

Technical Specifications (In-Cash Procurement)

Technical Specification - Nuclear Civil analysis Hot Cell Complex

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

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1 Purpose

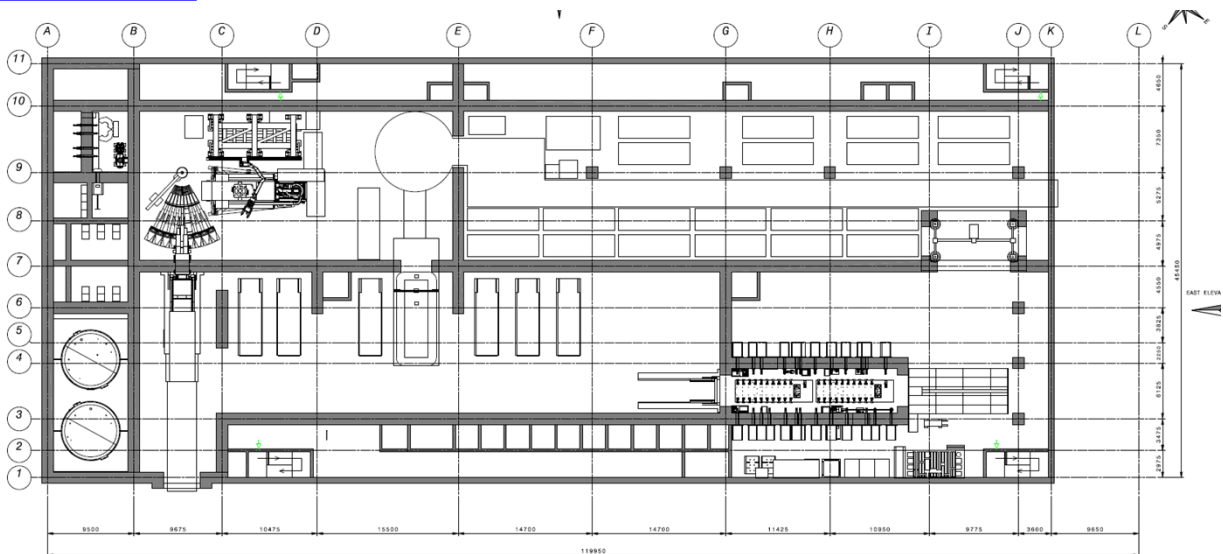
This document aims at specifying the design activities to be performed for the Hot Cell Complex (HCC) pre-conceptual and conceptual studies:

- 1 – Assessment of the Civil Work pre-conceptual design of the Hot Cell Complex,
- 2 – Review of deliverables issued by a third party, proposing in parallel design improvements.
- 3 – Reaction forces calculation for the heavy components of the Hot Cell Complex

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](#).



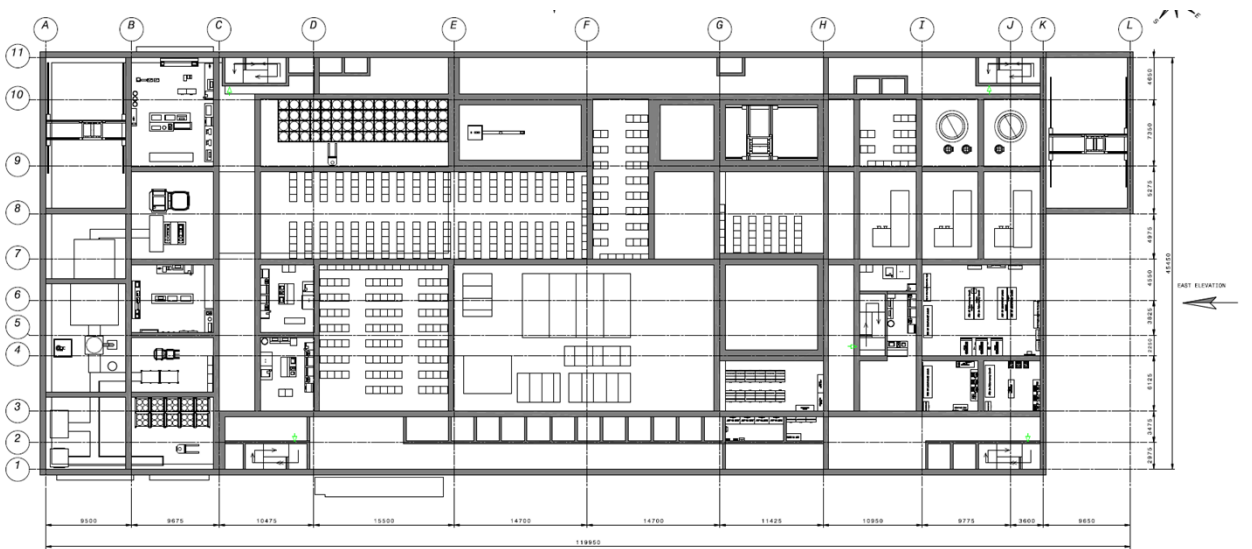
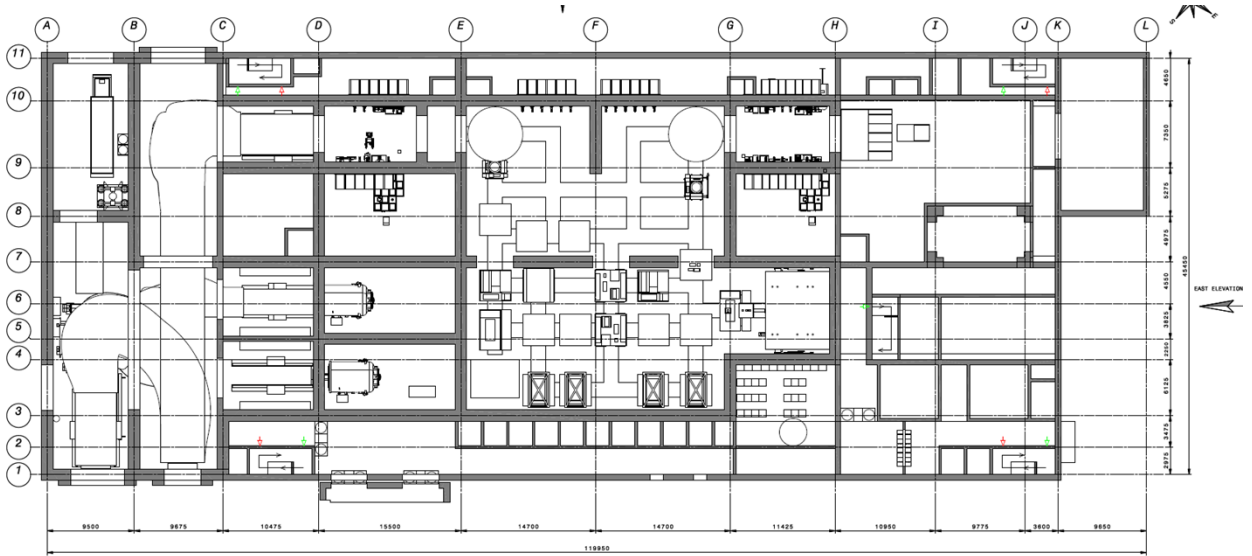


Figure 1 Building 21: B2, L1, and L2 levels (pre-concept)

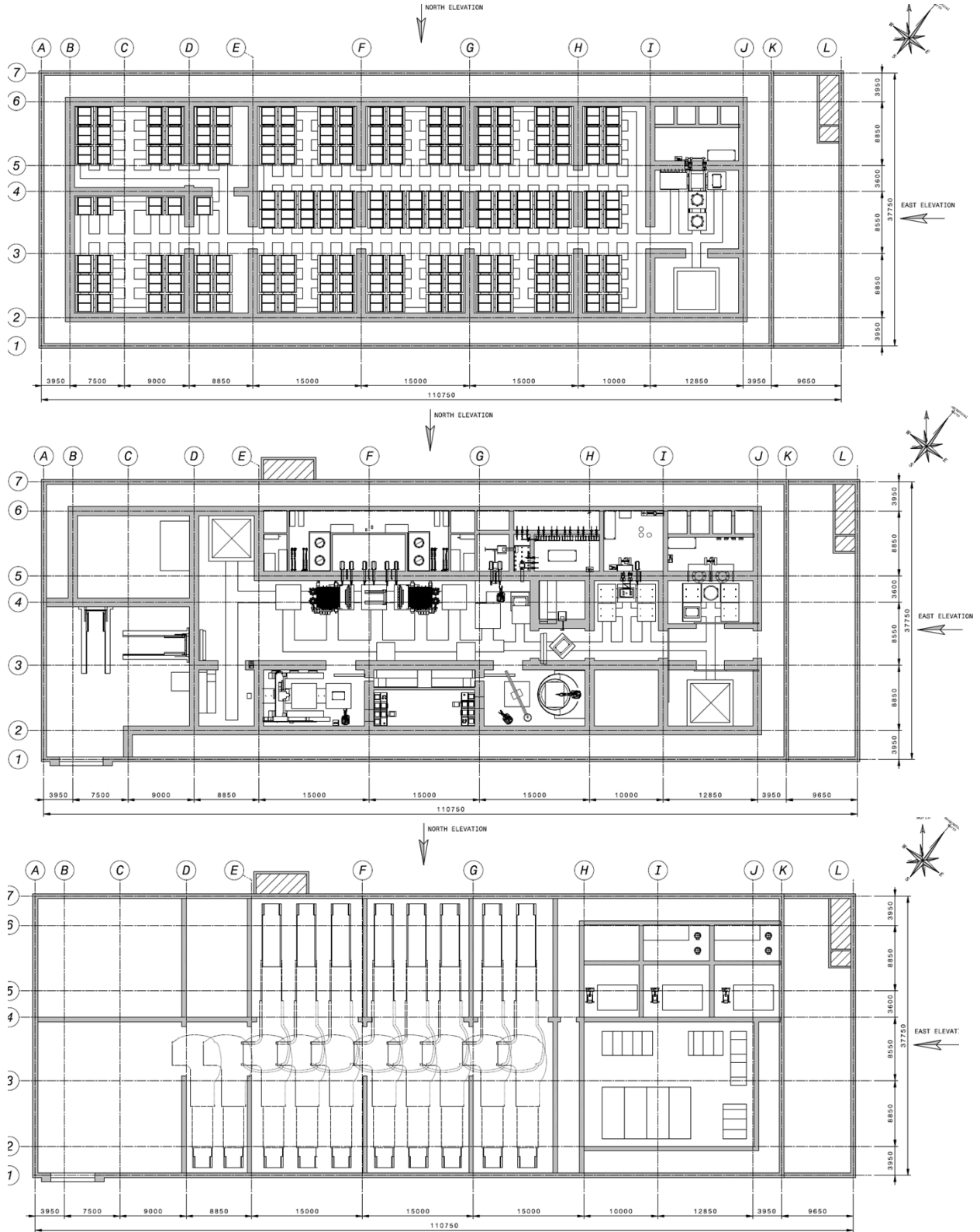


Figure 2 Building 23: B2, L1, and L3 levels (pre-concept)

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 civil work activities, from design optimization to calculations.

6.2 Objective of the contract

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

6.2.1 *Assessment of the civil work pre-concept and recommendations*

The contractor shall perform an assessment of the civil work pre-concept developed by the IO team. This implies to establish the collection of the loads and to make pre-sizing calculations of the structural elements of the HCC buildings.

During this phase, an issue log will be initiated, gathering all the points to be deeper investigated during the conceptual design. The answers to this issue log will be made by technical recommendations, aiming at simplifying as much as possible the design and reducing the cost of the buildings.

This activity corresponds to the Deliverable D1.

6.2.2 *Review and proposed improvement of deliverables elaborated by a third party*

As explained in section 6.1, an engineering activity is planned for next year regarding the HCC buildings and services conceptual design and it is broken down into 3 Work-Packages and many deliverables.

The contractor is asked to review the Civil Work aspects of the deliverables within 2 calendar weeks after reception of the documents. Each comment shall suggest a way to improve the design or the document itself. The type of document to be reviewed is from FEM analysis (including seismic conditions) to concrete outline drawings, anchorage calculation, floor response spectra or construction and installation methodologies. This review shall be in line with the technical rules and guidelines applied on the ITER project.

The contractor's skills shall be in accordance with this technical range. Dedicated civil calculations shall be performed in order to validate the order of magnitude of the outcome of conceptual design deliverables.

This activity corresponds to the Deliverables D2 and D4.

6.2.3 *Reaction forces calculation*

The reaction forces of the heavy loads that are to be installed in the HCC shall be calculated. After the definition of the loading combinations, these forces shall be determined for all the heavy components:

- among the mechanical systems including cranes, trolleys, lifting tables, shielding and confining doors
- for the process equipment, such as the lifting platform, the tilting tower, universal workstation...

This activity corresponds to the Deliverable 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 | <p><u>Assessment of civil work pre-concept</u> and technical recommendations:</p> <ul style="list-style-type: none"> - Load collection for the two buildings, - Pre-sizing calculations, - Issue log for the pre-concept, <p>The issue log will be continuously updated all along the contract.</p> <p><u>Preliminary version of the Civil Work Basis of Design</u></p> | T0 + 3 months |

| D # | Description | Due Dates |
|-----|---|---------------|
| D2 | <p><u>Preliminary review of the deliverables produced by a third party in the frame of the Hot Cell Complex buildings and services conceptual design regarding Civil Work topics, with associated recommendations. Review and recommendations shall be documented based on the lessons learned of the TKM complex, reference to nuclear facilities, code of practices, standards, etc.</u></p> <p>The expected deliverables are at least:</p> <ul style="list-style-type: none"> - Concrete outline drawings - Civil work FE analysis (static and dynamic) - Civil work floor response spectra - Civil work anchorage calculation <p><u>Preliminary version of:</u></p> <ul style="list-style-type: none"> - Construction and installation methodologies - Civil work general arrangement drawings - Civil work layout of loads <p><u>Final version of the Civil Work Basis of design.</u></p> | T0 + 6 months |
| D3 | <p><u>Calculation of the reaction forces for heavy loads</u></p> <p>Inventory and calculation of reaction forces for heavy loads (>20 T), including process equipment.</p> | T0 + 9 months |

| D # | Description | Due Dates |
|-----|---|--------------|
| D4 | <p><u>Final review of the deliverables</u> produced by a third party in the frame of the Hot Cell Complex buildings and services conceptual design regarding Civil Work topics, with associated recommendations. Review and recommendations shall be documented using drawings of existing systems, reference to nuclear facilities, code of practices, standards, etc.</p> <p>The expected deliverables are at least:</p> <ul style="list-style-type: none"> - Concrete outline drawings - Construction and installation methodologies - Civil work basis of design - Civil work general arrangement drawings - Civil work layout of loads - Civil work FE analysis (static and dynamic) - Civil work floor response spectra - Civil work anchorage calculation <p><u>Final version of:</u></p> <ul style="list-style-type: none"> - Construction and installation methodologies - Civil work general arrangement drawings - Civil work layout of loads | 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.

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,
 - Compliance with the technical rules and guidelines applied on the ITER project,

- Respect of quality requirements specified in [ITER_D_22MAL7 - Procedure for Analyses and Calculations](#),
- 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:

- Civil Works design of Nuclear buildings, including calculations and FEM analysis
- Construction and commissioning of nuclear buildings,
- Design and construction of building interfaces (Embedded Plates, penetrations, temporary openings),

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 \(ITER_D_258LKL\)](#).

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. |

| | Demonstrable skills and experience | Main features of the Hot Cell Complex facilities |
|---------------------|--|---|
| | Engineering/design | Design and overall integration of : <ul style="list-style-type: none"> - Building structure. Volume HCC 290,000 m³ nuclear concrete building (B21 and B23) - Approximately 600 rooms within the HCC, - Building systems, e.g. Heating, Ventilation, and Air Conditioning (HVAC), fire protection, electrical distribution, Instrumentation & Control (I&C), liners, red zone cooling, - Mechanical heavy handling, e.g. cranes, doors, trolleys, |
| Hot Cells expertise | Numbers of hot cells / red zones | 15 different hot cells in HCB, in total volume of red zones / C4 ventilation class = 26,000 m ³ |
| | 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 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 ² 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"> - Equatorial Port Plug (50t, 3.5m length x 2.4 m x 2m), - Upper Port Plug (25t, 6 m length), - Divertor (9t, 3.5m length, 2m high, 0.8m wide), - Vacuum Cryopump (2.9m length, 1.7m diameter), - Oversized Neutral Beam components up to 8m length, 3m high and 3.3m wide 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 |
| Radwaste management | Treatment of radioactive solid waste | Orders of magnitude during 20 years operation: <ul style="list-style-type: none"> - 1000 tons of MAVL waste - 100 tons FMA-VC - 100 tons purely tritiated waste - 10 tons TFA |
| | Treatment of radioactive liquid | Orders of magnitude: 200 m ³ / year |

| | Demonstrable skills and experience | Main features of the Hot Cell Complex facilities |
|--------------------------|--|---|
| | effluent 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"> - tilting 90° of 50t port plugs, - removal of subcomponents, - welding and control, - testing. |
| | Hot Cell Remote Handling | Design and integration of: <ul style="list-style-type: none"> - Tens of heavy duty long range manipulator, fully powered by electrical motors, - Few telescopic power manipulators, - Shielded windows, - Lighting and viewing systems, - Frames and handling tools, Buffer storage, remote decontamination, hands-on maintenance. |
| | 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 |