

## Technical Specifications (In-Cash Procurement)

# Technical specification - Electrical and I&C design Hot Cell Complex

This document aims at specifying the electrical design activities to be performed for the Hot Cell Complex (HCC) conceptual studies

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# 1 Purpose

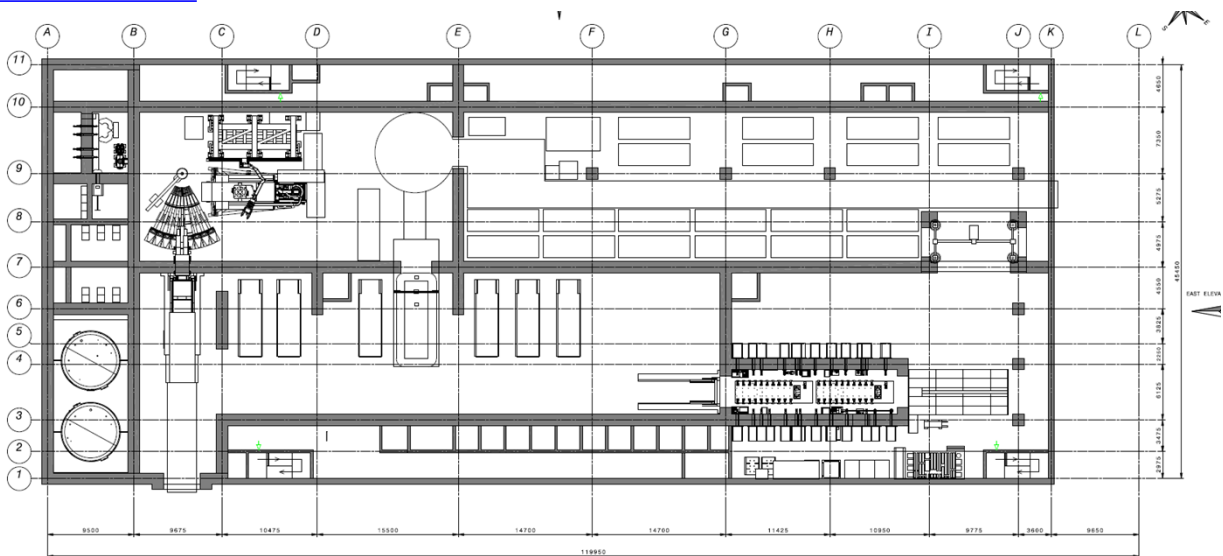
This document aims at specifying the design activities to be performed for the Hot Cell Complex (HCC) conceptual studies:

- 1 – Basis of the Electrical and I&C design for the buildings of the HCC,
- 2 – Conceptual Design documentation.

# 2 Scope

The scope includes the overall Hot Cell Complex, including the building and the processes, in particular the Hot Cell Complex building, the Radwaste process and the Hot Cell Remote Handling System.

The Hot Cell Complex is described in [ITER\\_D\\_X932PF - Description of Hot Cell Complex - Option 2](#). Hereunder are a few extracts of layout drawings [ITER\\_D\\_WDYC63 - HCC - Option 2 - 2D drawing BUILDING#21](#) and [ITER\\_D\\_WKF4X6 - HCC - Option 2 - 2D drawing BUILDING#23](#).



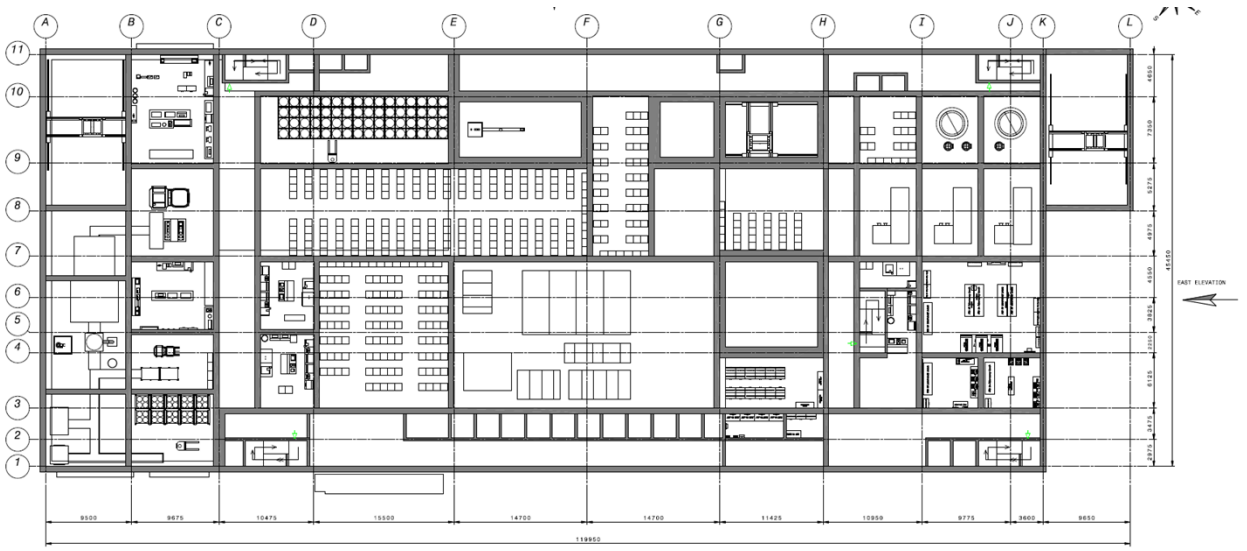
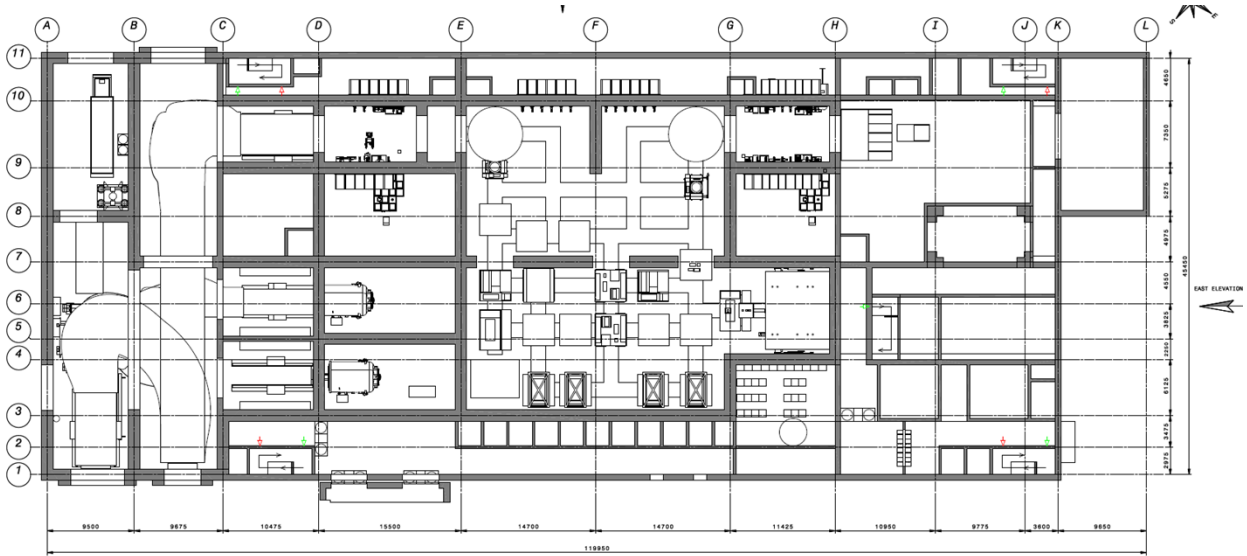


Figure 1 Building 21: B2, L1, and L2 levels (pre-concept)

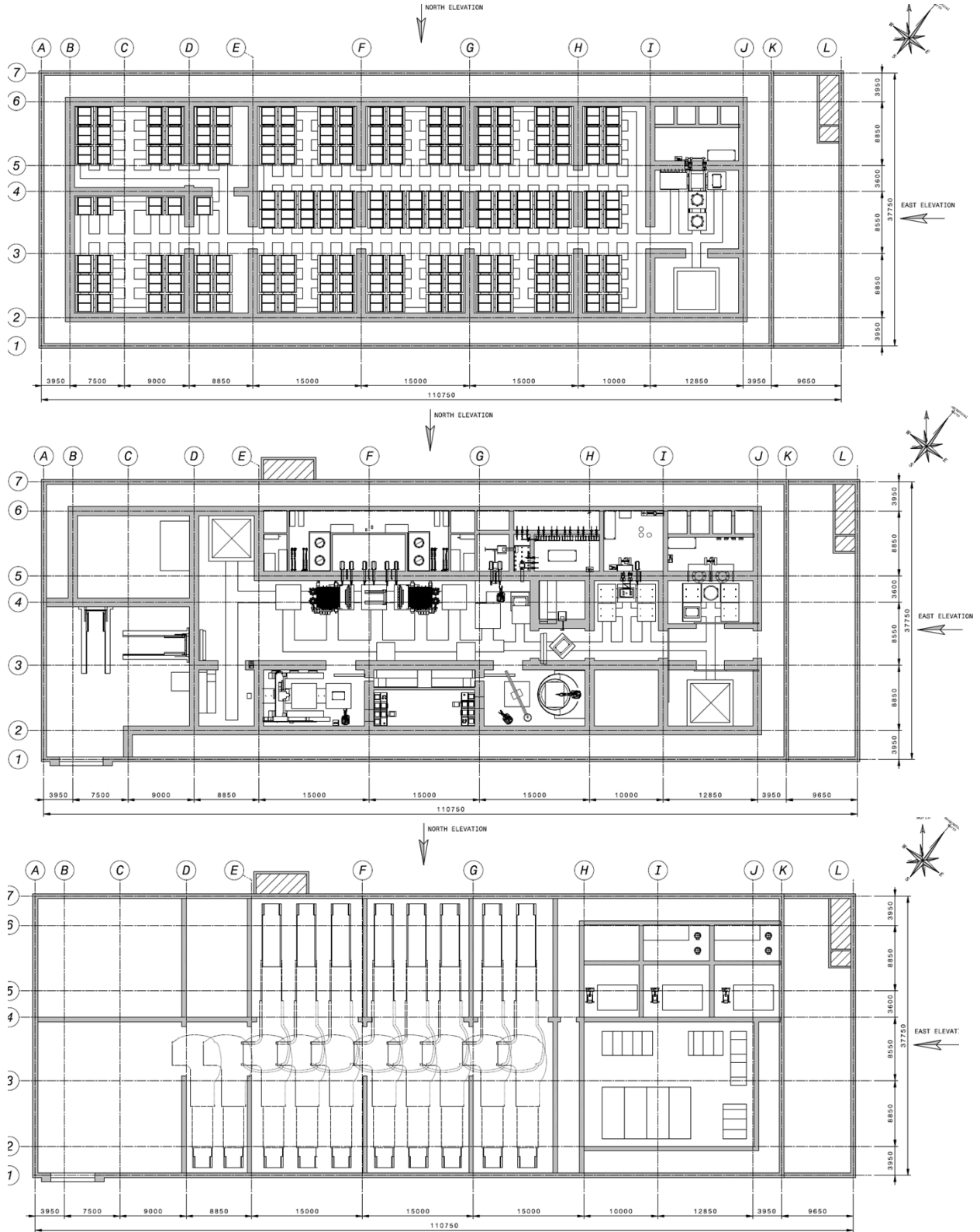


Figure 2 Building 23: B2, L1, and L3 levels (pre-concept)

The table in appendix summarizes main features of the Hot Cell Complex, illustrating the level of complexity and the required skills for this contract.

### 3 Definitions

For a complete list of ITER abbreviations see: [ITER Abbreviations \(ITER\\_D\\_2MU6W5\)](#).

### 4 References

#### Acronyms:

- C-R: Contractor Responsible. See Contract specifications for definition of duty.
- C-TRO: Contractor Task Responsible Officer. See Contract specifications for definition of duty.
- IO-RO: ITER Organization Responsible Officer. See Contract specifications for definition of duty.
- IO-TRO: ITER Organization Task Responsible Officer. See Contract specifications for definition of duty
- PBS: Project Breakdown Structure

### 5 Estimated Duration

The contract duration shall be one year and shall commence after the official start date and upon the mutual agreement of both parties. The services shall be performed on-site at IO.

### 6 Work Description

#### 6.1 Context

The pre-conceptual design of the Hot Cell Complex (HCC, cf. Figure 1 and Figure 2) is being developed by IO. This work is based on the existing conceptual design which was performed in 2017 in the frame of an engineering contract, and which outcome was to have one single building.

The main change is to host radwaste processing and components maintenance functions in two separate buildings.

Therefore, the following activities are being performed:

- Design activities of the HCC buildings,
- Design activities of the Radwaste and Remote Handling System located within the HCC,
- Safety analysis based on the Hot Cell Complex design.

A contract for the conceptual design of the Hot Cell Complex buildings and services will be started in Q2 2019, while series of contracts have been launched in order to study the Radwaste and Remote Handling Systems located within the Hot Cell Complex. The requested work is focused on electrical design activities.

## 6.2 Objective of the contract

The objective of the contract is broken down into 4 deliverables which correspond in fact to two types of activities as described below.

### 6.2.1 *Basis of design*

The contractor shall describe the design methodology that will be implemented for the whole technical field of the two buildings:

- For lighting, earthing, lightning protection, building equipment, HVAC system, fire detection and alarm system, liquid and gas, cables and cable trays.
- For I&C systems (building management system, mechanical equipment, HVAC, L&G, fire safety system, electrical monitoring, lighting control, personnel lifting)
- For electrical distribution system and, generally speaking, low voltage system

The first step will be to define the architecture design for electrical and instrumentation control. Then, the contractor will perform the dimensioning calculations for both I&C and electrical including the sizing of the cable trays. The compliance to the safety requirements shall also be demonstrated.

This basis of design shall be presented by the contractor during the conceptual design review of the HCC, planned on the last quarter of 2019.

This activity corresponds to the Deliverable D1 and D4.

### 6.2.2 *Conceptual design documentation*

The contractor will make the single line drawings and general arrangement drawings (including the layout of boards and cubicles, the cable trays routing), for both I&C and electrical fields.

This activity corresponds to the Deliverables D2 and D3.

## 7 Responsibilities

### 7.1 Contractor's Responsibilities

In order to successfully perform the tasks in this Technical Specification, the Contractor shall:

- Strictly implement the IO procedures, instructions and use templates;
- Provide experienced and trained resources to perform the tasks;
- Contractor's personnel shall possess the qualifications, professional competence and experience to carry out services in accordance with IO rules and procedures;
- Contractor's personnel shall be bound by the rules and regulations governing the IO ethics, safety and security IO rules.

### 7.2 IO's Responsibilities

The IO shall:

- Nominate the Responsible Officer to manage the Contract;
- Organise a monthly meeting(s) on work performed;
- Provide offices at IO premises;
- Provide a standardized IT working environment (laptop, screen, keyboard, webcam and headset).

## 8 List of deliverables and due dates

D #	Description	Due Dates
D1	<u>Preliminary version of the Basis of design for Electrical and I&amp;C:</u> <ul style="list-style-type: none"> <li>- Design methodology,</li> <li>- Architecture design for electrical and instrumentation control</li> <li>- Dimensioning calculations,</li> <li>- Safety Compliance Matrix,</li> </ul>	T0 + 3 months
D2	<u>Preliminary version of the conceptual design documentation</u> The expected deliverables are at least: <ul style="list-style-type: none"> <li>- Single line diagrams</li> <li>- General arrangement drawings for cubicles, boards and cable trays routing</li> </ul>	T0 + 6 months
D3	<u>Final version of the conceptual design documentation</u> The expected deliverables are at least: <ul style="list-style-type: none"> <li>- Single line diagrams</li> <li>- General arrangement drawings for cubicles, boards and cable trays routing</li> </ul>	T0 + 9 months
D4	<u>Final version of the Basis of design for Electrical and I&amp;C:</u> <ul style="list-style-type: none"> <li>- Design methodology,</li> <li>- Dimensioning calculations,</li> <li>- Safety Compliance Matrix,</li> </ul>	T0+12 months

To be noted that the priorities between the different Deliverables to be issued could be changed at the KoM or during the duration of the contract, as per IO request and in agreement with the contractor, but this will not affect the overall duration or the cost of the work.

## 9 Acceptance Criteria

These criteria shall be the basis of acceptance by IO following the successful completion of the services. These will be in the form of monthly progress reports as indicated in section 8, table of deliverables and further detailed below:



- Report and Document Review criteria.
- Reports as deliverables shall be stored in the ITER Organization's document management system, IDM by the Contractor for acceptance.
- Technical Responsible Officer is the Approver of the delivered documents.
- The Approver can name one or more Reviewers(s) in the area of the report's expertise.
- The Reviewer(s) can ask modifications to the report in which case the Contractor must submit a new version.
- The acceptance of the document by the Approver is the acceptance criterion.
- The acceptance criteria of the document correspond to:
  - Justified and documented comments,
  - Lessons learned of existing nuclear facilities,
  - Reference to existing technologies and proven solutions used in nuclear field,
  - Reference to existing and applicable Norms and Standards,

## 10 Specific requirements and conditions

Significant experience in:

- Design of electrical systems operating in irradiated and contaminated environment,
- Design of electrical systems for cranes, motorized doors, trolleys, lifting platform
- Design of Man-Machine interface
- Commissioning of electrical facilities
- Experience of nuclear process plant, control & instrumentation and associated safety

At least 10 years' experience is required in these fields of expertise.

The contractor shall present in the offer:

- a resource loaded schedule, in line with the delivery dates given in section 8,
- a resource estimate for each of the Deliverables,

## 11 Work Monitoring / Meeting Schedule

The work will be managed by means of Progress Meetings and/or formal exchange of documents transmitted by emails which provide detailed progress. Progress Meetings will be called by the ITER Organization, to review the progress of the work, the technical problems and the planning. It is expected that Progress Meeting will be held weekly or biweekly. Progress meetings will involve C-R, C-TROs, IO-RO and IO-TROs.

The main purpose of the Progress Meetings is to allow the ITER Organization/RHRM Division and the Contractor Technical Responsible Officers to:

- a) Allow early detection and correction of issues that may cause delays;
- b) Review the completed and planned activities and assess the progress made;
- c) Permit fast and consensual resolution of unexpected problems;
- d) Clarify doubts and prevent misinterpretations of the specifications.

In addition to the Progress Meetings, if necessary, additional meetings to address specific issues to be resolved may be requested by the ITER Organization.

For all Progress Meetings, a document (the Progress Meeting Report) describing tasks done, results obtained, blocking points and action items must be written by the Contractor. Each report will be stored in the ITER IDM in order to ensure traceability of the work performed.

## 12 Delivery time breakdown

See Section 8 – Deliverables and Due Date

## 13 Quality Assurance (QA) requirements

The organisation conducting these activities should have an ITER approved QA Program or an ISO 9001 accredited quality system.

The general requirements are detailed in [ITER Procurement Quality Requirements \(ITER\\_D\\_22MFG4\)](#).

Prior to commencement of the task, a Quality Plan must be submitted for IO approval giving evidence of the above and describing the organisation for this task; the skill of workers involved in the study; any anticipated sub-contractors; and giving details of who will be the independent checker of the activities (see [Procurement Requirements for Producing a Quality Plan \(ITER\\_D\\_22MFMW\)](#)).

Documentation developed as the result of this task shall be retained by the performer of the task or the DA organization for a minimum of 5 years and then may be discarded at the direction of the IO. The use of computer software to perform a safety basis task activity such as analysis and/or modelling, etc. shall be reviewed and approved by the IO prior to its use, in accordance with [Quality Assurance for ITER Safety Codes \(ITER\\_D\\_258LKL\)](#). Identification and control of items shall comply with [ITER\\_D\\_U344WG - Procedure for Identification and Controls of Items](#).

## 14 CAD Design Requirements (if applicable)

CAD requirements are listed below but no CAD work is formally requested in the frame of this contract.

If CAD design tasks are involved, the following shall apply:

The Supplier shall provide a Design Plan to be approved by the IO. Such plan shall identify all design activities and design deliverables to be provided by the Contractor as part of the contract.

The Supplier shall ensure that all designs, CAD data and drawings delivered to IO comply with the Procedure for the Usage of the ITER CAD Manual ([2F6FTX](#)), and with the Procedure for the Management of CAD Work & CAD Data (Models and Drawings [2DWU2M](#)).

The reference scheme is for the Supplier to work in a fully synchronous manner on the ITER CAD platform (see detailed information about synchronous collaboration in the ITER [GNJX6A](#) - Specification for CAD data production in ITER Contracts.). This implies the usage

of the CAD software versions as indicated in CAD Manual 07 - CAD Fact Sheet ([249WUL](#)) and the connection to one of the ITER project CAD data-bases. Any deviation against this requirement shall be defined in a Design Collaboration Implementation Form (DCIF) prepared and approved by DO and included in the call-for-tender package. Any cost or labour resulting from a deviation or non-conformance of the Supplier with regards to the CAD collaboration requirement shall be incurred by the Supplier.

## 15 Safety requirements

ITER is a Nuclear Facility identified in France by the number-INB-174 (“Installation Nucléaire de Base”).

For Protection Important Components and in particular Safety Important Class components (SIC), the French Nuclear Regulation must be observed, in application of the Article 14 of the ITER Agreement.

In such case the Suppliers and Subcontractors must be informed that:

- The Order 7th February 2012 applies to all the components important for the protection (PIC) and the activities important for the protection (PIA).
- The compliance with the INB-order must be demonstrated in the chain of external contractors.
- In application of article II.2.5.4 of the Order 7th February 2012, contracted activities for supervision purposes are also subject to a supervision done by the Nuclear Operator.

For the Protection Important Components, structures and systems of the nuclear facility, and Protection Important Activities the contractor shall ensure that a specific management system is implemented for his own activities and for the activities done by any Supplier and Subcontractor following the requirements of the Order 7th February 2012.

## 16 Appendix: Main features of the Hot Cell Complex

	Demonstrable skills and experience	Main features of the Hot Cell Complex facilities
Nuclear civil engineering of complex large scale project	High technology project	First-of-a-kind or research construction projects
	Strong links with industry and potential Plant manufactures	Wide range of disparate leading edge/high-tech systems and equipment to be designed for in the Preliminary and Construction Design stages in order to avoid risk of change during suppliers manufacturing design.
	International projects	ITER stakeholders are China, the European Union, India, Japan, Korea, Russia and the United States. It corresponds to 35 different nations. The project language is English and safety documentation to be delivered to the French safety authority shall be in French and English.
	Engineering/design	Design and overall integration of : <ul style="list-style-type: none"> <li>- Building structure. Volume HCC 290,000 m<sup>3</sup> nuclear concrete building (B21 and B23)</li> <li>- Approximately 600 rooms within the HCC,</li> <li>- Building systems, e.g. Heating, Ventilation, and Air Conditioning (HVAC), fire protection, electrical distribution, Instrumentation &amp; Control (I&amp;C), liners, red zone cooling,</li> <li>- Mechanical heavy handling, e.g. cranes, doors, trolleys,</li> </ul>
	HVAC and fire protection	2 air change per hour in accessible areas, switch to Detritiation System if tritium above threshold detection (safety function) Management of heat loads, fire loads, air conditioning, fire protection and mitigation
Hot Cells expertise	Network routing (e.g. cabling, piping, HVAC), management of penetrations and anchorage	About 400 Control Cubicles and 100 Electrical Distribution Boards located in the HCB and RWB. Routing of HVAC, cable trays, DS piping in peripheral corridor. Segregation of routing for PIC functions (e.g. power supply, instrumentation)
	Numbers of hot cells / red zones	15 different hot cells in HCB, in total volume of red zones / C4 ventilation class = 26,000 m <sup>3</sup>
	Management of irradiated and contaminated components	Contact dose rate = 250 Sv/h due to activation in the Tokamak. Contamination of tritiated and activated dust on In Vessel components and IRMS Constant efforts to prevent spread of dust in red zones (from

Radwaste management		design stage to operational procedures), ALARA	
	Tritiated environment	High level of tritium concentration > 4000 DAC in red zones Red zone / C4 areas fully covered by stainless steel liner, with an gap between the wall and the liner	
	Nuclear maintenance	10 different hot workshop, 300 m <sup>2</sup> average each, dealing with hands-on maintenance on components after remote decontamination, ALARA	
	Remote heavy handling in red zone	Handling of various heavy components, non-exhaustive list: <ul style="list-style-type: none"> <li>– Equatorial Port Plug (50t, 3.5m length x 2.4 m x 2m),</li> <li>– Upper Port Plug (25t, 6 m length),</li> <li>– Divertor (9t, 3.5m length, 2m high, 0.8m wide),</li> <li>– Vacuum Cryopump (2.9m length, 1.7m diameter),</li> <li>– Oversized Neutral Beam components up to 8m length, 3m high and 3.3m wide</li> </ul> Two lines of defence: high reliability of heavy transfer systems and mitigation means in case of unexpected load drop.	
	Docking of transfer casks	Transfer and docking of Remote Handling Transfer Cask, large size docking door: 2m x 2.4m	
	Treatment of radioactive solid waste	Orders of magnitude during 20 years operation: <ul style="list-style-type: none"> <li>– 1000 tons of MAVL waste</li> <li>– 100 tons FMA-VC</li> <li>– 100 tons purely tritiated waste</li> <li>– 10 tons TFA</li> </ul>	
	Treatment of radioactive liquid effluent	Orders of magnitude: 200 m <sup>3</sup> / year	
	Radwaste process remotely controlled	Type B radwaste process located in the red zones / C4 areas shall be fully remotely controlled (no man access).	
	Hot Cell Remote Handling	Complex remote operation	Port Plug refurbishment, example of tasks to be performed fully remotely: <ul style="list-style-type: none"> <li>– tilting 90° of 50t port plugs,</li> <li>– removal of subcomponents,</li> <li>– welding and control,</li> <li>– testing.</li> </ul>
		Hot Cell Remote Handling	Design and integration of: <ul style="list-style-type: none"> <li>– Tens of heavy duty long range manipulator, fully powered by electrical motors,</li> <li>– Few telescopic power manipulators,</li> <li>– Shielded windows,</li> <li>– Lighting and viewing systems,</li> <li>– Frames and handling tools,</li> </ul> Buffer storage, remote decontamination, hands-on maintenance.

Safety	Centralized control system	Functions such as ventilation management, remote transfers, remote refurbishment of In Vessel Components, remote waste treatment, shall be controlled from a centralized control room located in the Personal Access Control Building
	Seismic requirement	High seismic requirement (2 to 3 g acceleration in different dimensions) on building structure and part of the building system and process which is seismic classified according to the safety analysis
	Safety demonstration	Full traceability of safety requirement, from the “high level” safety requirement to the detailed safety requirement and the related reference documentation Exhaustive list of prevention, detection and mitigation means for each internal and external safety hazard (deterministic approach).
	ALARA	Implementation of the “As Low As Reasonably Achievable” approach into design activities, in particular regarding shielding calculation and hot workshops.
	Human Factor	Human factor integration, definition and tracking of Human Factor requirements, development of virtual mockup and Human Machine Interfaces for the centralized control room.
	French Nuclear Regulator licencing process	Safety analysis of the HCB and RWB based on the outcome of the consolidation / value engineering phase. Then continuous support to the licencing process: answer to ASN request, data and safety analysis for the update of the RPrS.