has been developed.



Cybersecurity roadmap

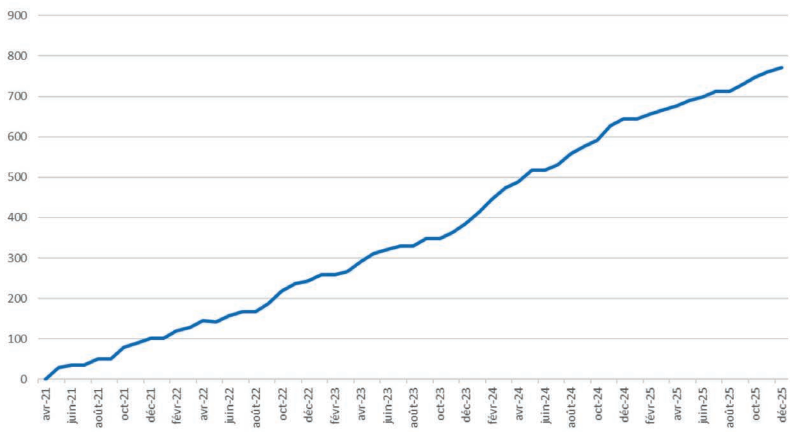
This year has seen a significant increase in cybersecurity considerations for JHR, including:

- The implementation of technical site visits to assess the security level of the I&C systems based on the cybersecurity requirements communicated to the contractors;
- The completion of the first risk analyses following the technical site visits to develop a remediation action plan;
- Specifications for piloting of a maintenance base;
- Definition of the monitoring strategy for JHR systems and the scope of the security operations centre;
- Definition of the functional, technical, and environmental requirements applicable to the future JHR data centre.

Several cybersecurity awareness sessions for project members were also organized in the year.

6.5 NUCLEAR SAFETY CULTURE

During the 2021–2025 period, monthly nuclear safety culture sessions were implemented to raise awareness of nuclear safety culture across the project in accordance with WANO principles.



Number of JHR team members trained

PAVING HE WAY FOR OPERATION 7

Franck JOURDAIN
Manager in charge of preparing JHR operation

7.1 FUEL MANUFACTURING

The manufacturing of the 5 inert mock-ups of JHR elements continued in 2025, with the assembly of bent plates on stiffeners, in order to constitute the inert sections. The manufacturing and riveting of the end caps, the last steps to complete these mock-ups, will begin in 2026.

Regarding UMo fuel, SERJH contributed its expertise to R2LEU project both on aspects related to neutronics and those related to manufacturing.

7.2 OPERATION PREPARATION

7.2.1 Operation documentation

In June 2025, the 31 chapters of the General Operating Rules were sent to French Safety Authority.

A contract was setup to help the future operator to write operation procedures.

The future operator also built a roadmap, planning the tasks to be done before reactor criticality.

7.2.2 Operating activities

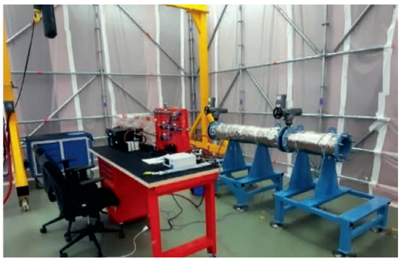
When a completed system is delivered on the construction site, the future operator becomes responsible for keeping it in good working order until the startup of the reactor.

In 2025, the heating substation and annex building cranes were transferred to the JHR future operator.

Leak tests were carried out on reactor building ventilation containment valves, in order to validate a method to perform the periodic inspection and tests during operation phase.

A mechanical workshop was created and put into operation in BMM building, allowing the quick repair of defective parts that may impact operation or maintenance, the unitary manufacturing of specific components, the modification or adaptation of existing tools.

Auxiliary building cranes



Test bench for BUR containment valves

7.2.3 Training

A campaign to deliver the technical operator training modules (FTE) began in Q4 2025, and will continue until Q2 2026. New modules have been created, in line with the progress of the project and the available input data (regarding handling tools, fuel, maintenance, reactor physics, nuclear ventilation…).

The collaboration with ILL continued with the immersion of a third pair of SERJH employees for 3 weeks, in order to gather feedback on both operational and organizational operations by directly observing practices in the field.

The layout of the room intended to host the new simulator is finalized. This room, which is configured identically to the JHR control room, will enable the validation of operation documents, and the operators training in real operating conditions.

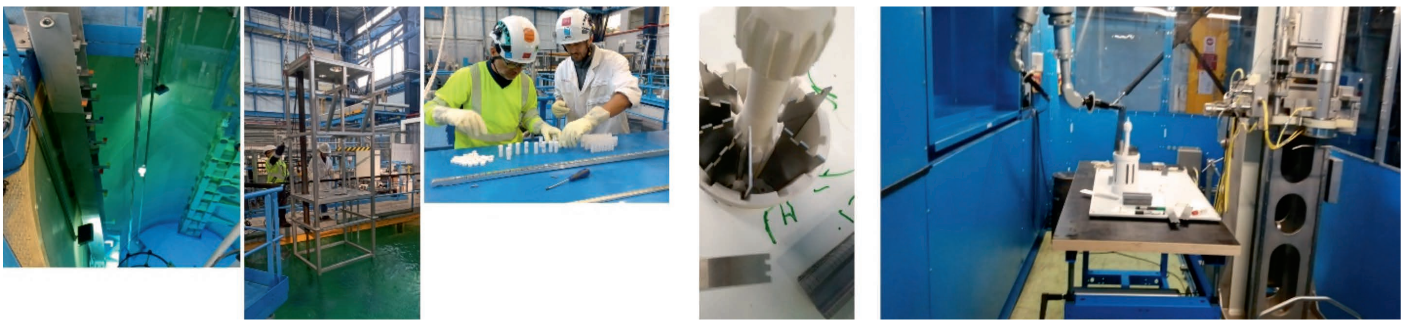
7.3 SUPPORT TO JHR PROJECT

The future operator brought its skills as an operator to JHR project by verifying the operability and maintainability of the equipment through the analysis of work contractors' documents, and participation in tests (in factory or on site), including tests of the stoplogs and doors of the RES lock pool, underwater and under-hot cell conveyors, as well as those of various hot cell equipment.

Regarding studies, the future operator contributed its expertise in the field of thermal hydraulics and neutron physics to perform studies supporting the design of several experimental devices such as MADISON (thermohydraulic study of the total loss of power supply), ADELINE (definition of operating points), CARMEN (characterization of nuclear heating) and OCCITANE (neutronic study).

SERJH also participated in the Detailed Design Review of MICA, and provided technical support for design or feasibility studies of experimental devices such as CLOE, LORELEI V2, PRESTO, FUICA, RISHI, Lead-Bismuth capsule.

Tests in support of the design of experimental devices were carried out in TOTEM facility: notably on CARMEN (corrosion tests), MICA (leak tests), on the MOLFI targets (feasibility of remote operation of targets in hot cell, underwater handling, dropping targets in a pool), on DOSI-LONG (handling tests). The airline bay has been modified and put back into service in order to carry out thermohydraulic tests on OCCITANE and MICA devices in 2026.



Tests performed on mock-ups in TOTEM facility

Jean-Luc Roehlly
Methods & Tools Manager

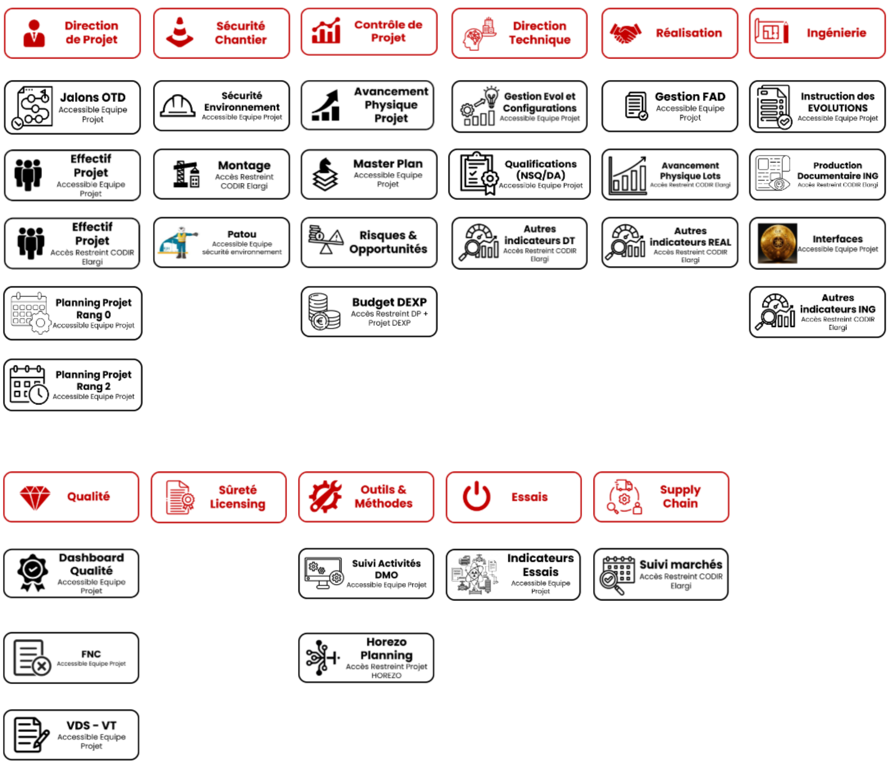
8.1 INFORMATION SYSTEM

Since the beginning of 2024, the Methods and Tools Department has been responsible for supporting JHR in the maintenance and development of its IT tools. The department is organized around three areas of activity:

- Usersupport, including assistance and training, hardware and application license management, and access rights management;
- Maintaining the operational readiness of the information system, incident and problem management;
- Managing projects for new software implementation or evolution of software.

MAIN ACHIEVEMENTS IN 2025

Deployment of JHR management indicators



In 2025 we set up a management dashboard on the JHR Web portal, bringing together the main indicators for managing project operational processes.

Built by the business units, these indicators are deployed on Microsoft Power BI.

The modernization of the system architectures organizes data and processes with the following goals:

- Align the information system with the JHR strategies
- Facilitate data access
- Reduce complexity and redundancy
- Promote data interoperability and consistency
- Improve flexibility and responsiveness
- Facilitate maintenance and upgrades

Software components have been deployed for 2025:

Data hub: JHR has deployed an infrastructure based on Qlik Talend API (Application Programming Interface) and Talend ESB (Enterprise Service Bus) on the CEA Network. This infrastructure will orchestrate data exchange between the various applications.

Digitalization of forms and processes: Leveraging Microsoft SharePoint and Nintex Automation K2 tool, JHR has begun digitizing processes, such as Inspection Notices for Lot holders and Open Point Management tool, including its first module for tracking reservations.

Data repositories: Essential for the design, implementation, and operation of JHR, the functional benchmarks can now be integrated into 3 DExperience (Dassault Systems PLM - Product Lifecycle Management).

KEY MILESTONES IN 2026

Consolidation of data repositories: Several additional reference data will be implemented in 2026 to improve data consistency and the performance of our processes: equipment, markets and lots, business organizations, roles and authorizations, and locations.

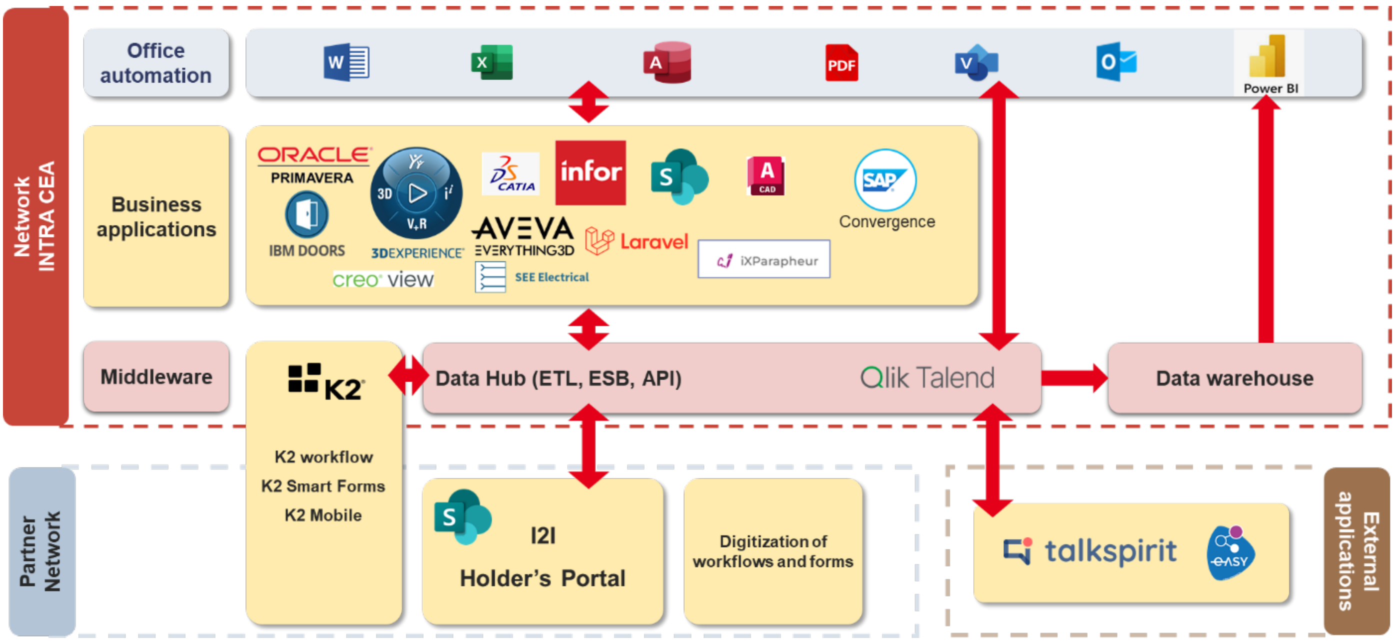
Other application components will be deployed for **process digitization using K2 tool**: Work Authorization and Lockout/Tagout (AT), Permit Management, Non-Compliance (NC), Open Points for Digital Mock-Up (DMU), Local Adaptations (FDAI), Temporary Means for testing (DMP) and Visitor Access to JHR site.

A **Data Warehouse** will be deployed to make data analysis and production of performance indicators more robust and efficient.

The **PLM on 3DExperience** will integrate new functionalities, including change management, configuration management, and improved search capabilities.

The **CMMS** (Computerized Maintenance Management System) for CEA Cadarache center will be deployed and interfaced with other application components, including the PLM system.

Furthermore, increasing integration between our applications will be possible using Talend data gateway:



Finally, as part of the generative AI initiative launched at the CEA, JHR is participating in the deployment of AI solutions to improve project performance. The first concrete use cases for JHR will be implemented in 2026. These tools will allow us to increase our efficiency on simple tasks such as producing summaries and meeting minutes, but also on more complex cases involving technical analysis of data produced for JHR design and construction.

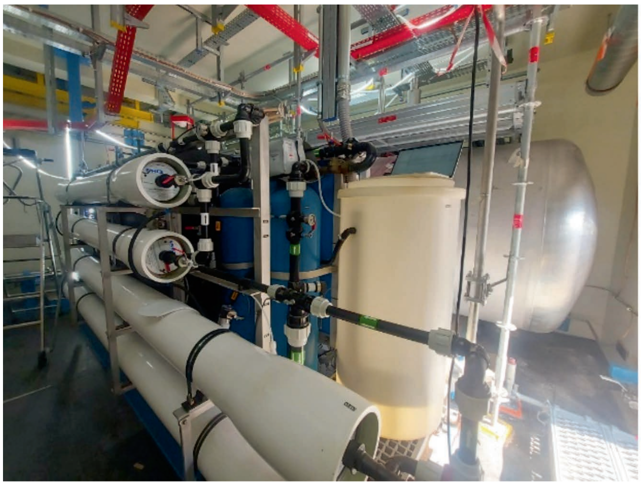
Bruno CAMMAS
Commissioning Tests Manager

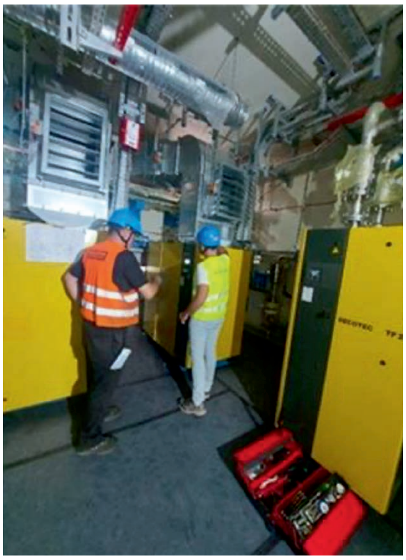
8.2 COMMISSIONING TESTS

Within the JHR project, the Commissioning Tests Department is responsible for the following tasks:

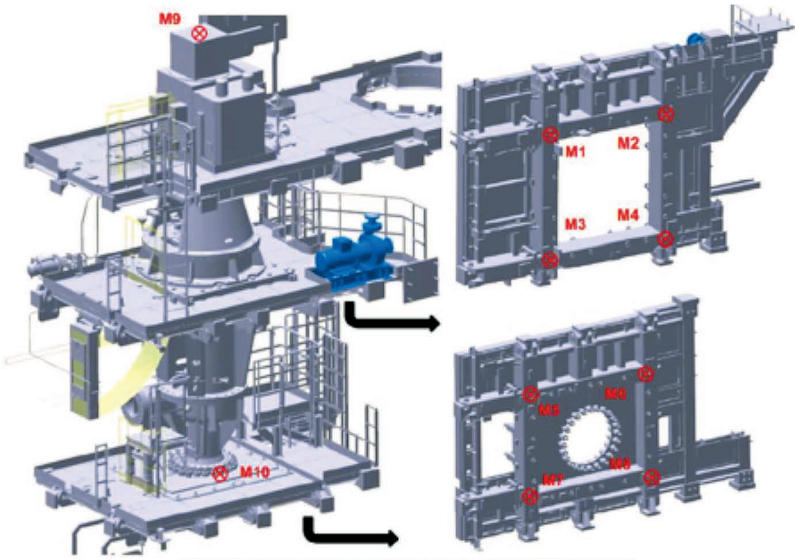
- **Task No. 1:** Supervise and monitor the performance of functional tests on the various systems, planned in the factory and on site by the RJH Project contractors:
  - Monitor enforce the testing documentation of the Contract Holders in accordance with the overall JHR test organisation;
  - Supervise and monitor the execution by the Contract Holders of on-site functional tests, mainly commissioning tests and functional tests.
- **Task No. 2:** Define, prepare and then carry out the integration and commissioning tests as well as the overall installation tests, to be performed by CEA before and after loading the reactor.

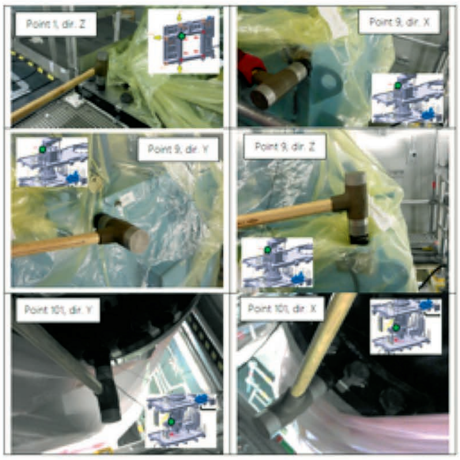
Approximately 7,300 functional commissioning tests will need to be carried out at the JHR site, including 1,100 tests related to nuclear safety. While most of these tests will take place after the commissioning of the high-voltage power supply, scheduled for August 2029, 2025 has already seen the first functional tests carried out on various handling equipment (bridge cranes, hot cells lifting units, pool conveyors, etc.) as well as on several fluid production systems (demineralised water, compressed air, etc.)





The first tests related to the process of characterizing the vibration behaviour of the reactor's primary cooling circuit were also carried out:





Philippe GAÏ
Project Control Manager

8.3 RISK MANAGEMENTS

Risk and opportunity management is at the heart of project control, making it possible to anticipate key issues and implement mitigation actions in due time.

Key risks and opportunities for the JHR project have been compiled into a single portfolio (~170 risks) that is managed at project level, improving the resolution of cross-disciplinary issues, and identifying risks and opportunities at each level of the organisation.

The status of actions is monitored on a monthly basis and regular reviews are performed at each level of the JHR organization. A shared Risk Management integrated system tool has been implemented to facilitate updates and reporting.

Philippe GAÏ
Project Control Manager

The main objectives of the JHR project in 2026 are to:

- Reinforce occupational safety practices in a context of significant erection activity and start of local trials
- Finalise the technical configuration (3D implementation) in the upper area hosting the experimental devices (CEDE)
- Pursue the close quality and schedule monitoring of equipment manufacturing to ensure its timely site delivery before installation
- Launch the tender process for manufacturing of the experimental devices and sign the first contracts
- Finalize tests on the BMR building
- Finalize the discussions with the ASNR on the updated JHR safety report (batch 2).

10 ACRONYMS

ADELINE	JHR Advanced Device for Experimenting up to the Limits of the Nuclear fuel Element
ASNR	French Nuclear Safety Authority and Radiation
BAS	Safeguard building
BARC	Bhabha Atomic Research Centre
BMM	Assembly and warehouse building
BND	Building containing the ultimate emergency equipment (hardened safety core)
BORAX	Severe reactivity insertion accident
BUA	Nuclear auxiliary building
BUR	Nuclear unit reactor building
BR2	Belgian Materials Testing Reactor
CABRI	CEA research reactor dedicated to safety tests
CARMEN	JHR device to measure neutron and gamma fluxes
CEA	French Alternative Energies and Nuclear Energy Commission, JHR owner and French JHR consortium member
CEDE	Experimental shielded cubicle room
CFSI	Counterfeit, fraudulent, and suspect items
CGN	China General Nuclear Power Corporation – Chinese partner in the JHR consortium
CIEMAT	Centre for Energy, Environmental and Technological Research, Spanish JHR consortium member
CLOE	JHR Corrosion Loop Experiment
CORAIL	Thermohydraulic loop in the TOTEM facility
CORALIE	CEA loop in the TOTEM facility to measure hydraulic characteristics of experimental devices (in-core and reflector areas)
CVR	Research Centre Řež, Czech JHR consortium member
DAC	Decree authorising the construction of a nuclear facility (licensing process)
DAE	Department of Atomic Energy in India, Indian JHR consortium member
DSSN	Nuclear Safety and Industrial Safety department at CEA
EDF	Electricité De France, French JHR consortium member
ESPN	French ministerial order governing nuclear pressure equipment
EURATOM	European Atomic Energy Community supporting the development of the European nuclear industry
FIDES	Framework for Irradiation Experiments
FWG	Fuel Working Group
HFDS	Senior Defence & Security Official (French Ministry of Energy)
HFR	High Flux Reactor of Netherlands
HGXR	Finnish In-Kind Hot cell Gamma and X-Ray scanning system
HRT	Research and Technology Hall (CEA Cadarache)
HVAC	Heating, Ventilation and Air-Conditioning
I&C	Instrumentation & Control
ICERR	International Centre based on Research Reactors
IFE	Institute For Energy technology, Halden
IGCAR	Indira Ghandi Centre for Atomic Research
IMS	Integrated Management System
INB	Licensed nuclear facility

INCREASE	In-Core Real-Time Mechanical Testing of Structural Materials of the FIDES-II JEEP programme
INL	Idaho National Laboratory (USA)
IPP	Integrated project platform
IRSN	Institute for Radiation Protection and Nuclear Safety (now part of ASNR)
JAM	JHR Archive Material project
JEEP	Joint Experimental Programmes within FIDES II program
JHR	Jules Horowitz Reactor
JRC	Joint Research Centre, European consortium member
LOCA	Loss-Of-Coolant Accident
LTA	Lost Time Accident
LVDT	IFE laboratory specialised in sensor studies
LVR15	Czech Republic research reactor
LWR	Light Water Reactor
MADISON	Multi rod Adaptable Device for Irradiation of LWR Fuel Samples Operating in Normal conditions
MICA	JHR Materials Irradiation Capsule
MIT-R	Massachusetts Institute of Technology Reactor (USA)
MOLFI	Displacement system used in the production of molybdenum
MTR	Materials Test Reactor
MWG	Material Working Group
NEA	OECD Nuclear Energy Agency
NRC	US Nuclear Regulatory Commission
OCCITANE	Out-of-Core Capsule for Irradiation Testing of Ageing by Neutrons JHR device
OECD	International Organisation for Economic Co-operation and Development
OSIRIS	Previous CEA MTR phased out in 2015
PROSPERO	JHR device to monitor beginning-of-life changes in reactor materials and vessel material behaviour under irradiation during its lifetime
PWR	Pressurised Water Reactor
REE	Intermediate interim storage pool
RER	Reactor pool
RISHI	Research facility for Irradiation studies in Sodium at High temperature (sodium loop designed and built by IGCAR)
R&D	Research and development
STUDSVIK	Swedish JHR consortium member
SCK CEN	Belgium Nuclear Research Centre, Belgian JHR consortium member
TOTEM	CEA cold test facility
TWG	Technical Working Group
TSO	Technical Support Organisation
UGXR	Finnish in-kind of an Underwater Gamma and X-ray scanning systems
UKNNL	UK Nuclear National Laboratory, British JHR consortium member
VAUTOUR	CEA Cadarache cubicle designed to resist to explosion from NaK/water reactions
VTT	Technical Research Centre of Finland, Finnish JHR consortium member
WG	Working Group
WLTA	Without-Lost-Time Accident

March 2026

Jules Horowitz Reactor

JHR PROJECT

BP9

13115 St Paul Lez Durance - France

https://jhrreactor.com/

JHR@cea.fr

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