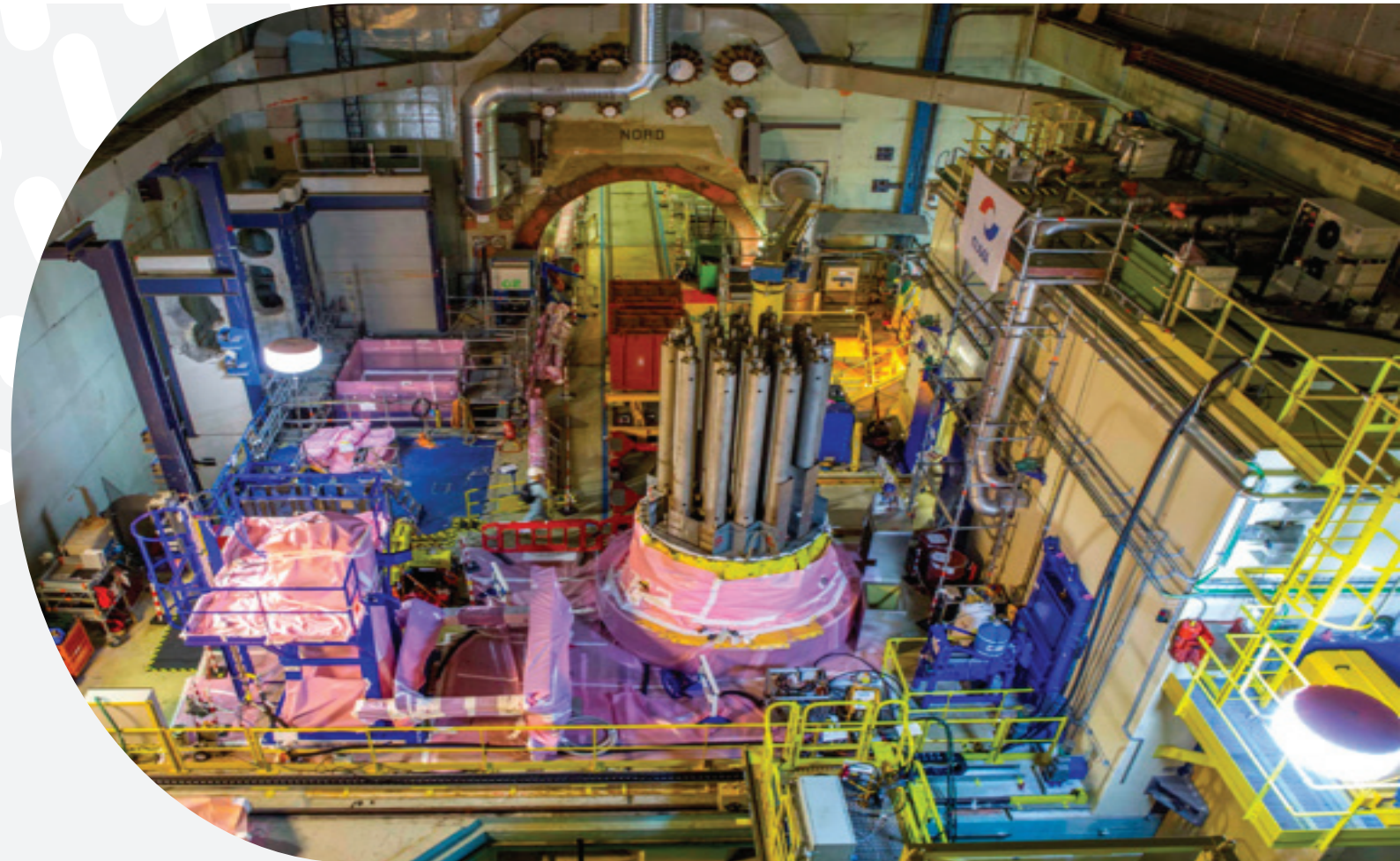


PROJECT

Hot cell for vessel decommissioning (EDF – CNPE of Chooz A)



After having performed preliminary engineering and characterization work allowing to set the main choices of the Reactor Vessel (RV) dismantling, EDF has awarded the consortium Westinghouse – NUVIA France, a contract for the dismantling of its Chooz A RV.

The project started in 2010 with a preconceptual design, conceptual design, detailed designed performed by the consortium. The site works started from 2014, when equipment was evacuated from the pool, site installation, preparation works of the pool and construction of the solid waste treatment hot cells were performed. The solid waste treatment hot cell was completed and commissioned in 2018. From this stage on, the project will go ahead with cutting & solid waste conditioning operations, until the entire dismantling work is completed (RV and RV thermal insulation segmentation).

LOCALISATION

Pays : France

PROJECT PARTIES

Client : EDF DP2D

Partenaires : Westinghouse

Sous-traitants : ECA (for the detailed design of the equipments), Spie Nucleaire (Main Low Voltage power supply), Siemens (fire detection system)

KEY FIGURES

Start date: 2010

Commissioning of the hot cell: 2018

Operations ongoing

Key disciplines covered by NUVIA during the project:

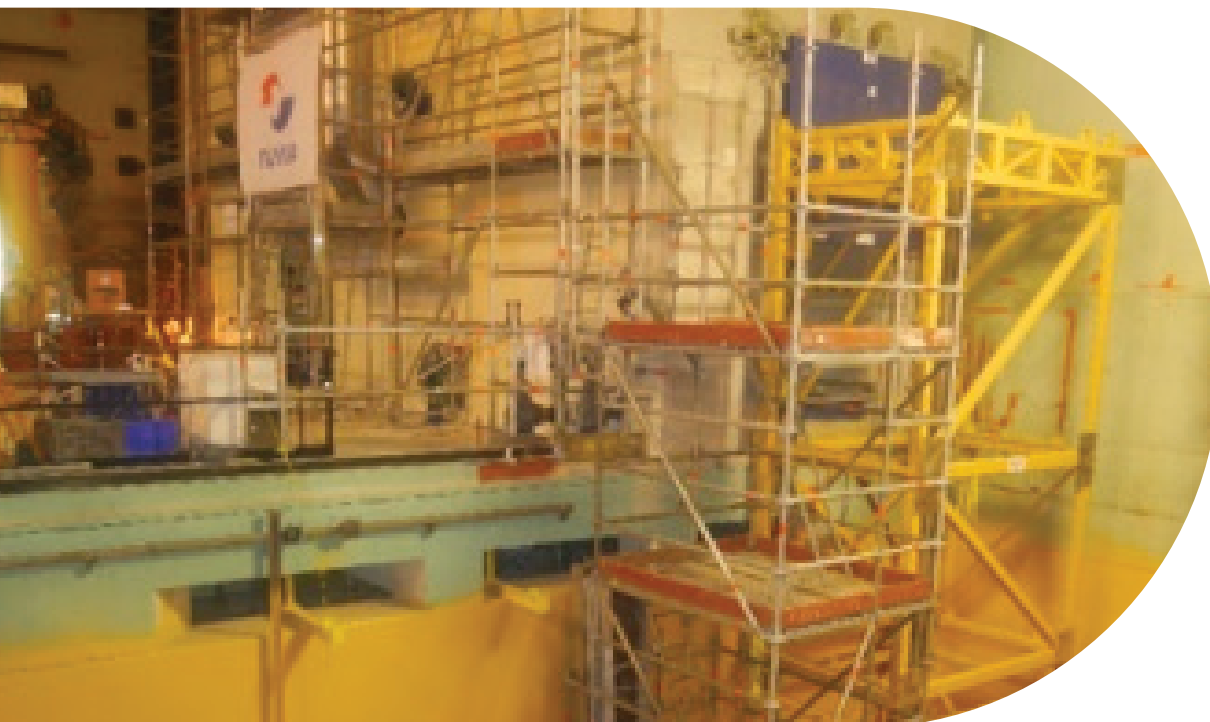
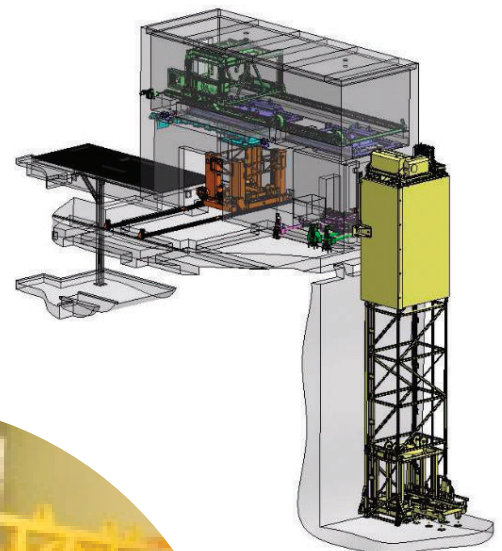
1	Integration & coordination, project management	✓
2	Masterplan (site plan)	
3	Process systems	✓
4	HVAC & dynamic confinement	✓
5	Building architecture	✓
6	Civil engineering	✓
7	Electrical systems	✓
8	Instrumentation & control	✓
9	Access control system & equipment	✓
10	Process equipment	✓
11	Piping	
12	Building equipment	
13	Plumbing & sewing system	
14	Remote handling	✓
15	Fire safety systems	✓
16	Security systems	
17	Sustainability approach and systems	✓
18	Cryogenic plant	✓
(+)	Nuclear safety	
(+)	Neutronic & bioshielding design	✓

Description

Integration & coordination, project management

NUVIA handled all the project management related to the Design, the Procurement and the Construction & Commissioning of the solid waste treatment hot cell, namely:

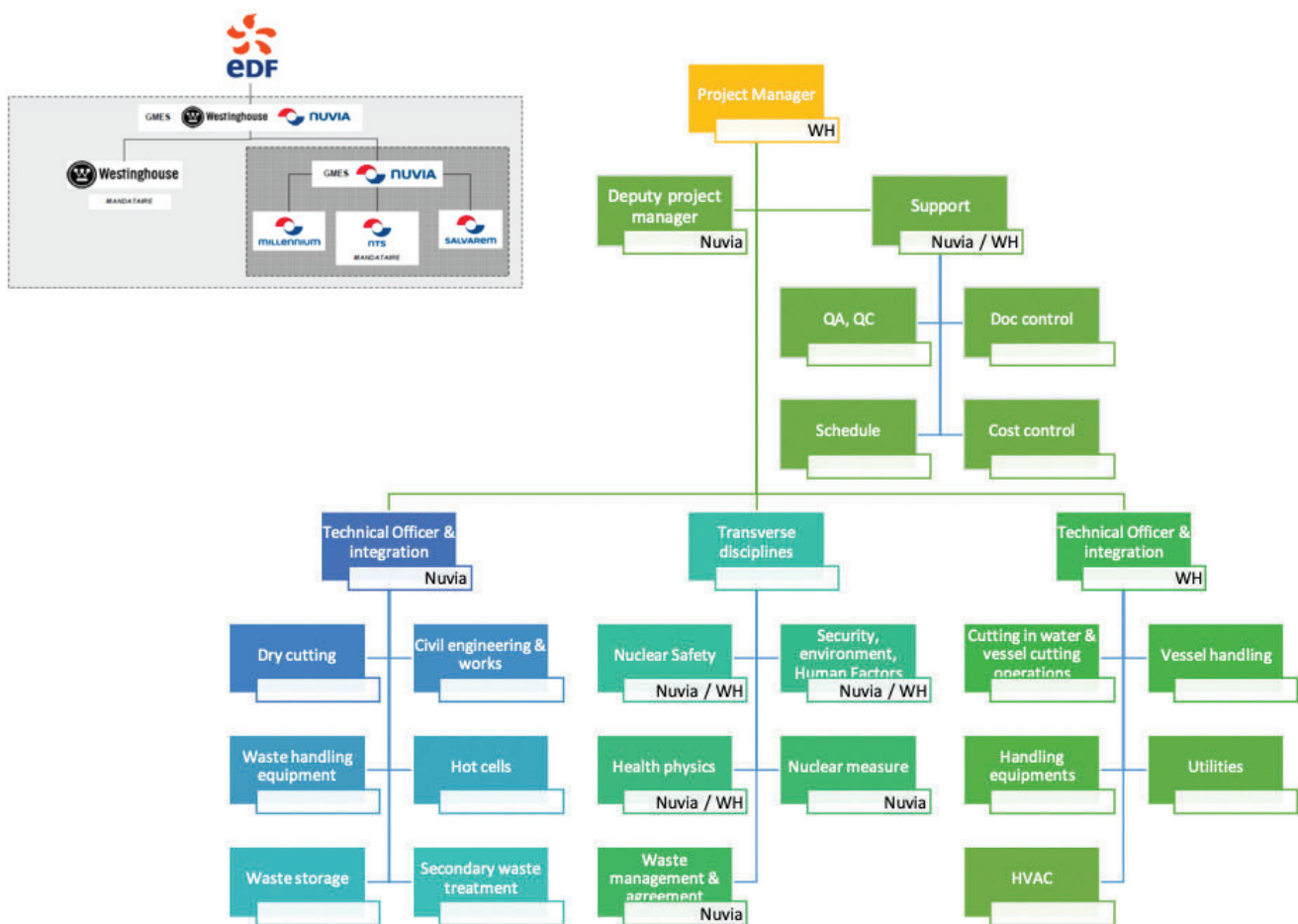
- Client relationship and contractual follow-up
- General project management activities: management plan, quality plan and document quality supervision; Non conformities and deviations follow-up
- Management of schedule, interfaces, subcontractors



The project was organized around a core project & technical team, in charge of the whole design process. Principal engineers led the different work packages.

Each work package leader is in charge of carrying out the design of the installations for which they are responsible, paying special attention to the interfaces with other work packages (or phases), especially for any impact on the safety critical issues of the project.

They set technical specifications which will be used for subcontractors and suppliers. During the implementation or installation phase, they are in charge of execution documents approval, commissioning activities follow-up, as well as the processing of the non-conformity and modification sheets. They also monitor the progress against the contractual deadline targets for each batch.



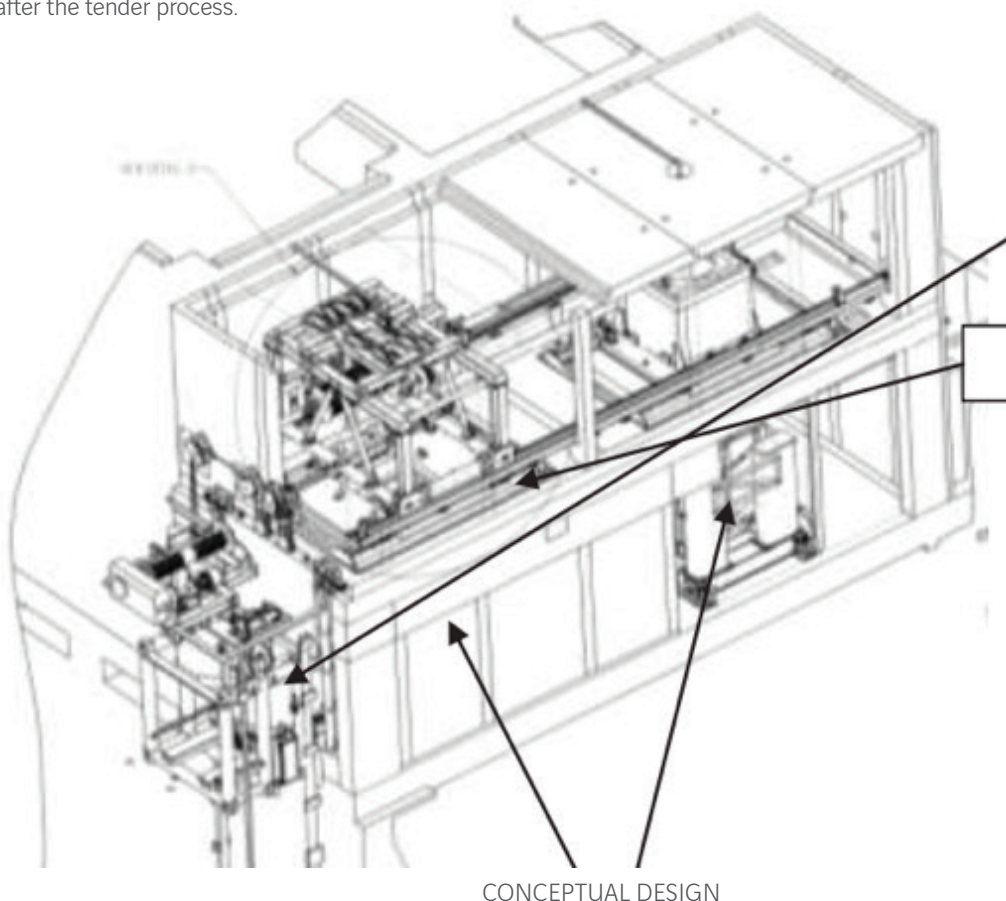
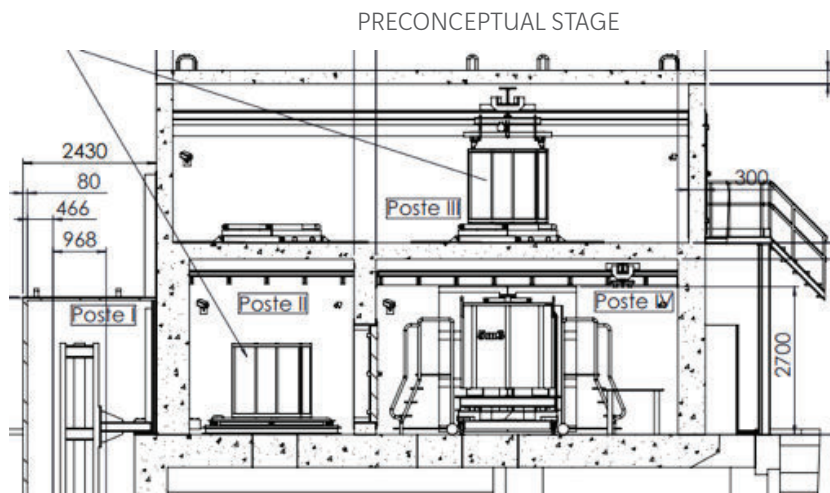
ORGANISATION GÉNÉRALE DU PROJET

Process systems & equipments

Regarding process systems, NUVIA managed

- The integration of the different pieces of equipment and interface with the EC&I, HVAC and utilities
- The preparation and the installation of all the mechanical components of the hot cell (nuclear measures, mechanical equipment) and coordination between the other disciplines
- The organization of the unitary subsystem tests (Factory Acceptance Tests), the preparation of all the Tests and Commissioning Procedures (Site Acceptance Tests) and performance of the tests, until full commissioning the hot cell
- The coordination and preparation of all the maintenance documentation for the operations
- NUVIA conducted a preconceptual design for the high-reliability process equipments on its scope (handling of the cut waste from the vessel, characterization & final conditioning of the waste). A functional specification was derived from this preconceptual design and ECA was selected as subcontractor after the tender process.

As part of the global design process, a CE marking certification approach was deployed for the hot cell system. This approach has to ensure, from an operational point of view, the safety of any operators, in particular through the integration of an inter-locked access control system in the supervision of the hot cell. The access control system was thus developed taking into account personal authorization and operational mode for the hot cell.

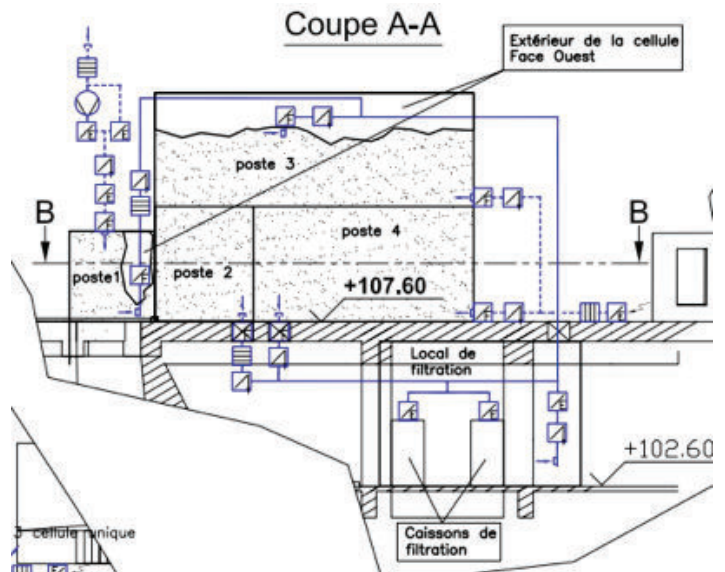


CONCEPTUAL DESIGN

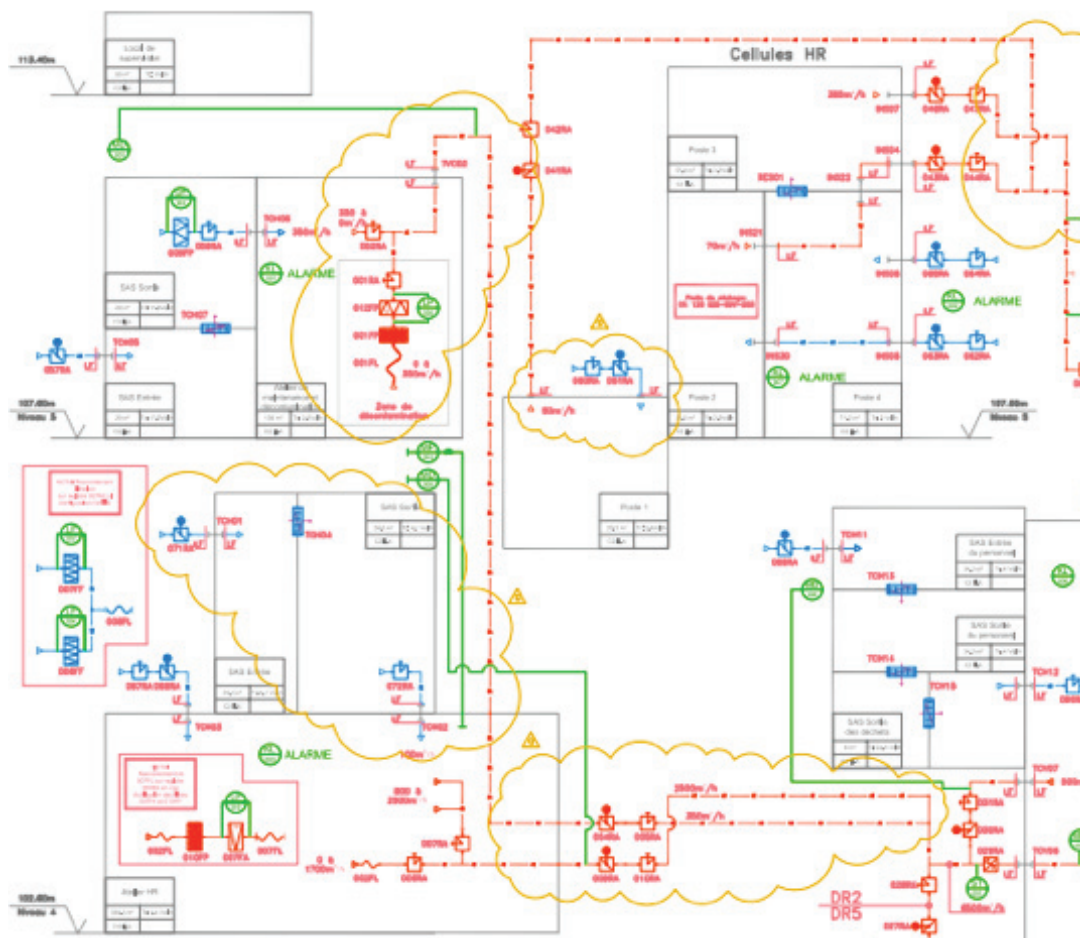
HVAC & dynamic confinement

Nuclear safety is central to define HVAC & dynamic confinement in this project. There was no requirement regarding thermal comfort in this case but all the accidental configuration with spreading of contamination were to be covered.

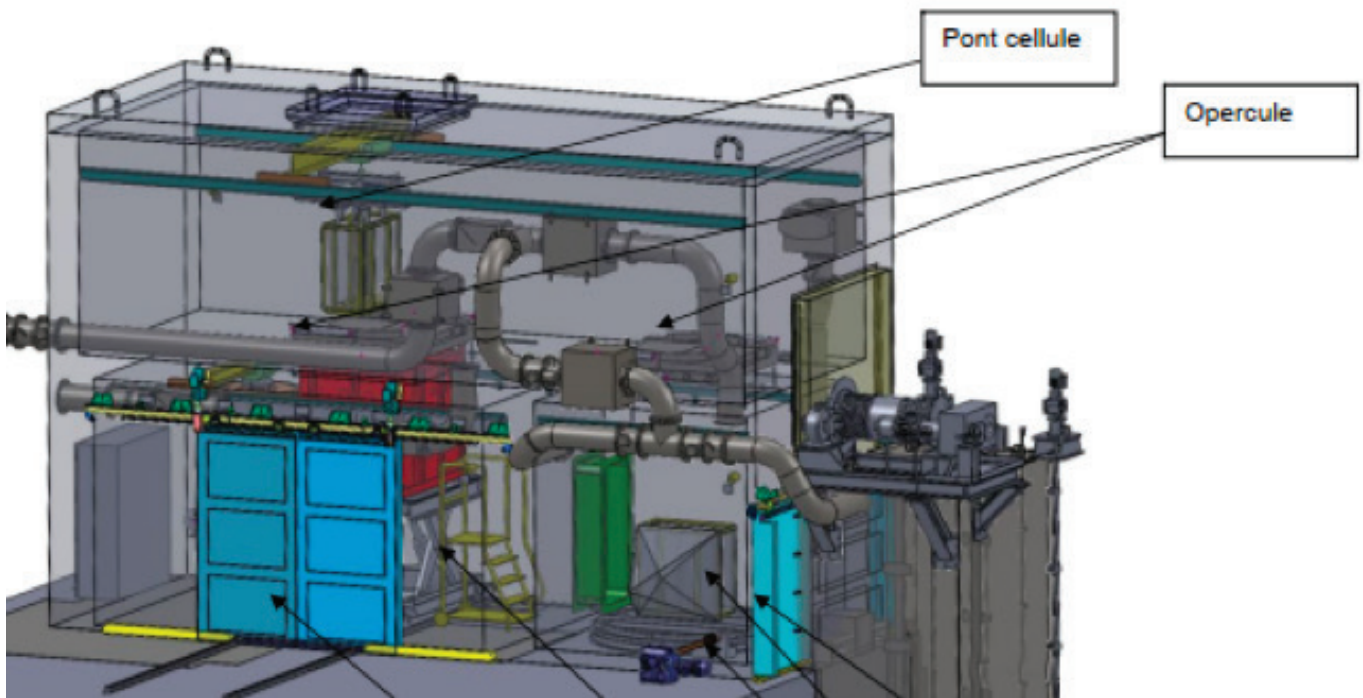
From this requirement on dynamic confinement requirements, several optimization of the HVAC layout were conducted, from pre-conceptual design until the detailed design. A room was designed and dedicated to ventilation system & equipment, in the existing building.



PRECONCEPTUAL STAGE



DETAILED DESIGN



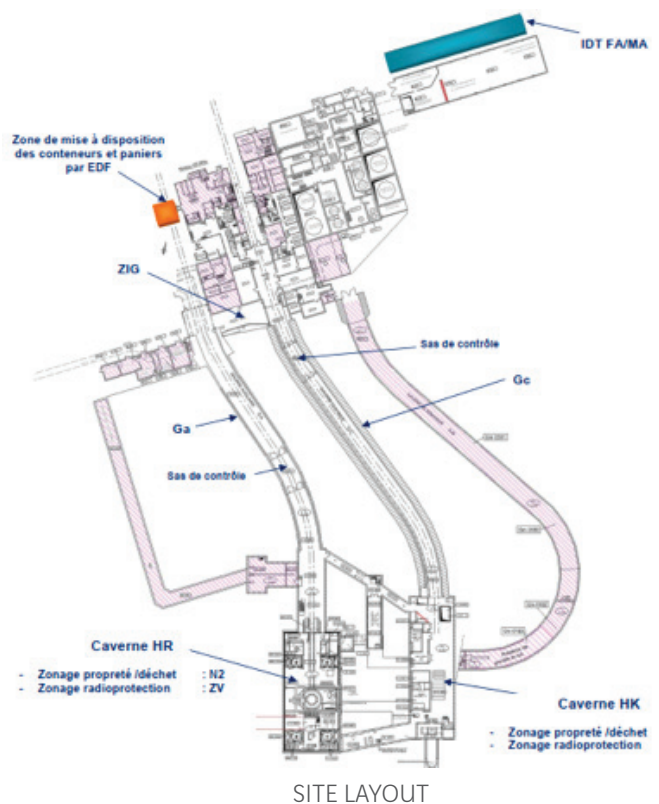
BUILDING ARCHITECTURE – INTEGRATION OF HVAC DUCTS IN THE 3D MODEL

Building architecture

NUVIA role was to combine the constraints coming from:

- The constructability in this existing facility, due to a unique access through a 1km-long tunnel (the reactor being built in the mountain) and a limited accessibility of the gantry crane of the cave
- The resistance of the existing structure and the congested space, which was limiting the possibilities for the cell implantation
- The space requirement due to the process itself, HVAC, utilities & process maintenance issues
- The conclusions coming from the throughput analysis (requirement for waste buffer storage, secondary wastes...)

Several optimizations of the configuration and layout of the cells were performed at the stage of the preconceptual design and conceptual design, until final configuration was defined.



SITE LAYOUT

Civil engineering

Civil engineering analysis constrained the building architecture of the hot cell from the very beginning of the preconceptual design, as the hot cell was to be built in an existing facility, bringing new load cases to the structure.

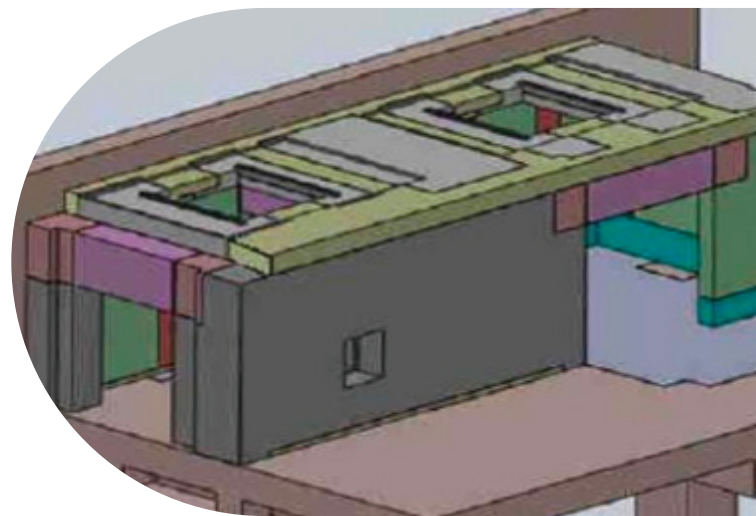
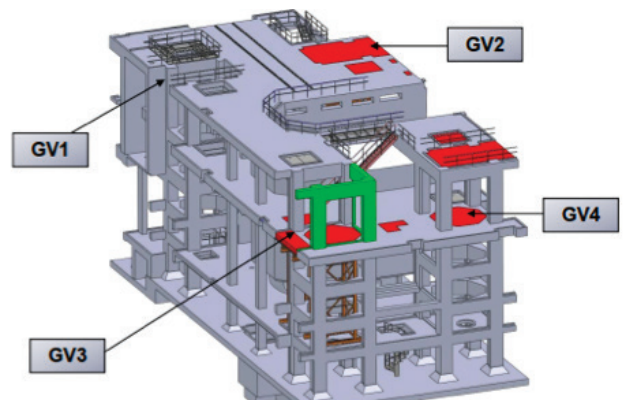
No seismic design was required for this project (no requirement from the safety analysis nor investment protection), which made the process easier. Construction methods guidelines, along with bioshielding requirements, were defined from the early stages of the projects, in order to guarantee the compatibility of the cell, on the one hand, with the existing cell and, on the other hand, with the target in terms of radiological ambient dose-rate.

Moreover, various modifications of the existing structure were required for the project (cutting, strengthening, creation of new slabs and levels).

NUVIA (Nuvia Structure) performed the complete scope from pre-conceptual to detailed design and construction of the hot cell.

For the construction phase,

- Dedicated construction methods were developed in order to comply with the structural capacity of the existing slabs
- First floor rebars cages were prefabricated and supplied
- Concrete was mixed directly in the reactor hall with a specific batching plant, and poured in place. Among others, a 1m-thick wall with a recess for the spectrometry was casted
- Second floor was built from prefabricated wall



SYNTHETIC VIEW OF THE MODIFICATIONS FOR EXISTING STRUCTURE & DEFINITION OF A CONSTRUCTION SEQUENCE COMPLIANT WITH THE RESISTANCE OF THE EXISTING STRUCTURE



CONSTRUCTION OPERATIONS

Electrical systems, Instrumentation & control

Only low voltage electrical systems were addressed by NUVIA for the hot cell. Design for the connection of the hot cell to existing electrical systems was subcontracted to "SPIE Nucleaire", whereas the electrical systems until the main panel were integrated as part of the process equipment discipline.

The solid waste treatment hot cell is an independent system in the existing plant, with its own dedicated instrumentation and control room. Instrumentation & control of the hot cell was thus designed and implemented by the consortium, collecting the data and information from the process equipment control system. The conceptual design stage led to a functional specification for instrumentation & control, detailing the requirements (HMI, reliability of the data storage, architecture), all the control & alarms monitored by the system and the FAT / SAT procedures to be implemented:

- General assessment of the system
- Electrical power monitoring & control panel
- Fire detection monitoring & control panel
- Filtration & ventilation monitoring & control panel
- Adiological monitoring & control panel
- Utilities (compressed air, breathing air production) monitoring & control panel

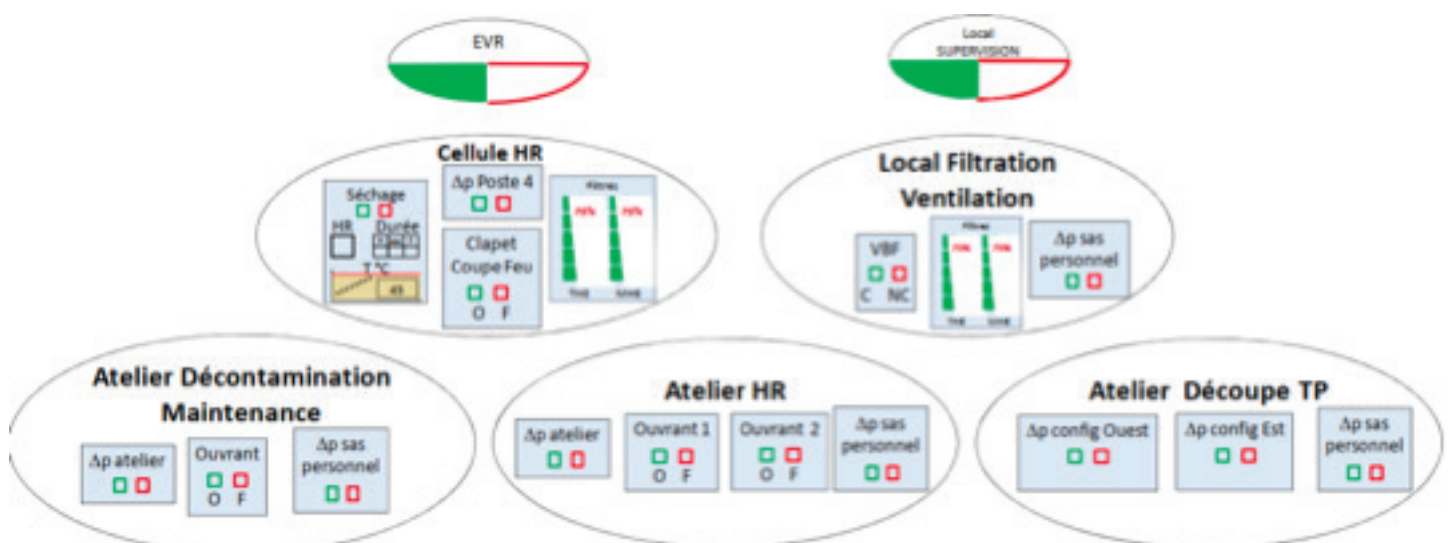
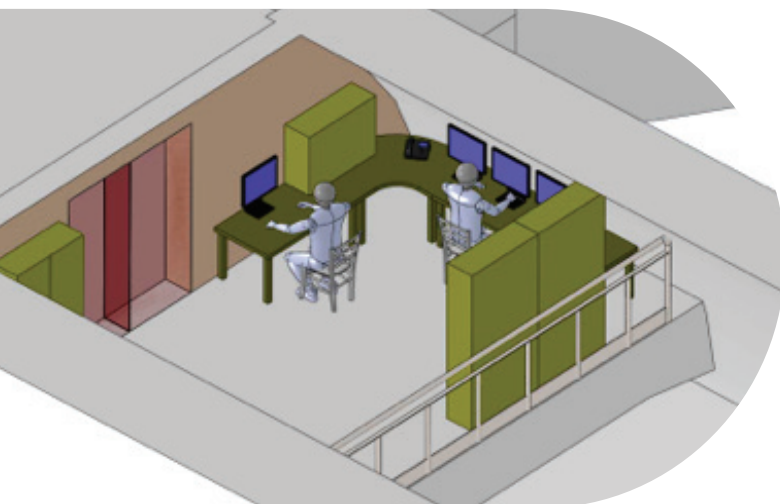
The normative context for the instrumentation & control was French regulations, no additional performance requirement coming from the nuclear domain.

Fire safety systems

NUVIA was responsible for integration of fire safety sensors and their integration in the general fire safety system of the existing plant. This expertise was subcontracted to SIEMENS as industrial operator of the existing system and following a fire risk analysis performed by NUVIA (Millennium). The modification of the existing plant layout (creation of new walls, opening of others...) implied a full review and upgrade of the fire detection system.

Nuclear safety

In addition to the here-above mentioned studies, a complete nuclear safety analysis and underpinning file for the Safety Authority was written. Health physics calculations and design of nuclear probes (spectrographic & radiation measures to characterize the nuclear wastes) were also part of Nuvia's scope.



CONCEPTUAL DESIGN – FUNCTIONAL REQUIREMENT FOR INSTRUMENTATION & CONTROL