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Technical Specifications (In-Cash Procurement)

Technical Summary - HCF D&B procurement

This document is the technical summary for the HCF D&B procurement, for the Call for Nomination step.

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1 Background

1.1 ITER PROJECT, ITER ORGANIZATION and F4E

ITER is a first of a kind mega-project with a wide range of disparate leading edge/high-tech systems to be assembled and installed into buildings at its site in Saint Paul lez Durance, Cadarache, in the south of France.

The ITER Organization (IO) is the nuclear operator, complying with the relevant French Laws and regulations, authorization, codes and standards applicable to Basic Nuclear Installation (INB). IO is responsible for integrating the activities from the early stage of design to the procurement, the assembly, commissioning and operation. The ITER Members contribute to the ITER Project with contributions in cash to the budget of the IO and with contribution in kind (buildings and/or equipment) through legal entities called “Domestic Agencies”.

The new ITER Research Program (1) and the new Baseline led to the following substantial changes that are impacting the Hot Cell Facility:

- Staged approach of the ITER Research Program: Start of Research Operation / Deuterium Tritium phase 1 (DT-1) / Deuterium Tritium phase 2 (DT-2)
- Beryllium First Wall replaced by Tungsten First Wall
- Revision of maintenance strategy of Port Plugs
- No change of full set Divertors or First Wall Panels during DT-1 (see above)
- Reduced dose rates, reduced contamination levels

Fusion for Energy (F4E) is the EU’s Domestic Agency. It is responsible for delivering Euratom’s contribution to the ITER project and the Broader Approach (EU-Japan agreement on fusion).

Hot Cell Facility is within the scope of both the IO and F4E[1]. Execution of the F4E scope shall be limited to the economic operators that are legally established in the territory of an F4E Member.

Both the IO and F4E may be the Client under the HCF contract.

1.2 Hot Cell Facility

The Hot Cell Facility (HCF), located on the north side of the Tokamak complex (see Figure 1 and Figure 2 below), is composed of its building (Hot Cell Building, HCB) along with its external platform, the processes and the supporting systems (described in section 4.1). The HCF ensures the maintenance of components as well as the radwaste treatment and storage processes. The HCF is described in more details in sections 3.2 and 4.2.1.

Thanks to the opportunities provided by the new ITER Research Program, the following main simplifications have been implemented on HCF requirements for DT1 and design principles:

- Reduced requirements for In-Vessel-Components: Drastic simplification of remote repair and cancellation of the Port Plugs test (thermal cycling)

[1] The F4E scope and the ITER scope are described in section 4.2 of this Call for Nomination.

- No Beryllium risk for hands-on operations
- No need to buffer store a full set of Divertor Cassettes
- No need to change a full set of First Wall Panels
- No need of Radwaste detritiation process
- Limited number of discarded components during DT-1 phase, hence no need to design and build a complex "Radwaste Type B" (*Medium Activity Long Lived Radwaste, ''MAVL Moyenne Activité Vie Longue'' in French*) process / facility
- Limited functions implemented in the HCF
- Reduced Radwaste inventory

In line with an objective of great technical simplification, reduction of cost and schedule, the IO and F4E have redefined high level requirements and demonstrated the feasibility of such design through the pre-concept 2024 design.

1.3 Personal Access Control building

The Personal Access Control Building (PACB) is a building next to the HCF, enabling the control access to the nuclear buildings (HCB, TKC). The second function is to house the control rooms for the supervision of the Hot Cell Facility, together with the TKM remote Handling Systems. The PACB is described in more details in sections 3.3 and 4.2.2.

These functions are located in PACB because they are not associated to the same level of stringent nuclear safety requirements that apply to the HCF.

Abbreviations are given in Appendix 1.

2 Purpose

The HCF Project scope delivered by the Contractor shall be fit for purpose:

- Designed, built and commissioned in full compliance with all safety and functional requirements, performance criteria, technical specifications and inputs, applicable rules, standards and regulations, etc.
- Below a price cap defined by the Client,
- Within the defined milestones
- With construction and operation constraints on ITER site and substantiated with all the requested documentation
- Fully integrated at Interfaces (see section 4.4 below) and with systems outside Contractor scope of supply: either inside the HCF with the central Air detritiation system, or outside the HCF with the Remote Handling (RH) cask, RH transfer and storage containers, radwaste (RW) and Test Blanket Module (TBM) export containers, maintenance and test of Iter Remote Maintenance System (IRMS), cementation and buffer storage of Radwaste (RW) type A, personnel access control building, remote control room, etc.

It must be noted that part of the requested deliverables shall be used as support documentation for the Client to establish safety files associated with the licensing process and to answer to the French nuclear regulator. The ITER facilities constitute a Basic Nuclear Installation (INB "Installation Nucléaire de Base") according to French regulation, specifically identified with the number-INB-174. As such, the Contractor is hereby informed, and shall inform its subcontractors that:

- The Order 7th February 2012 (hereinafter referred to as the INB Order) 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, if any,
- The Protection Important Activities are also subject to a surveillance done by the IO as Nuclear Operator.

3 HCF Project overview

3.1 Main features of plant and building

The HCF is made of a concrete building, located adjacent to the Tokamak (TKM) Complex, north side (see Figure 1) from which it is connected through a number of access ports as shown in Figure 2.

A cargo lift is located in the TKM Complex for the transfer of components and equipment between different floor levels, while personnel access corridors are allowing the entrance of operators.

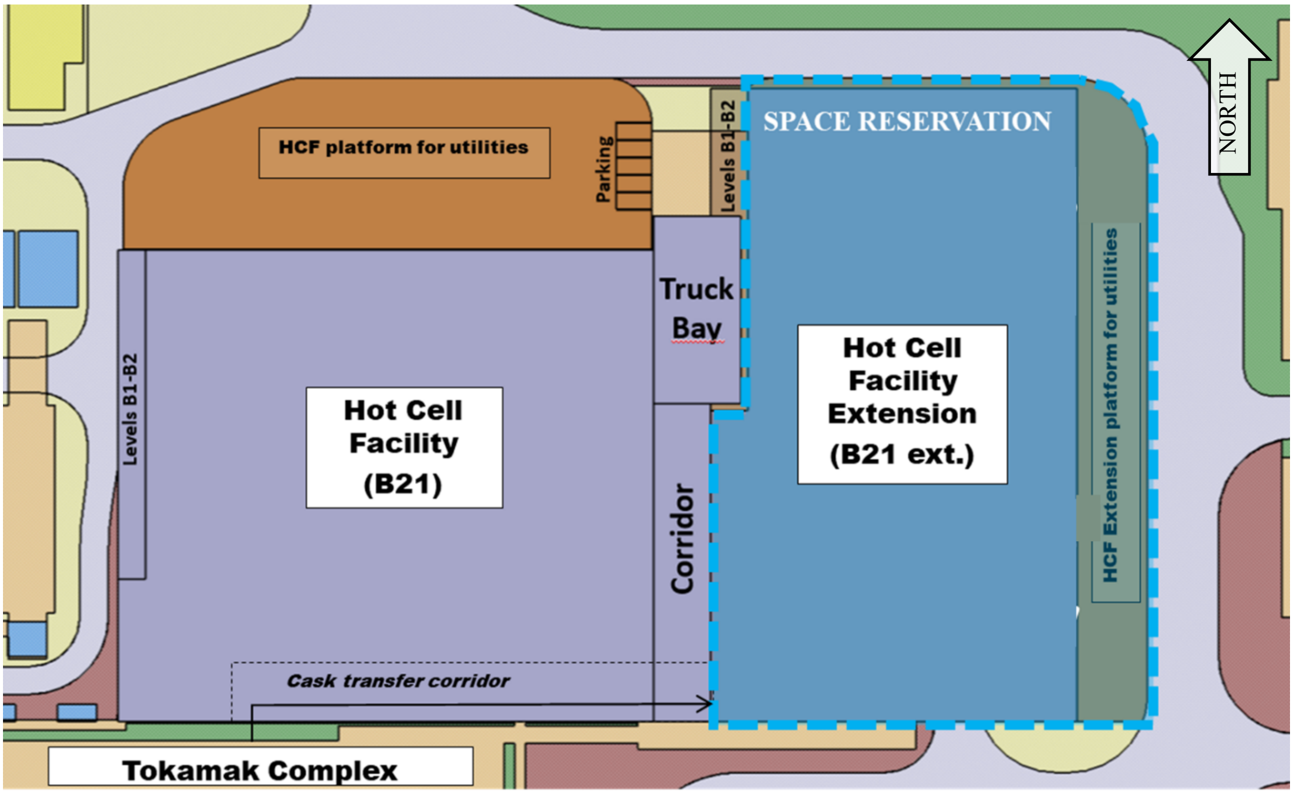


Figure 1: Staged construction of the Hot Cell Facility

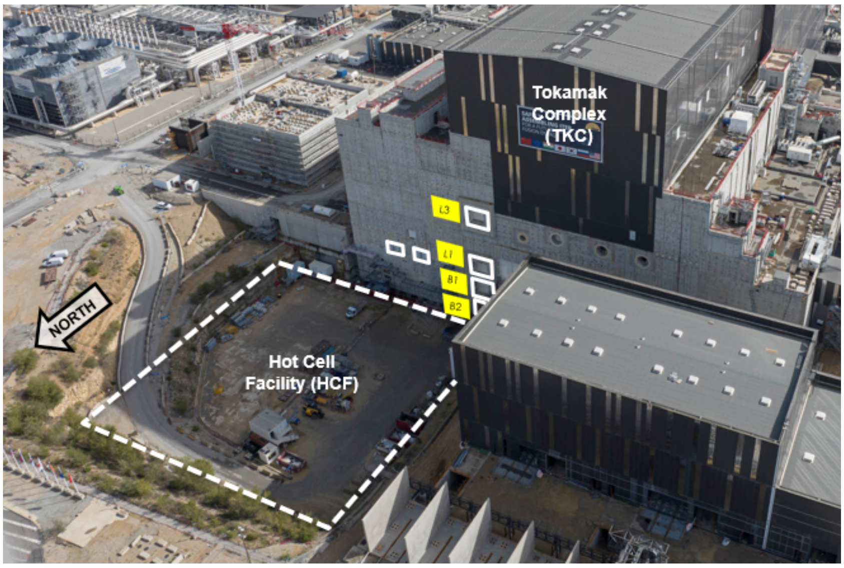


Figure 2: HCB layout area, Site interfaces and constraints

The Hot Cell Facility Extension (HCF ext.), corresponding to B21 ext., is a separate building out of scope of the HCF contract. However, a space reservation is allocated for the next ITER research plan phases for which major interfaces are connected with the HCF.

To be noted that the construction of the HCF could occur at the same time as the construction of the adjacent buildings as well as operation activities (e.g. SRO). This strong constraint shall be considered at an early stage of design, in term of technical feasibility, cost, functional and physical interfaces and coactivity of the work on site (e.g.: HCF construction could occur in a congested/constrained area).
An indicative illustration of the HCF preconcept 2024 is provided in appendix 5.

3.2 Main requirements and functions of the HCF

The HCF shall be ready at start of DT-1 phase. The HCF shall provide the following process functions:

- **Maintenance** of radioactive structures, systems and components (SSC)
- Treatment and storage of **radioactive solid and liquid waste** (radwaste)

The first level of breakdown of these functions covers:

- **Maintenance**:
  - The remote **maintenance** (including cleaning) and **storage** of activated and contaminated **In-Vessel-Components (IVC)**. The IVC are the components located inside the Vacuum Vessel of the Tokamak, facing plasma operations. Maintenance of these components includes replacement or small repair of the component.
  - The **maintenance** and **storage** of **Ex-Vessel-Equipment (EVE)**. The EVE corresponds to equipment located outside the Vacuum Vessel for which the levels of contamination and activation is limited. Maintenance of these equipment includes replacement or repair of the equipment.
  - The remote **decontamination of ITER Remote Maintenance Systems (IRMS)** before their export for maintenance outside the HCF. IRMS covers the remote

handling systems used to remove (and install) in-vessel-components from/to the vacuum vessel.

  - Remote **inspection**, **cleaning**, and **maintenance** of Systems Structures and Components (SSC) permanently located (captive) within areas of the HCB where personnel access is highly restricted or forbidden.
  - Remote **Post Irradiation Examination (PIE)** activities / sample collection to characterise samples coming from the Tokamak and track the source term in the HCF associated with the components received/exported.
- **Radwaste**:
  - Treatment and buffer storage of **Type A solid radwaste** (RW). Type A RW corresponds to low-level waste. Treatment covers sorting, characterization, small volume reduction if necessary, packaging and export outside the HCF
  - Treatment and buffer storage of **liquid radwaste**. The liquid RW includes aqueous and non-aqueous effluents as resins (and possible concentrates). The HCF requires to perform the complete treatment from reception to discharge or export of the liquid RW covering normal operations and accidental scenarios (e.g.: Loss of Coolant Accident (LOCA))
  - Treatment and buffer storage of **TFA RW**. TFA corresponds to very-low-level waste. Limited treatment of TFA RW covers reception, buffer storage, pre-characterization, possible size reduction, pre-packaging and export out of the HCF.

To be noted that:

- many components, equipment and radwaste are contaminated with tritium
- some Type A radwaste have a high level of activation and contamination forbidding hands-on treatment

Alongside of these two main functions, the HCF needs to provide personnel and material access to the Tokamak Complex as well as several laboratories.

The Hot Cell Facility is an INB meaning that all supporting functions and constraints to build, operate and decommission an INB is required (following the French INB Order 7th of February 2012). The following list provides examples of these supporting functions and constraints – *list non-exhaustive*:

- Civil works
- Supporting systems (described in section 4.2.1)
- Security features
- Nuclear safety & occupational safety provisions and features
- Regulations constraints and boundaries
- Operational functions and constraints
- Control, data access and communication
- Decommissioning design requirements

Further details regarding the process functions are provided in appendix 3.

3.3 Main requirements and functions of the PACB

The main PACB functions are:

- To provide an access point personnel to Tokamak Complex (TKC, i.e. Building 11 and Building 14) and HCB and manage all first access control steps,
- To accommodate the control rooms for the supervision, control and monitoring of the remote handling (both Tokamak and Hot Cell Remote Handling operations), radwaste activities and hands-on activities to be performed in the Tokamak Complex and the Hot Cell Building,
- To provide the welfare facilities for the personnel present in PACB, HCB and TKC.

Building 24 (PACB) is a facility planned to ensure the **safe, secure, and regulated access of personnel to the Tokamak Complex (Buildings 11 and 14) and the Hot Cell Building (B21)**. Whereas the PACB would carry out key roles in radiological access control and hygiene, it shall be intended to be classified as a non-nuclear building.

The PACB is intended to serve as the sole personnel entry point to the Tokamak Complex starting from the Integrated Commissioning (IC) phase and continuing into the Start of Research Operations (SRO) phase.

The PACB design shall incorporate robust access control measures to prevent unauthorized entry, safeguard against external threats, and ensure personnel radiation protection and contamination control. These functions shall be supported by the REMS laboratory, real-time monitoring systems, and controlled-access barrier rooms.

The flow of access and exit within the PACB includes the capacity of full body monitor devices.

In addition to managing access, the PACB would house **control rooms** for the supervision, control, and monitoring of operations involving remote handling (both Tokamak and Hot Cell Remote Handling operations) and hands-on tasks conducted within the Tokamak and Hot Cell facilities.

Furthermore, the building would be equipped with **personnel welfare facilities**, including changing rooms, decontamination showers, and sanitary accommodations, to support staff working in Buildings 11, 14, 21, and the PACB itself. These spaces would ensure that all personnel follow appropriate decontamination protocols before entering or exiting radiologically controlled areas.

The PACB is also planned to incorporate contamination monitoring systems, laundry handling areas, and wastewater management infrastructure. Wastewater from decontamination processes would be collected in holding tanks for sampling if it cannot be demonstrated that they can be released in the site industrial drainage network. Contaminated water would be transferred for off-site treatment, while clean water would be discharged to the site's sanitary drainage system.

To comply with radiological safety standards, the building shall enforce unicity of passage and segregation of access by building.

As an order of magnitude, the PACB facility involves the following features:

- Approximately 190 staff accessing Buildings 11 and 14,
- Approximately 50 staff entering Building 21,
- Expected < 50 operators working in the Remote Handling Control Room (RHCR).

3.4 Stakeholders and other companies

A Design & Build approach has been chosen as the preferred option for the delivery of the scope.

Beyond the contractual link with the client, the Contractor (for HCF design and build) may be in interaction with other stakeholders in charge of activities in relation with the HCF contract and more widely with the ITER Project. Among the potential stakeholders in interface with the Contractor, there may be contractors in charge of (the following list is not exhaustive):

- Audit
- Occupational health and safety
- Legal inspection
- Any expertise required by the client
- Client's Insurances
- Etc.

Please see also Appendix 2 for conflict-of-interest principles.

4 Contractor's Scope of Work

4.1 HCF Project scope

The HCF Project includes the delivery of the processes, building, Supporting Systems and external platform for the Hot Cell Facility. It includes all phases from First Design phase (delivered during Competitive Dialogue, part of the procurement process), the Detailed Design phase, as well as qualification, the Construction phase up to test and commissioning phase. Each phase is described in section 4.6 and shall cope with the functional needs described in section 3.2.

The HCF Project includes also the design of the PACB, the construction of the PACB will likely be an option, this scope will be confirmed during the procurement process.

The Contractor shall deliver an integrated and operational facility, including nuclear safety (see appendix 4) up to its defined scope boundaries and associated external boundaries interfaces. Figure 3 provides a schematic overview of the HCF Contractor scope.

The procurement procedure is presented in section 6.

4.2 Contractor scope

More specifically, the Contractor's scope and boundaries at high-level for this procurement are:

4.2.1 For HCF

- **Processes**:
  - Remote handling maintenance:
    - In-Vessel-Components maintenance
    - IRMS: decontamination processes
  - Integration of Ex-Vessel-Equipment maintenance
  - Radwaste management
    - Type A solid RW: treatment and buffer storage
    - Liquid RW treatment and storage
    - TFA: only reception, characterization, buffer storage and size reduction for large components
- **Building and its associated external platform and mechanical systems**:
  - Hot Cell Building (HCB) and its external platform civil works
    - Geotechnics and foundations: site-specific studies, excavation works, foundation design, soil improvement measures based on geotechnical assessments
    - Site preparation: site clearance, earthworks, drainage and utilities integration
    - Structures: Reinforced concrete, steel structures, embedded items potential stainless-steel liner
    - Metal works: steel works and platforms
    - Earthing and lightning protection
    - Finishing: decontaminated and anti-dust paint

    - Mechanical building systems: doors, handling and lifting means
- Bridges between HCB and TKM
- Site integration
- Long-term sustainable structure for the existing HCC temporary retention wall located between the Zone 7W (South-East of Building 14) and the HCF (see figures in Appendix 6)

- **HCF Supporting Systems**:
  - Nuclear HVAC systems & LAC (Local Air Coolers) systems, drainage systems, fire detection & suppression systems within the HCF
  - Air Detritiation System (ADS): Network distribution of ADS within HCF
  - Liquid & Gas (LGAS): network distribution within HCF
  - Power Supply and Electrical distribution: power supply distribution within HCF and including Load Center in the scope and interface with other ITER buildings
  - Chilled Water System (CHWS): SIC and non-SIC
  - Cable Trays including the routing of the cables and pulling/termination for all systems inside the building and technical galleries within HCF is in scope
  - Instrumentation & Control (I&C) for all Systems provided by Contractor.
  - CODAC, Central Interlock System & Central Safety System: Instrumentation and Control system for all the systems is in the scope. Integration of common network architecture and interface with the CODAC, Central Interlock System & Central Safety System and ITER site buildings are in the scope
  - Access Control: doors, camera, sensors, security access in scope and major interface with ITER security requirements
  - Radiological and environmental monitoring systems (REMS).

The ownership of the scope is split as follows:

PBS	Discipline / Scope	SCOPE
61	Infrastructure works	F4E
62	Civil Works	F4E
	Finishing Works	F4E
	Liner	F4E
	HVAC	F4E
	Building Electrical systems	F4E
	Control and Instrumentation	F4E
	Fire Detection, Alarm and Protection	F4E
	Nuclear Drainage	F4E
	Mechanical Equipment - cranes	F4E
	Mechanical Equipment - doors	F4E
	Mechanical Equipment - Lifts, turnstiles	F4E
65	Liquid and Gas Networks	F4E
23	Remote Handling	IO
26	Cooling Water Systems – H1 (PIC) South	IO
	Cooling Water Systems – H1/H3 (PIC) North	IO
	Cooling Water Systems – H2 non-PIC	IO
32	Tritium Plant (DS) – piping routing	IO
43	Steady State Power Supplies – Load Centre	F4E
44	Cable Trays of the HCF	F4E
45	CODAC	IO
46	Central Interlock System	IO
48	Central Safety System	IO
64	Radiological and Environmental Monitoring	F4E
	Radiological and Environmental Monitoring - routings	F4E
66	Radwaste Treatment and Storage, except Type A	IO
	Radwaste Treatment Type A	IO
69	Access Control – Security	IO
	Access Control – Communication with safety	IO

4.2.2 For PACB

The contractor is responsible to design (as firm part of the future contract) and built (as an option of the future contract) the PACB.

Similarly to the HCF, the Contractor shall be responsible for the complete design, procurement, construction, testing, and commissioning of all technical areas introduced above for the PACB in section 3.

It is the responsibility of the Contractor to arrange the necessary infrastructures considering the clearance area for the Hot Cell extension.

The scope includes the foundations, main structure, earthing and lightning protection systems, finishing works as well as all technical services such as heating, ventilation and air conditioning (HVAC), mechanical, electrical, instrumentation and control, potable water, drainage, handling devices, fire detection and protection, and all equipment related to the access, control rooms and welfare functions.

PACB is F4E scope.

4.3 Out of Contractor's scope

- **Processes**:
  - Maintenance for Remote Handling Systems: *maintenance and test of IRMS are out of scope*
  - Radwaste type A solid: *cementation and buffer storage before export out of ITER site are out of scope*
  - Radwaste *TFA: buffer storage and characterization before export from ITER site is out of scope*)
- **Building and its associated external platform and mechanical systems**:
  - NB cell door in TKM is excluded
  - Temporary Fence with INB area
  - As mentioned previously, it is reminded that HCF extension is excluded
- **HCF supporting systems**:
  - Air Detritiation System (ADS): HCF central unit systems design and supply are out of scope
  - Chilled Water SIC: Chillers unit capacities in TKC are out of scope with interface for the connection to HCF (see below)
  - Cask & Plug Remote Handling System (CPRHS): out of scope but major interface
  - Transfer and storage of IRMS equipment is out of scope,
  - Delivery of radwaste containers during operation is out of scope,
  - Design and delivery of TBM shipping flask is out of scope.

4.4 Scope boundaries and interfaces

4.4.1 Internal and external interfaces

Internal Interfaces correspond the interfaces between systems or equipment within the HCF Project Contractor scope. External boundaries Interfaces correspond to the interfaces at the boundaries of the Contractor scope, meaning between a system (or equipment) within the Contractor's scope and a system out of the scope.

The HCF is part of the global ITER Project and thus must interface at its external boundaries with multiple project stakeholders, mainly:

- The Tokamak clients (i.e. In Vessel Components, Ex Vessel Equipment, IRMS, RW producers, etc.)
- The available centralized ITER support systems (electrical power, site utilities, cooling water, other site infrastructures, etc.)
- Other nuclear maintenance and radwaste systems (Hot Cell Extension, TFA Facility, Cold Test Facility, etc.) located outside of HCF (out of Contractor's scope) on ITER site
- The HCF will also need to interface with different external services (final repositories, outsourcing services, etc.)

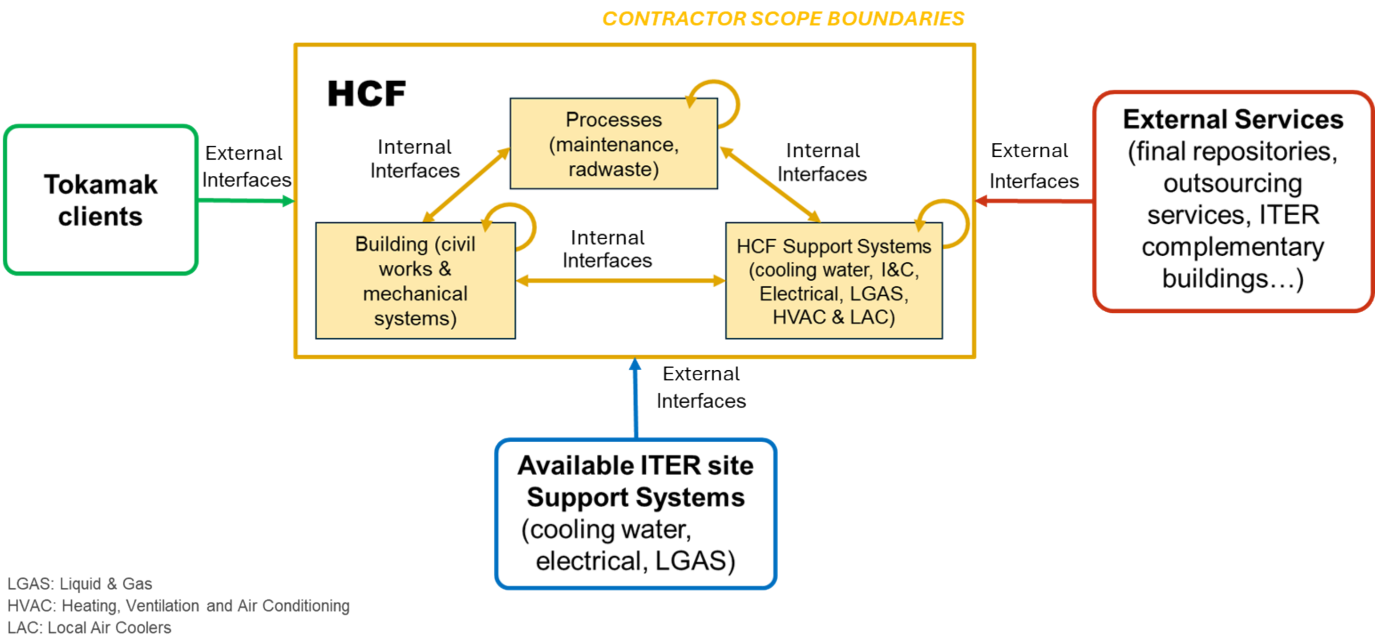


Figure 3: HCF scope and its internal and external interfaces

The HCF shall take into consideration the design of the different clients (IVC clients, Port Cell Equipment, miscellaneous…) which cover a great range of overall dimensions, weights and radiological content: from an activated Port Plug weighting several tenth of tons to much more standard pieces of equipment (pipes, valves, etc.).

Attention will need to be given to the differences of design maturity levels of the clients which will go from conceptual design level to already built components.

The HCF shall also respect the constraints coming from the site, for example:

- Global footprint allocation (for final building and construction phase)

- Civil work interfaces with the TKM building (Cargo Lift, NB Cell, Effluent tunnels)
- Road accesses
- Existing underground network
- Site utility allocations to the HCF (maximum electrical power supply demand, maximum Liquid and Gas supply allocation, maximum cooling water supply, etc.)
- Detritiation System capacities (HCF Air Detritiation System) and Water Detritiation System located in the Tokamak Complex,
- Surrounding buildings (existing, in construction, in operation, or planned after Hot Cell Facility construction)

The Contractor will be provided with External boundary Interface requirements. The Contractor will be in charge to ensure compliance with these External boundaries Interfaces requirement and to collaborate with the Client.

In addition, the Contractor shall develop the Internal Interfaces to the HCF, notably in between:

- the different process systems
- the HCF internal Supporting Systems (see definition in section 4.2.1)
- the building and all the systems contained in the HCB
- all the miscellaneous equipment located in the HCB

4.4.2 Main External interfaces

The list below is providing few examples of external interfaces between HCF Contractor scope and ITER support systems:

- Interface with Cask and Plug Remote Handling Systems (CPRHS)
- Interface with HCF central DS unit systems
- Interface with the stack located on B14 for HVAC
- Interface with TKM chilled water supply (SIC) for supply to HCF
- Interface with the CODAC, Central Interlock System & Central Safety System
- Interface with ITER security system
- Interface with Electrical power supply
- Interface with supply connections for the demineralized water, for the potable water network, for the breathing air site production, compressed air, hot water site network
- Interface with industrial drainage, precipitation drainage,

4.5 Main missions

The main missions of the Contractor shall notably be, for the whole implementation phase from Competitive Dialogue, contract award to the start of HCF operation:

- To successfully deliver the Contractor's scope described in section 4.1.
- To deliver and be accountable at each phase for the delivery of a fully integrated and functional HCF fit for its purpose, and within the price cap, schedule, requirements and performance.
- To ensure the global integration of all the systems at each phase (including systems out of scope, such central DS, RH cask, cementation mobile unit, IRMS container, etc)
- To perform the Nuclear Safety analyses, and to support the Client (Nuclear operator) in its exchanges with the French nuclear regulator ASNR

- To manage and control the HCF Project configuration, to track and propagate requirements
- To managed and be accountable for the HCF Project interfaces
- To develop and lead the implementation of the Quality Management system for the HFC Project, compliant with the IO MQP and approved by the Client
- To control, managed and report the Project costs, schedule and R&O in close coordination with the Client
- To work closely with the Client and identified stakeholders
- To handle ITER RESTRICTED information according to specific protection measures

4.6 Overview of phases

The Contractor shall develop a design plan that considers the different maturity levels of the systems and the Client's document schedule in an integrated engineering sequence.

First Design phase

The First Design phase will be performed during the Competitive Dialogue phase of the procurement procedure. It will allow the bidders to develop their solution (technical, cost, schedule) to a level sufficient for the bidders to commit on a robust and stable design and build firm offer. Similarly, it will enable the Client to select the best offer and award the contract to the selected bidder to deliver its offered solution.

Detailed Design phase

Upon contract signature, the contract execution phase shall start with the Detailed Design phase. This phase aims to complete the design to a level where the final definition of the facility is sufficiently complete to allow committing on and starting the manufacturing and construction, substantiated with a complete set of justification documents. It is the last phase before entering into construction phase.

Qualification phase

The Qualification phase shall start together with the Detailed Design phase and shall be completed ideally before launching the manufacturing for the SIC components identified by the qualification program.

Construction phase

The Construction phase includes manufacturing and supplies, the civil work construction, the support systems and processes installation, up to mechanical completion. The mechanical completion is the completion of a multi-disciplines system and the verification that the system has been correctly installed according to the procedures. It includes electrical, instrumentation, command-control, mechanical, piping, parts and components of the system or sub-system. Noted that the construction phase includes all associated design activities.

Test and Commissioning phase

The Test and Commissioning phase will allow to perform all required test and commissioning (at both the system and facility levels) to demonstrate compliance with all requirements and to finalize the demonstration of performances at all levels (systems, facility level, etc.).

The Contractor shall handle ITER RESTRICTED information according to specific protection measures.

4.7 Client / Contractor interactions

All along the contract execution, the Client will not interfere (expect for specific topics described below or in the contract), and the Contractor remains fully responsible and accountable for its entire scope, including for the implementation of opportunities such as:

- A significant opportunity to add value through adoption of best-in-class procurement and contractual arrangements
- A significant opportunity to reduce project costs and optimize schedule by the adoption of best technological solution, standardization and use of COTS, best engineering sequence, and the early involvement of manufacturers and construction contractors in the design and construction phase

However, The HCF Project is characterised by features and topics that require specific interactions between the Contractor and the Client, such as:

- A need to interact efficiently with the Client for specific topics related to INB order and Nuclear Operator duties, such as for nuclear safety cases, licensing, etc
- Multiple scope boundaries interfaces between the Contractor and the Client, requiring dedicated organization for a successful management
- Site constraints management (e.g. access, co-activity, see section 3.1)

The contract may be improved with collaborative clauses and rules to be adjusted during the Competitive Dialogue phase.

4.8 Example of the expected main Contractor deliverables

Hereunder are few examples (limited list, non-exhaustive) of typical high-level deliverables that will be requested. The detailed list will be updated and clarified per phase in the technical specification at the Competitive Dialogue stage.

Design Management		
Design Plan and integrated engineering sequence	Document Production Plan	System management plan
Surveillance Plan	Change request & management	Deliverable list
Quality Plan	Procurement record	R&O report
Design description		
System Design Description (SDD)	Design justification	Previous ROX
System load specification	Electrical load list	Fire loads
General Arrangements	Drawings (Sub-assembly, detail, iso)	Building drawings
Process Flow Diagram (PFD)	Piping and Instrumentation Diagrams	Doors schedule
Electrical diagrams	I&C documents	Bill of Material
Component list	Mechanical engineering model	Structural integrity report
Detailed Model	Software/programming Code	Calculation Reports
Systems Detailed Performance Def	Components technical specification	Tech spec to suppliers
Qualification Summary Report	Failure Modes and Effects Analysis / Failure Modes Effects and Criticality Analysis (FMEA/FMECA)	Hazard Identification and Risk Analysis (HIRA)
R&D plans	Equipment or Component List	Fire Protection analysis

Investment Protection analysis	ALARA Analysis	Human Factor Analysis
Occupational Radiation exposure (ORE) assessment	List of PIC/SIC components	Maintenance plan
Mock-up and trials reports (physical and VR)	Component Classification Documents	Design calculations
Interface Control Document (ICD)	Interface Sheet (IS)	Finite Element Models (FEM)
RAMI Analysis	Remote Handling Compatibility Assessment (RHCA)	Remote Handling Plant Definition Form (PDF)
Remote Handling Task Definition Form (TDF)	Hazard Identification and Risk Assessment (HIRA) Analysis	Technical Procurement Specifications
Seismic analyses	Radiation hardness analyses	Heat loads analysis
Manufacturability analyses	Constructability analyses	Maintainability analyses
Manufacturing, construction, assembly and installation		
Part drawing	Factory Qualification Test Plan	Acceptance Plan
Inspection & Test report	On-site assembly Plan	Manufacturing drawings
Shipping or Logistic plan	Assembly/Installation Plan	Assembly/Installation drawing
Operation, Maintenance, and decommissioning		
Operations and maintenance manuals	Operational Sequence Descriptions (OSDs)	Operations management database and system
Maintenance or inspection plan	Maintenance instructions	Decommissioning Plan
System engineering, integration, justification		
Detailed functional analysis for each phase of design	Compliance against functions, performances and requirements	Design compliance Matrix
Configuration management model	Interface Compliance Matrix	Design justification plan
2D plans (Civil works and General Arrangements)	3D models (compatible with IO tools and databases)	Level of details per design phase and margins definition
Integration reports (including clash analysis)	Transverse functions implementation	Transfer of models under IO format
Nuclear Safety		
Safety options file is the main deliverable at the end of the Competitive Dialogue. "Rapport de sureté" Hot cell Safety file and supporting documents corresponding to the level of maturity of each design phase. Operation limits and conditions "Règles générales d'exploitation" Etc…		
Project Management		
HCF detailed wbs	HCF detailed schedule	HCF cost estimate
HCF risks and opportunities register	Project management plan	Lessons learn, root cause, non-conformity management
Etc…		

5 HCF Project Timeline

The HCF project timeline encompasses the long-term scope of the contract, from contract award to completion of the integrated test and commissioning and start of operation. This contract requires a long-term involvement. The requirements on detailed schedule and mechanism will be presented at later stage of this procurement procedure, and the Contractor will develop its delivery schedule in compliance with those requirements.

Figure 4 gives a conservative illustration of the potential sequence of activities up to the Deuterium Tritium Operation (DT-1) phase. It may be subject to changes.

The contractual schedule will be finalized during the Competitive Dialogue process. Upon contract signature, this schedule shall allow sufficient margin and buffer against this timeline to mitigate risks and secure delivery for DT1 operation, while it is intended to provide the Contractor with acceptable flexibility in its implementation sequence to achieve optimization and schedule performance.

To be noted that:

- Maintaining the schedule is crucial for the timely release of a key project stage gate by the French nuclear regulator (Autorité de Sûreté Nucléaire et de Radioprotection “ASNR”).
- It is expected from the Contractor that technical solutions would be based on existing and proven techniques, aiming at reducing risks and delivery at fixed price. That said, innovative and disruptive solutions that reduce risks and delivery at fixed price are welcome.

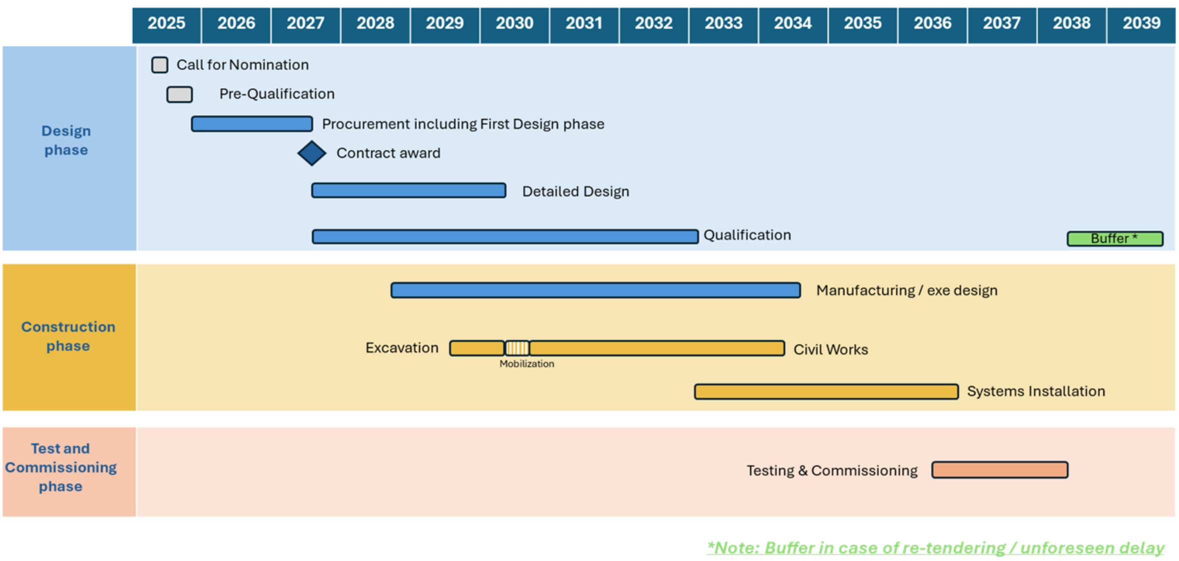


Figure 4 : Illustration of the potential sequence of activities – illustration only

6 Procurement Procedure

The chosen procurement procedure is Competitive Dialogue.

Competitive Dialogue is a procedure allowing competition, which is introduced for procurements that are complex in nature, where technical parameters are difficult or not defined in advance and need to be addressed with qualified selected economic operators (bidders).

Competitive Dialogue procedure follows Call for Nomination (CFN) and Pre-Qualification (PQ). First, the CFN process, the IO formally invites the Domestic Agencies to nominate potential candidates that are capable of providing the required supplies, services or works in order to enable the IO to pre-qualify the nominated companies. Second, the PQ process ensures that offers are sought only from qualified Candidates who have the requisite capacity and experience to satisfactorily perform the intended work. The aim of the PQ is to establish a list of qualified candidates based on the set of selection criteria. PQ process is conducted and the limited pre-qualified candidates are invited to take part in a Competitive Dialogue process.

Maximum 3 bidders will be selected from the PQ phase to participate during the Competitive Dialogue, while each and in parallel will produce, a First Design stage and the cost estimate of the scope with its associated time schedule

The main objectives of the Competitive Dialogue are the following:

- To achieve the most suitable design compliant with the nuclear safety objectives, the system requirements and the facility performances which enables to commit to the fixed price.
- To obtain a fixed price for the HCF below the price cap defined by the client
- To obtain an optimized long-term schedule meeting the target delivery date and intermediate milestones
- Bidders to endorse the functional and nuclear safety requirements and confirm the exhaustivity and clarity of technical specifications
- To get a safety demonstration and safety requirements compliant with the safety objectives
- Compliance with the resulting specifications
- To establish a cost-effective engineering process allowing to optimize the concurrent engineering and the construction sequence
- To identify cost-effective construction methods and technologies
- To refine and to agree the contractual scheme,
- To secure the early Contractor involvement and the long-term commitment
- To establish the basis of the safety demonstration (DOS)
- To enable the initiation of detailed design stage

The organisation of the Competitive Dialogue may be based on the following principles and steps:

In Competitive Dialogue, any qualified companies/consortia (bidders) submit an initial tender, in which proposed solutions will be further discussed and elaborated with the bidders.

The dialogue continues until one or more solutions are judged to satisfy the requirements. During the dialogue, contractual and commercial conditions are also developed to reflect the progress made in developing solutions. At this stage, the dialogue is concluded, and the bidders are invited to submit a best and final offer based on the finalized technical specifications and contractual conditions.

The Competitive Dialogue will result in a design and build contract awarded to the best value for money tender according to the criteria that will be defined in the Instructions To Tenderers.

Such contract will be awarded to a fixed price and the IO and F4E reserve the right to award one or several contracts at the end of the Competitive Dialogue. The works will be assigned progressively.

Bidders will be compensated during the First Design phase, per rules defined in the tender process.

The competitive dialogue is foreseen to last 18 months in total.

The compensation is a lump-sum amount dedicated to indemnifying the delivery of the First Design stage and the cost estimate of HCF Project at completion with its associated time schedule.

Specific mechanisms will be set-up to guarantee the full payment of the lump-sum as long as intermediate deliveries (i.e. commercial and technical offers) meet specific requirements that will be developed in the Instructions To Tenderers at later stage of the procurement procedure.

7 Procurement Schedule

A tentative timetable is outlined as follows:

Procurement Schedule	Tentative Schedule
Issue Call For Nomination	
Receipt deadline of Call For Nomination	
Issue pre-qualification	30th July 2025
Receipt of pre-qualification	16 October 2025
Issue Competitive Dialogue	15th December 2025
Best and Final Offer Submission	16th June 2027
Estimated Contract award date	27th October 2027

Table 1: Tentative Timetable of the procurement

8 Application

The Client intends to award a contract to a single entity or grouping which will be called "Contractor" under the contract. The grouping could take different forms such as permanently and legally established one, or an ad-hoc consortium established for a specific tender procedure or project.

Application to the Competitive Dialogue tendering procedure is open to all legal entities participating either individually (as a single entity) or as consortium provided that:

1. A single entity, or consortium leader, and consortium member(s) and subcontractor(s) must be those entities established within the ITER member states.
2. The execution of the scope funded by the European Union (see the F4E scope and the ITER Scope described in section 4.2 of this Call for Nomination) shall be limited to economic operators that are legally established in the territory of a F4E Member.
3. A legal entity cannot participate individually or as a grouping in more than one tender application. Legal entities belonging to the same grouping are allowed to participate separately if they are able to demonstrate independent technical and financial capacities.

In case of consortium, all members (i.e. the leader and all other members) will be jointly and severally liable to the Client. This is the Client's standard requirement to ensure that the consortium as a whole will execute the project scope with full responsibility. Nevertheless, the tenderer could propose an alternative liability scheme and the Client may discuss it during tendering process including Competitive Dialogue if it may be judged pertinent and beneficial for the project.

Applicants (single entity or consortium) must comply with the selection criteria to be defined at the PQ (Pre-Qualification) stage. The details will be clarified at the time of PQ package.

The IO formally invites the Domestic Agencies to nominate potential candidates via Call for Nomination (CFN). Following the nomination (candidate list) submitted by each Domestic Agency to the IO, the Pre-Qualification and Competitive Dialogue will be launched via our digital procurement tool "IPROC".

Interested bidders are kindly requested to register in the IO Ariba e-procurement tool called "IPROC". You can find all links to proceed along with instruction going to: *https://www.iter.org/fr/proc/overview* . When registering in Ariba (IPROC), suppliers are kindly requested to nominate at least one contact person. This contact person will be receiving the notification for the follow-up tender process.

Additionally, when the Pre-Qualification documentation will be published, any interested economic operator will be able to participate in the Pre-Qualification phase by submitting the Pre-Qualification application in response to publication of the Pre-Qualification documentation.

9 HCF Project main features

The HCF Project involves design and construction of a large scale nuclear regulated facility, including building and process, and in particular hot cells, remote handling, radwaste management, tritium management and safety analysis, as exchanges with the ASNR.

The HCF Project involves the following activities:

<table>
<tr><th></th><th>Domain</th><th>Activities</th></tr>
<tr><td rowspan="4">Project Management</td><td>Project Control</td><td>- Design to Cost method
- Fixed price approach
- Cost estimate
- Schedule update and progress monitoring
- Baseline Change Procedure
- Earned Value Management
- Risk and Opportunity management</td></tr>
<tr><td>Technical management</td><td>- Design development for all disciplines
- Manufacturing and supply for all disciplines
- Construction and installation for all disciplines
- Integration, management of Configuration, Requirements, interface, requirements, Interface
- System Engineering
- Digital Mock-up</td></tr>
<tr><td>Quality management</td><td>- Quality in complex EPC projects
- Systems thinking quality approach
- Management of globalized supply chain
- Data Management
- Quality risk management</td></tr>
<tr><td>Complex Project Challenges</td><td>- Development, support of resilient, sustainable solutions to manage Project challenges</td></tr>
</table>

The HCF Project involves the following technical features:

	Domain	Main features of the HCF
Nuclear civil engineering of complex large scale project		
	Strong links with industry and potential Plant manufactures	Some disparate leading edge/high-tech systems and equipment to be designed for in the Preliminary and Construction Design stages 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. 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 (see scope for exhaustive details): - Building structure. Net Volume HCF 100,000 m^3 nuclear concrete building - Approximately 200 rooms within the HCF including process rooms but also shafts, airlocks, changing room, segregation of confinement and external aggressors' systems, corridors, etc - Building systems, e.g. Heating, Ventilation, and Air Conditioning (HVAC), fire protection, electrical distribution, Instrumentation & Control (I&C), cabling, liners, red zone cooling, - Mechanical heavy handling, e.g. cranes, nuclear shielding and confinement doors, trolleys, - Utilities platform e.g. electrical systems (load centers), liquid and gas production and distribution, tank storage, fire protection and evacuation, etc.
	Nuclear HVAC	Nuclear HVAC system applying ISO17873 standard recommendations and promoting the isolation of the rooms upon tritium detection. Red zones cooling function
	Fire Protection	Management of fire loads, air conditioning, fire protection and mitigation
	Network routing (e.g. cabling, piping, HVAC), management of penetrations and anchorage	Approximately 350+ Instrumentation panels and 130+ Electrical distribution boards is to be in the building. Also, there are Distribution Transformers, MV/LV switchgears, UPS and batteries located inside the Load Center associated with HCB. Approximate Cable Trays (highways) length is 15kM+. Routing of HVAC, cable trays, DS piping. Segregation of routing for PIC functions (e.g. power supply, instrumentation)
Hot Cells expertise	Numbers of hot cells / red zones	Hot cells in HCF, in total volume of red zones / C4 ventilation class = 1,600 m^3 : Including decay buffer storage area, operation buffer, maintenance, export of Test Blanket modules and Post Irradiation operation and cleaning and decontamination red/C4 zones. There are temporary red zones. For example: • The cask is not shielded, and the transfer of activated components leads to temporary red zones like the cask transfer area. • The transfer of liquid radwaste to the drain tank room can lead to temporary red zone depending on the scenario of transfer.

	Domain	Main features of the HCF
	Management of irradiated and contaminated components	Activated and contaminated objects/components from TKC Radiation sources and order of magnitude for DT1: • activated components/objects: dose rate up to few Sv/h • Activated dust (mix of Tungsten, stainless-steel, boron), around 200 kg spread on components/objects • Tritium, around 100 g spread on components /objects • ACP in water, filters, resins
	Tritiated environment	Tritium contaminated components leading (through outgassing and dust resuspension) to airborne contamination in premises up to C4** (ISO 17873), T4** (ISO level 16646) levels.
	Nuclear maintenance	Multiple large hot workshops, providing the space and means to perform hands-on maintenance on components and in-vessel remote handling systems, following remote decontamination.
	Remote heavy handling in red zone	Remote handling and management of various large and heavy components in the performance of cleaning, decontamination, inspection, Post Irradiation Examination and limited maintenance. Approximate mass and size of components to be handled include, but are not limited to: – 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 First Wall and Shield Block (5t, ~1m x 1m)
	Docking of transfer casks	Transfer and docking of Remote Handing Transfer Cask, large size confinement docking system, ~2m x 2.4m
Radwaste management	Treatment of radioactive solid waste	Cutting of large metallic waste, sampling, packaging, sorting, characterization, laboratory analysis, tritiated waste container storage, radwaste container transport, radioactive sample export Orders of magnitude for 10 years operation: – 100 tons FMA-VC with low dose rate (for processing) – 600 tons FMA-VC with high dose rate (for storage) – 50 tons purely tritiated waste – 700 tons TFA
	Treatment of radioactive liquid effluent	Design of radioactive liquid effluent storage and processing systems: storage, transfer, evaporation, filtration, ion exchange, sampling, laboratory analysis Orders of magnitude: - 200 m^3 / year of high activity aqueous effluents - 1000 m3/year of low activities aqueous effluents - 7 m3/year spent resins, 7 m3/y oils, 500 litre/y scintillation cocktails
	Complex remote operation	Remote performance of cleaning, decontamination, inspection, Post Irradiation Examination and limited maintenance. Design and integration of: – Power manipulators / mobile robotic systems – Electrical master-slave manipulators – Overhead handling systems – Trolleys / floor mounted movers – Lighting and viewing systems

	Domain	Main features of the HCF
		– Frames and handling tools – Inspection, sampling, cleaning, decontamination, maintenance tooling suites
Safety	Centralized control system	Key features of the HCF centralised control system, located in the PACB (out of scope) are the remote control and operation of building systems (HVAC, cargo lifts and doors, remote transfer systems, remoted maintenance systems for IVC, remote radwaste treatment, environmental and video monitoring systems. Key functions include operational management systems, virtual reality system, digital twin, etc.
	Civil and mechanical works	Large and complex nuclear concrete structures to be design with multiple physical interfaces with equipment and existing buildings and built on a construction site partially in operation. Mechanical works (doors, lifts, handling systems, platforms,...) design, manufacturing and installation with specific confinement/shielding/ seismic requirements
	Seismic requirement	Buildings structures/support systems and process, seismically classified according to the safety analysis, subject to high seismic design and construction requirements, and in particular for the interfaces definition.
	Safety demonstration	Full traceability of safety requirement, from the “high level” safety requirement to the detailed safety requirement, their implementation and the demonstration of meeting the expected performances for the facility, systems and components with a specific focus on safety functions and PIC. Demonstration of compliance with French nuclear and radiation safety regulation and implementation of ITER safety approach regarding safety analysis and demonstration.
	ALARA	A formalized ALARA approach is mandatory and implies that at each design stages, an assessment of the ORE (Occupational Radiation Exposure) should be conducted according to the maturity of the design and the CONOPS and dose reduction measures identified accordingly.
	Human and Organizational Factors (HOF)	Integration of HOF into the design, operation, maintenance and decommissioning is mandatory and should follow the principles and approaches presented in the ITER Human Factor integration plan, The corresponding activities and deliverables are also specified in this plan.
	French Nuclear Regulator licencing process	The licensing process in addition to the milestones associated to the delivery of regulatory safety files implies technical exchanges with the French regulatory bodies. The contractor is expected to contribute to the answers, additional studies and document updates to be provided during this process.

Table 2: HCF Project main features (indicative values)

Appendix 1: Abbreviations

Abbreviation	Definitions
ADC	Complementary Applicable Document
ADS	Air Detritiation System
ALARA	As Low As Reasonably Achievable
ASNR	*« Autorité de Sûreté Nucléaire et de Radioprotection »* - French Safety Authority
Be	Beryllium
C4	Ventilation Classification C4 according to ISO 17873
CFN	Call for Nomination (step of IO procurement)
CODAC	Control, Data Access and Communication
CPRHS	Cask & Plug Remote Handling System
DAC	Derived Atmospheric Contamination
DBA	Design basis accidents
DEC	Design extension conditions
DCM	Design Compliance Matrix
DIR	Design Integration Review
DT1	Deuterium Tritium phase 1 of ITER operation
DT2	Deuterium Tritium phase 2 of ITER operation
ED	Detailed Safety Requirement (former "Exigence Définie")
EVE	Ex-Vessel-Equipment
F4E	Fusion For Energy, European Domestic Agency
FMA-VC	Low and Medium Activity, Short Life Radionuclide (called ''Type A radwaste'' at ITER)
HCB	Hot Cell Building (also referred to ITER Building 21)
HCF	Hot Cell Facility
HCF ext.	Hot Cell Facility Extension
HVAC	Heating, Ventilation, and Air Conditioning
I&C	Instrumentation & Control
ICD	Interface Control Document
INB	« *Installation Nucléaire de Base »* - Nuclear Facility
IRMS	ITER Remote Maintenance System
IS	Interface Sheet
IVC	In-Vessel-Component
LAC	Local Air Cooler

Abbreviation	Definitions
LGAS	Liquid & gas
LOCA	Loss Of Coolant Accident
MAVL	Medium Activity, Long Life Radionuclide (called ‘’Type B radwaste’’ at ITER)
MBSE	Model Based System Engineering
MQP	Management and Quality Program
PACB	Personal Access Control Building
PCR	Project Change Request
P&ID	Piping and Instrumentation Diagram
PIA	Protection Important Activity
PIC	Protection Important Composant
PIE	Post Irradiation Examination
PFD	Process Flow Diagram
PP	Port Plug
PQ	Pre-Qualifcation (step of the IO procurement)
QAP	Quality Assurance Program
QD	Safety Requirement (former “Qualité Définies”)
R&O	Risks and Opportunities
REMS	Radiological, Environmental & Monitoring Systems
RPrS	« *Rapport Préliminaire de Sûreté* » - Preliminary Safety report
RS	Rapport de sureté
RW	RadWaste
SIC	Safety Important Component / Safety Important Class
SSC	Structures, Systems and Components
SLD	Single Line Diagram
SOF	Safety option files
SRD	System Requirement Document
SRO	Start of Research Operation
TBM	Test Blanket Module
TFA	Very low-level radwaste
TKM	Tokamak
VE	Value Engineering

Appendix 2: Conflict of interest Principles

These principles apply to parent companies and their subsidiaries.

Principle 1

A company involved in the design & build HCF contract, as part of any Entity* or as a subcontractor, is not allowed to bid for any tenders related to external control and supervision (such as audit, project control, cost control, works supervision, etc., see notably stakeholders listed in clause 3.4) of the Design & Build contract.

Principle 2

A company involved in the writing of any part of the Design & Build tender package (draft contract and technical specifications) is not allowed to bid, as part of any Entity*or as a subcontractor, for the Design & Build contract.

** Entity is defined as either a single existing company, or a company participating in a single existing entity whatever its role within this single existing entity, or a consortium, or a company participating in a consortium whatever its role within the consortium, or a company participating in a new legal entity whatever its role within the new legal entity.*

Appendix 3: High-level functional analysis

This appendix presents the high-level functional analysis performed for the Hot Cell Facility. This analysis focuses mainly on the processes, meaning the client needs. The description of the functions are mentioned in section 3.2 and this appendix presents extracts from the MBSE Capella-modelling, providing a an schematic overview of the functional analysis.

The breakdown of the diagrams presented below are to be read and understood in hierarchical order as a fennel:

- Figure 5: 1st level functions for the HCF - maintenance and radwaste
    - Figure 6: 2nd level functions for the HCF - maintenance
        - Figure 8: 3rd level functions for the HCF – maintenance of IVC / EVE / IRMS
            - Figure 9: 4th level functions for the HCF – maintenance of In-Vessel-Component (IVC) general sequence
                - Figure 10: 5th level functions for the HCF – maintenance of TBM (Test Blanket Module)
            - Figure 11: 4th level functions for the HCF – integration of the maintenance of Ex-Vessel-Equipment (EVE) general sequence
            - Figure 12: 4th level functions for the HCF – integration of the maintenance of IRMS (ITER Remote Maintenance System) general sequence
    - Figure 7: 2nd level functions for the HCF – solid and liquid radwaste
        - Figure 13: 3rd level functions for the HCF – radwaste management (solid/liquid)
            - Figure 14: 4th level functions for the HCF – solid type A radwaste
            - Figure 15: 4th level functions for the HCF – liquid radwaste

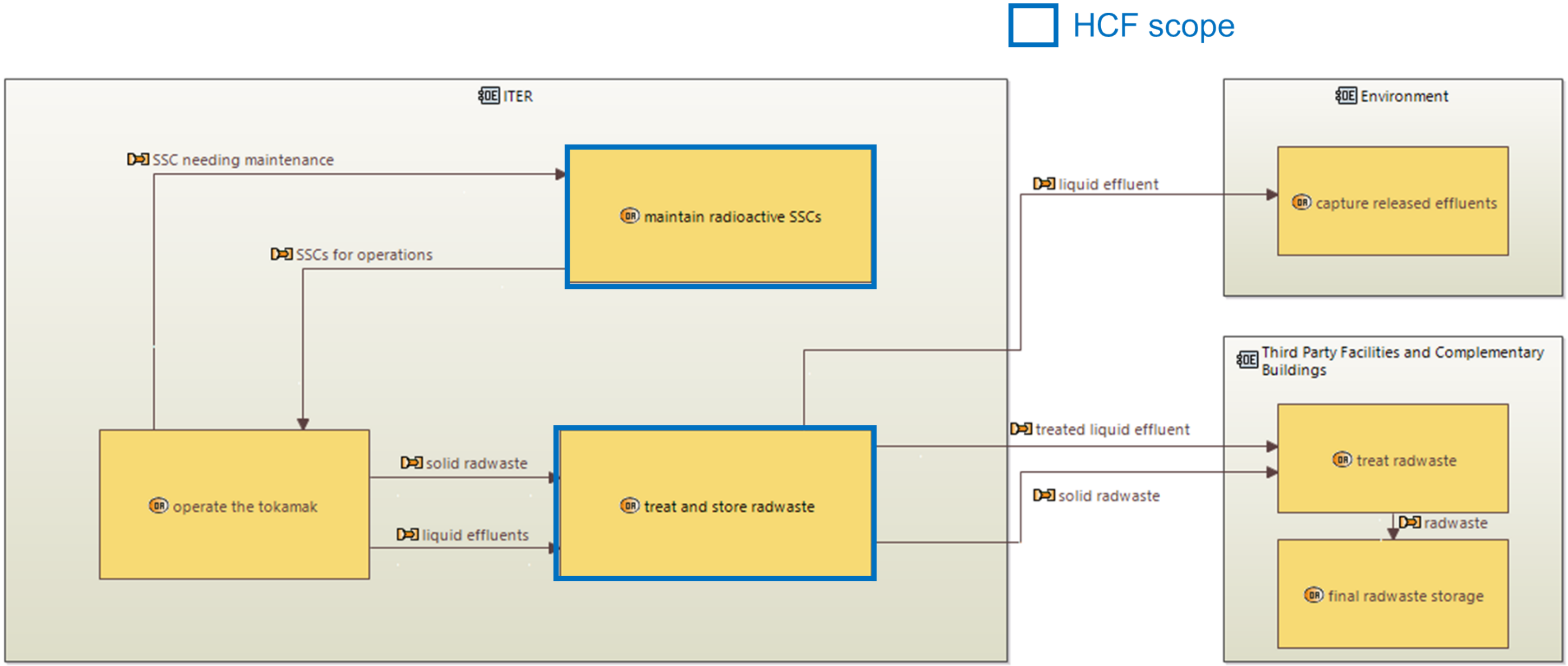


Figure 5: 1st level functions for the HCF - maintenance and radwaste

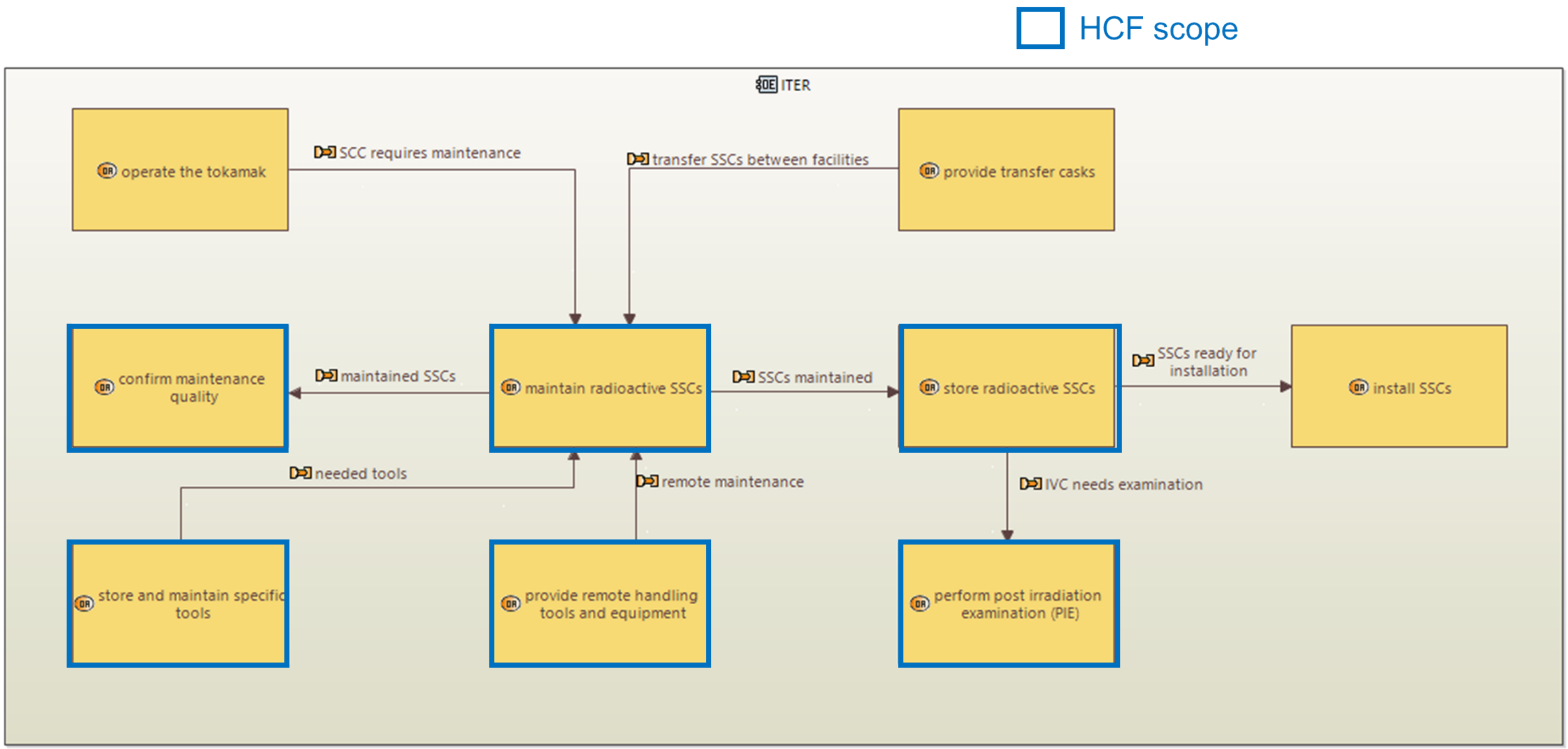


Figure 6: 2nd level functions for the HCF - maintenance

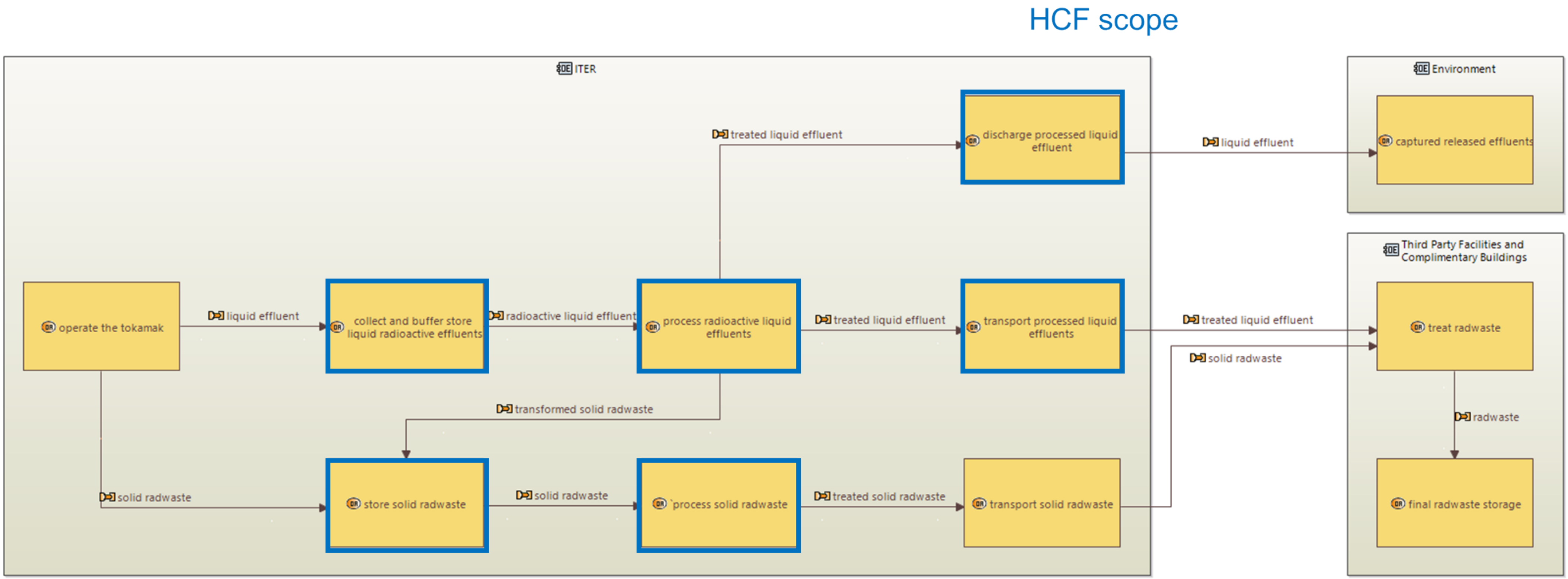


Figure 7: 2nd level functions for the HCF – solid and liquid radwaste

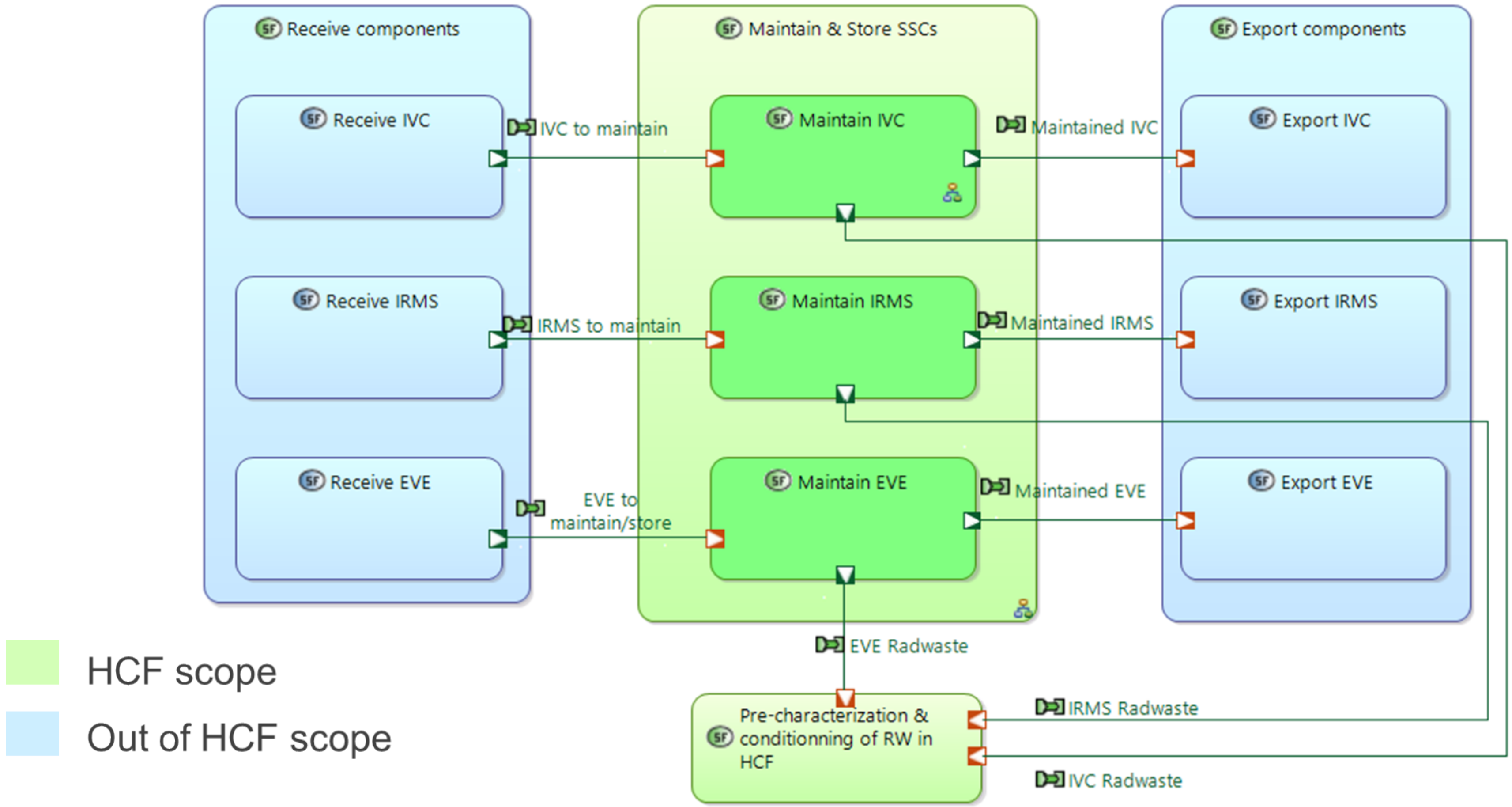


Figure 8: 3rd level functions for the HCF – maintenance of IVC / EVE / IRMS

IVC: In-Vessel-Component
IRMS: ITER Remote Maintenance System
EVE: Ex-Vessel-Equipment

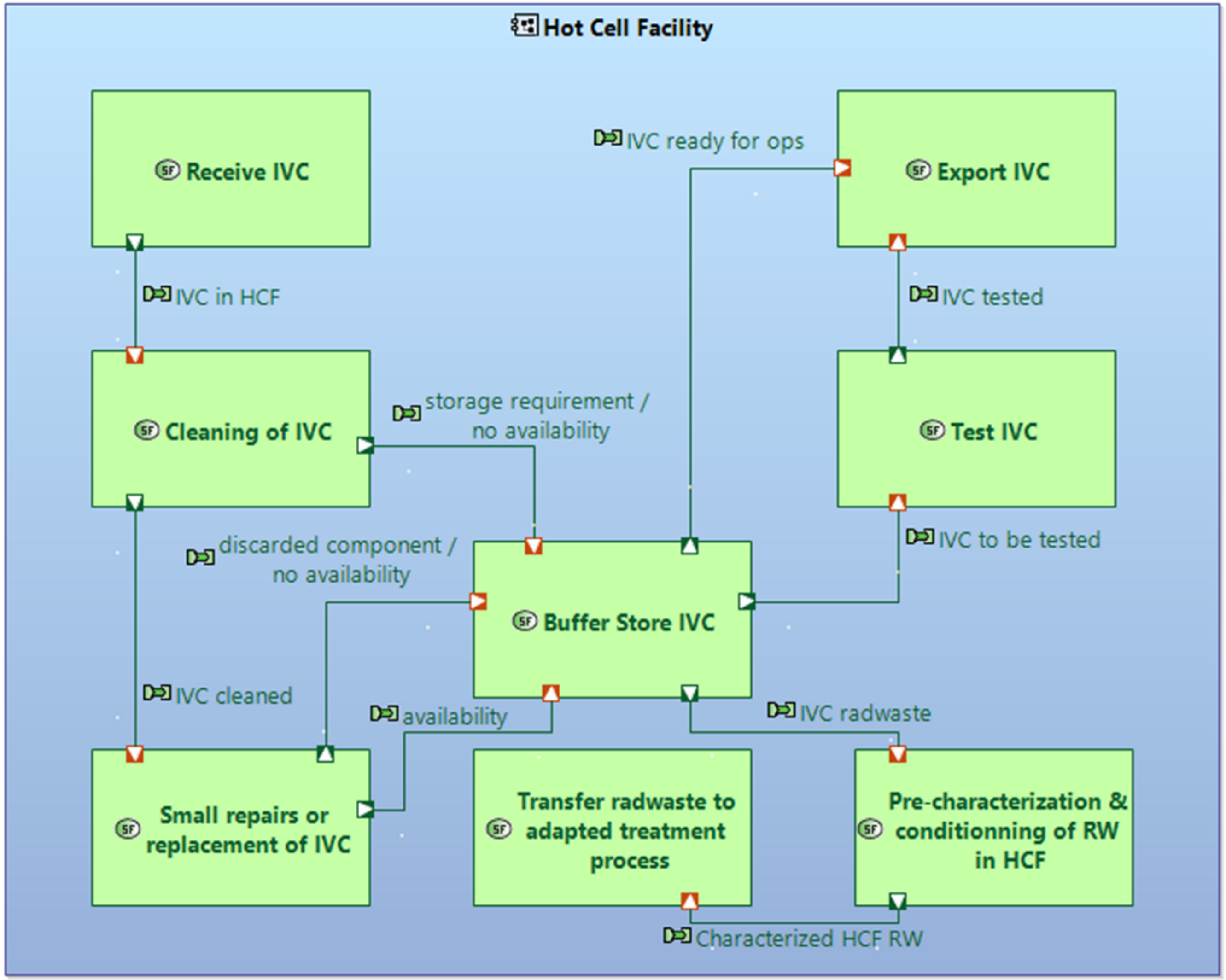


Figure 9: 4th level functions for the HCF – maintenance of In-Vessel-Component (IVC) general sequence

Based on Figure 9, by focusing on the box ''Small repairs or replacement of IVC'', the following diagram is obtained for the IVC TBM case:

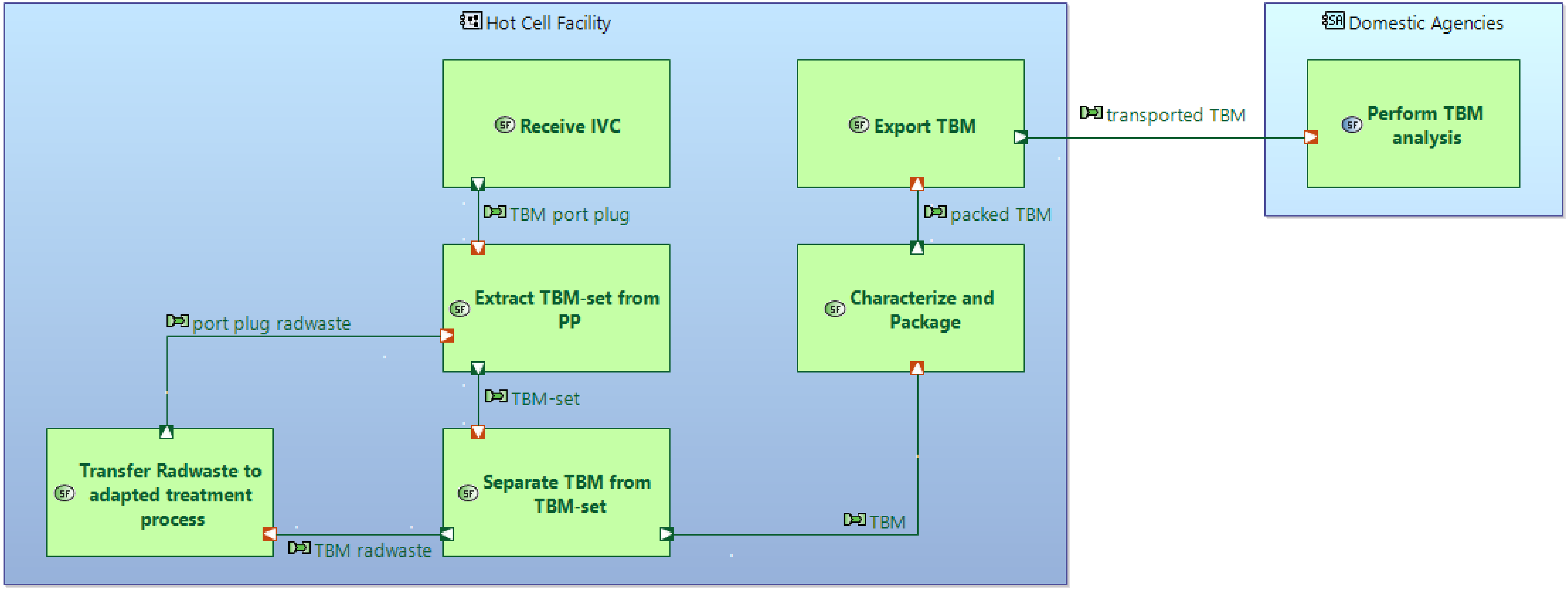


Figure 10: 5th level functions for the HCF – maintenance of TBM (Test Blanket Module)

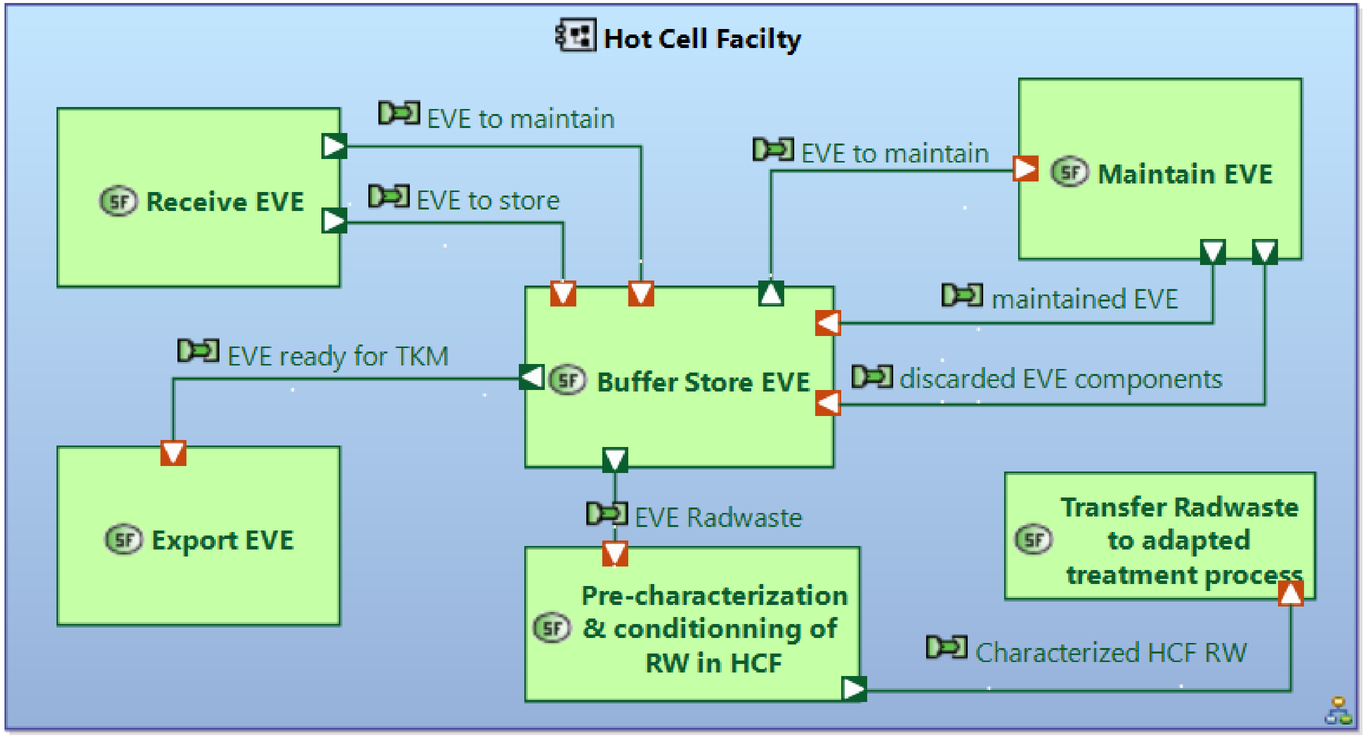


Figure 11: 4th level functions for the HCF – integration of the maintenance of Ex-Vessel-Equipment (EVE) general sequence

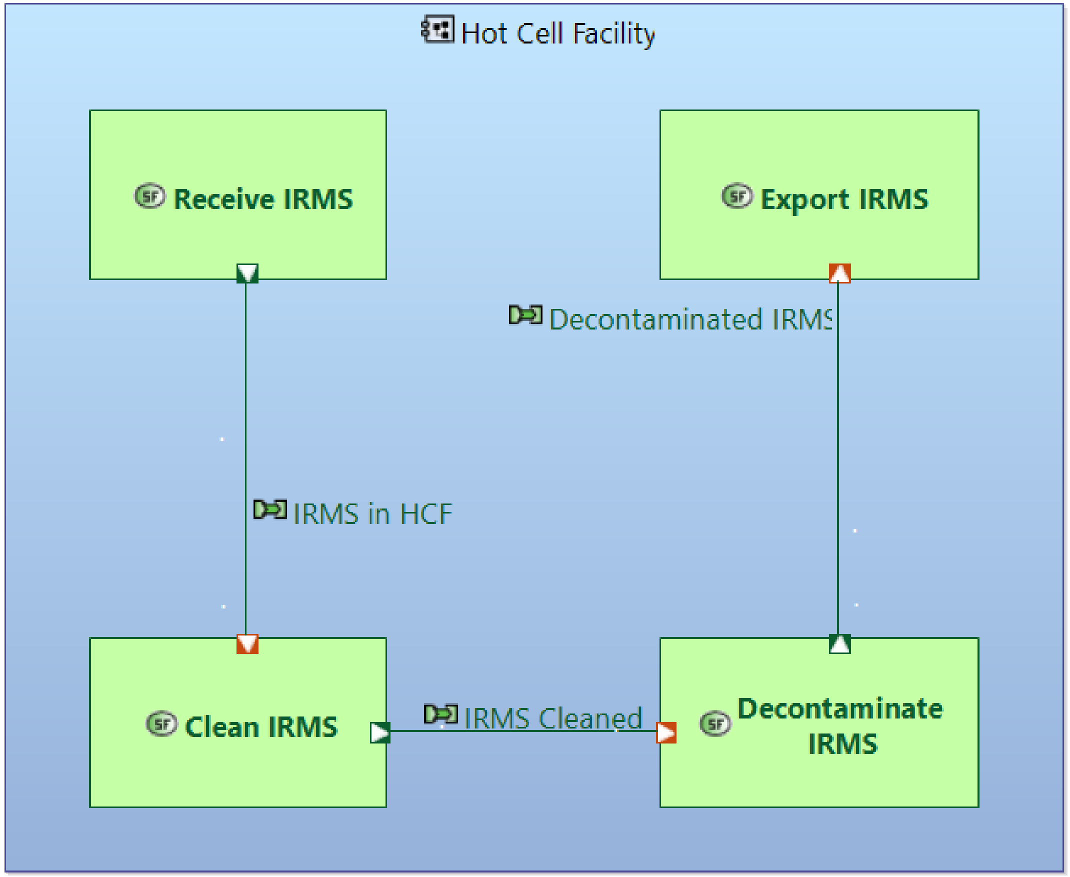


Figure 12: 4th level functions for the HCF – integration of the maintenance of IRMS (ITER Remote Maintenance System) general sequence

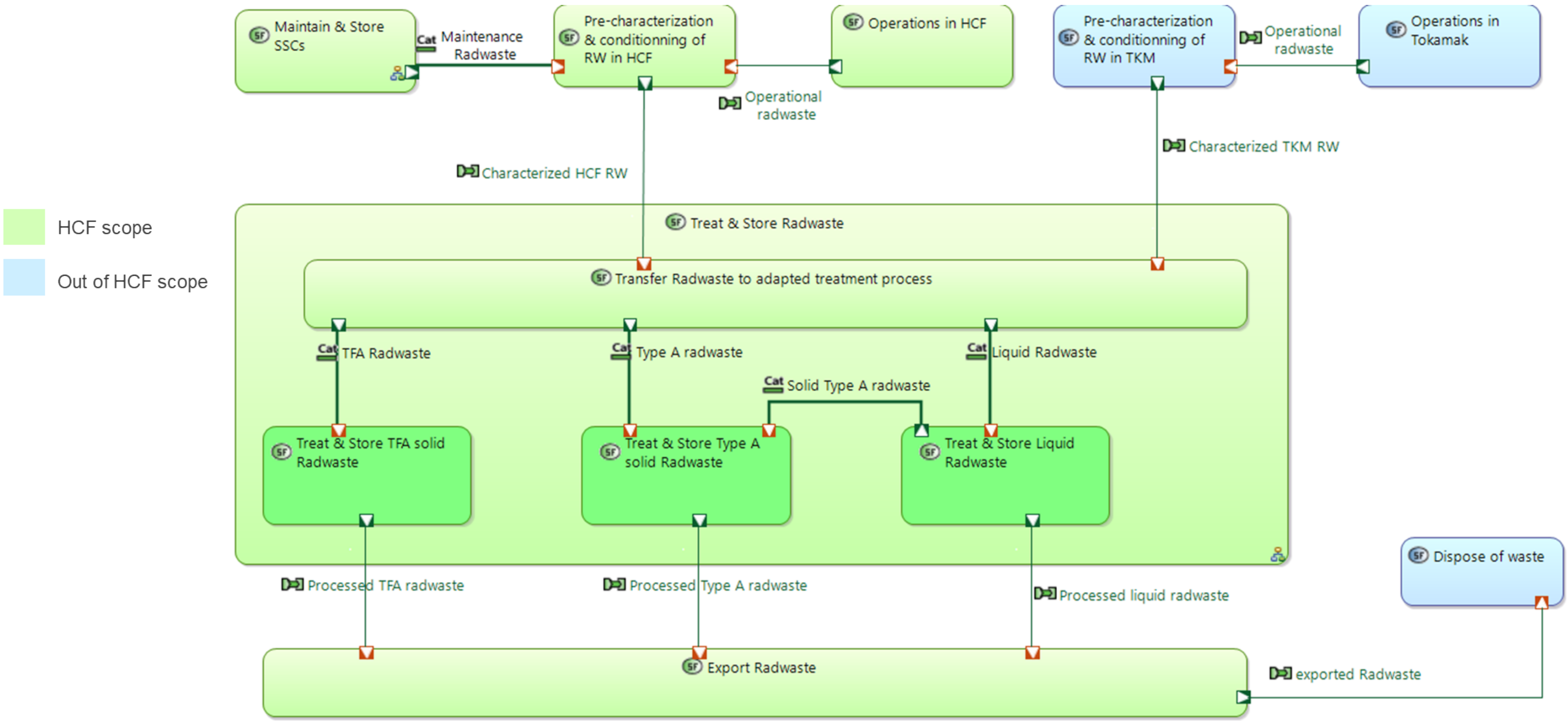


Figure 13: 3rd level functions for the HCF – radwaste management (solid/liquid)

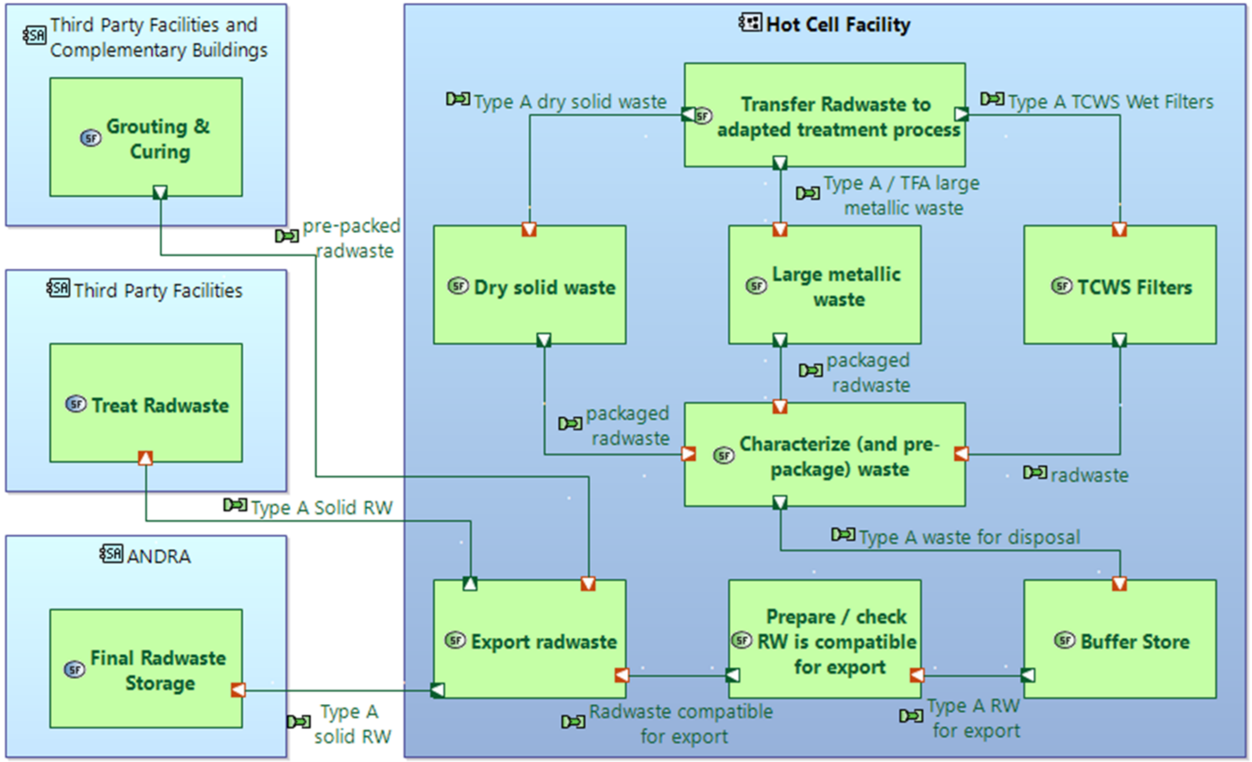


Figure 14: 4th level functions for the HCF – solid type A radwaste

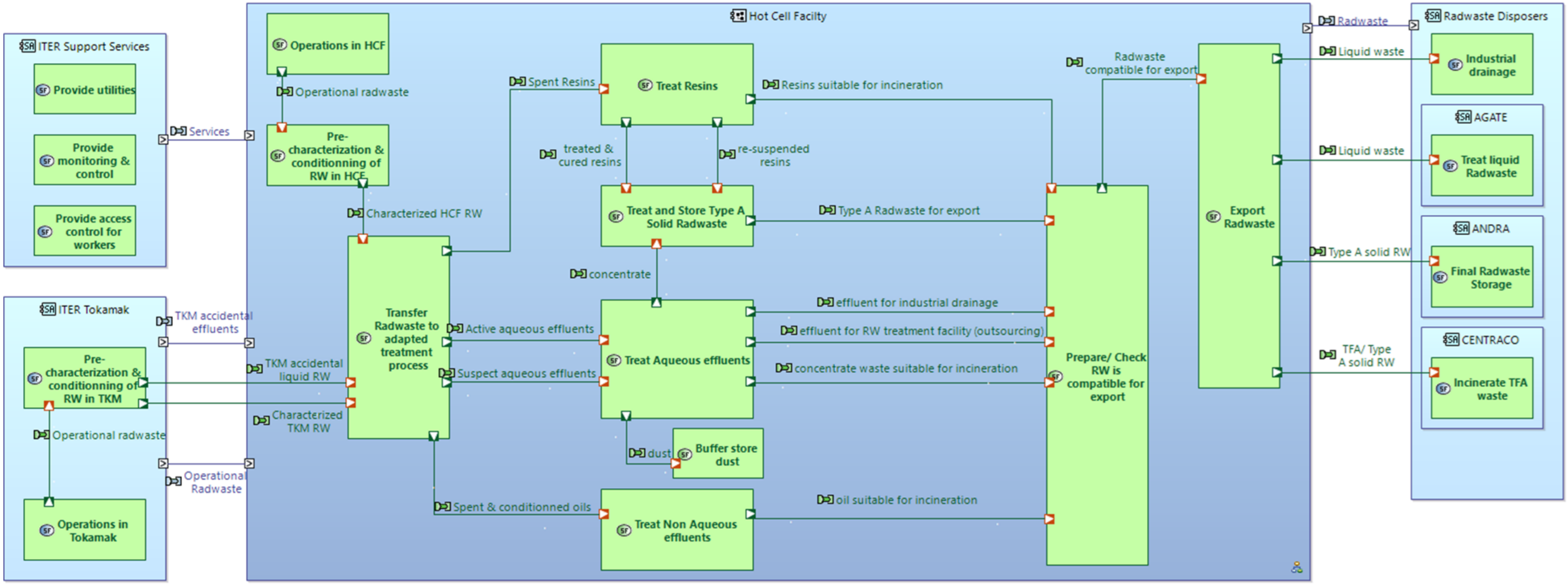


Figure 15: 4th level functions for the HCF – liquid radwaste

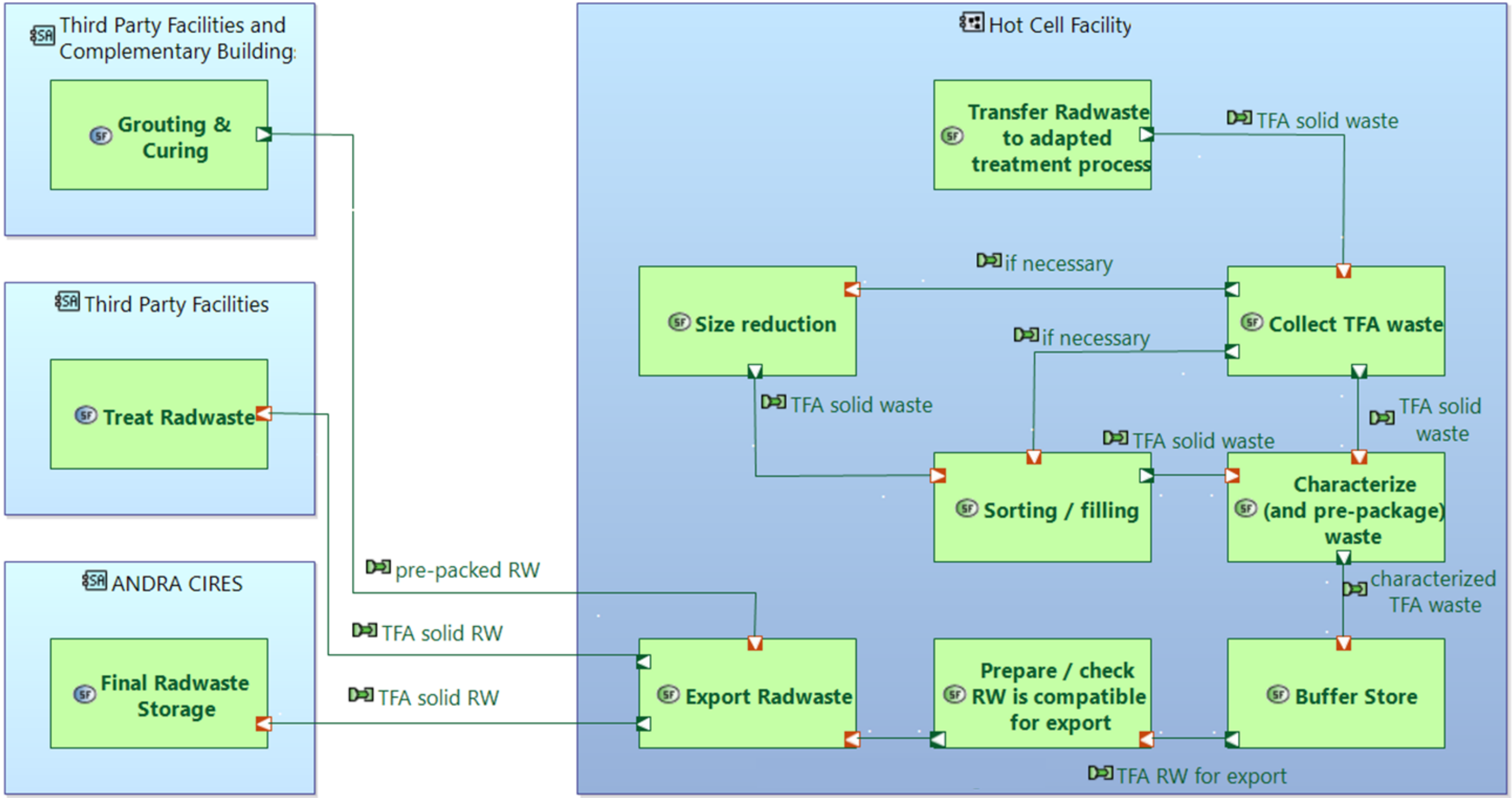


Figure 16: 4th level functions for the HCF – solid TFA radwaste

Appendix 4: Safety Approach

HCF being at preconcept level stage, safety starts with the establishment of high-level safety requirements that are not solution oriented and which quantity and completeness will develop with the design process. The safety requirements establishment usually follows the logical sequence described below:

1. Application of national regulation (environmental code, labour code, public health code, INB order, decision ASN 616, …)
2. Application of dedicated requirements from the regulator issued specifically for the facility (decree, PT)
3. Breakdown, refinement, tailoring of requirements from 1 and 2 through an iterative safety analysis process that takes into account the design of the facility at its different stages of maturity, the radiation hazards associated with the facility, the potential accidents from events and circumstances resulting from external and internal hazards, components failure, human factors.

The high-level safety requirements provided by ITER for HCF are based on steps 1 and 2 of the above sequence. They are limited in number and open (not solution oriented) to allow the rolling of the engineering process with the required flexibility to identify the best design solution. It is important to keep in mind that the strategy chosen by the project regarding safety high level requirements and their potential revision consist in not challenging the ITER decree in a way that it would constitute a "substantial modification" of it, leading to the need for a new decree implying the associated full administrative procedure including public inquiry.

This strategy implies also to not challenge the boundaries and typology of the facility nuclear safety stakes presented in the supporting files (RPrS, Impact study) associated to the obtention of ITER decree, which in more concrete way consists in:

1. Complying with the existing general safety objectives (GSO) and collective dose objective already defined,
2. Complying with the releases (gaseous and liquid effluents) foreseen during normal operation presented in the impact study,
3. Not drastically challenging the maximum radiological (and hazardous substances) consequences on environment and public presented in the RPrS for the different categories of event from design basis accidents (DBA) up to design extension conditions (DEC) included,
4. Not introducing a new hazard that would require, due to its potential ability to jeopardize the interest to be protected, to be explicitly considered in the decree,
5. Not leading to the creation of ICPE categories/thresholds (radioactive or not) that would lead ASNR to challenge ITER decree
6. Ensuring that off-site, from the fence and beyond, the area is an unregulated area (white zone with effective dose below 80 µSv/month) from radiation zoning perspective; same condition is applied on site to normally accessible zones located outside the buildings housing radiation sources.

In addition, it can be added the capability to limit radwaste production and ensure their management up to their evacuation to waste disposals. This one is not a purely safety topic but it is a requirement from French Nuclear safety authority INB order titre VI "waste management", and ITER decree article 2.V.5). Regarding radwaste, it can be reminded that the decree (art 2.V.5) specifies that the operator shall take all the necessary measures so that the waste produced during the facility's experimental operation can be removed from the facility after radioactive decay at the latest ten years following the end of this experimental operating period.

The Contractor is in charge to take ownership of the high-level safety requirement and refined them according to step 3 in compliance with the ITER strategy described above and the design development.

This integration and development of the safety requirements must lead to the production of a safety option file (SOF) as a deliverable of the Competitive Dialogue. The table of content of the SOF will be proposed by ITER and a collaborative approach and intermediates milestones for its delivery will be defined in the contract. The SOF will be submitted to the French regulator and the contractor is expected to participate potentially to technical meetings with the authority and to the update of the document as needed.

It is paramount that the SOF is achieved through a close collaboration between safety engineers and designers within the Contractor team as well as between Contractor and Client in an iterative process to ensure consistency and feasibility. The different alternatives studied regarding safety options and the justification for the final choices made in the SOF shall be traced. Deviations from the principles/approaches specified in the high-level safety requirements and reference documents shall be presented, justified and discussed with ITER organization.

The SOF will be delivered at the end of the Competitive Dialogue and validated at the First Design stage milestone. The following phases of the engineering process foreseen in the design and build Contract implies gate reviews for which HCF ‘’rapport de sureté” (RS) are expected to be delivered. The content of the RS shall be compliant with the regulator decision n 2015-DC-0532 from 17/11/2015, the high-level safety requirements and take into consideration the feedback of the authority regarding the SOF.

The detailed organization, tasks, resources, schedule and intermediate milestones and studies implemented for the delivery of the RS and associated files shall be presented to ITER organization for validation.

As for the SOF, it is paramount that the safety deliverables are performed in close collaboration and consistency with designers.

Appendix 5: Illustration of Preconcept 2024

Caution: the information presented below is not a requirement but an illustration of a pre-concept.

The HCB and HCB-Extension (if deemed necessary) are located on the area 28, on the northern side of the Tokamak Complex.

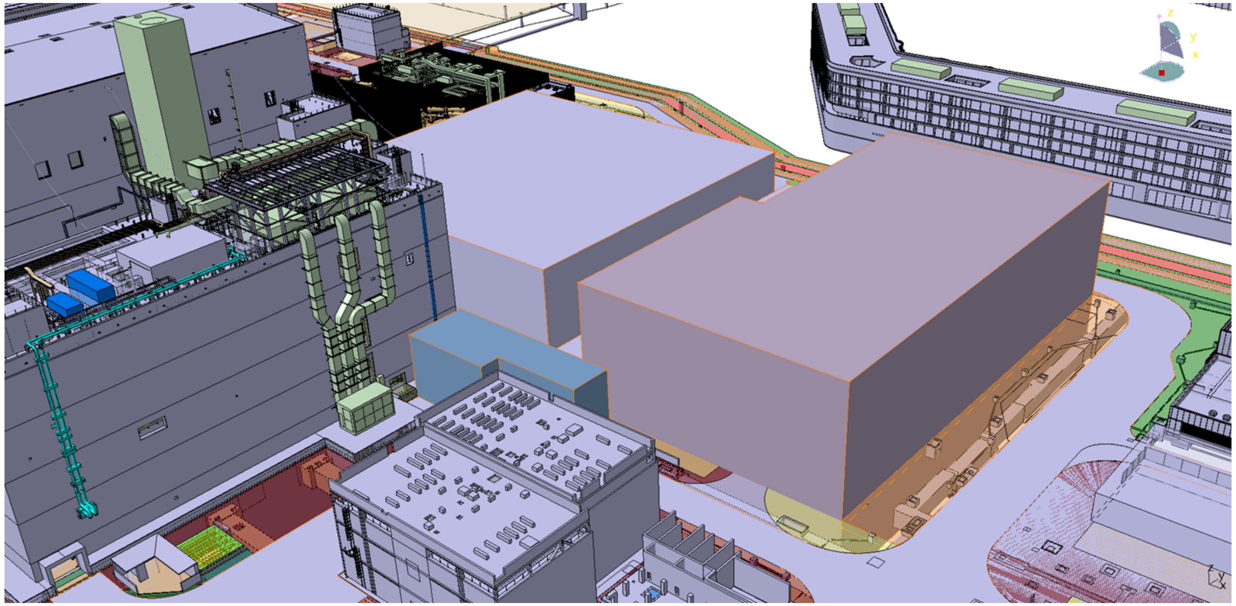


Figure 17 Zoom on the Area 28

The illustrative overall dimensions of the HCB preconcept are:

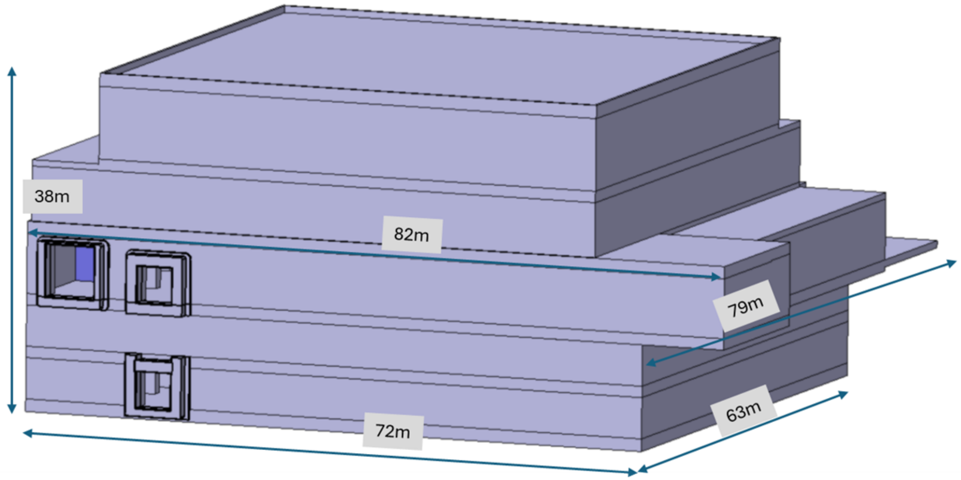


Figure 18 : 3D model of the 5 storey HCB

Dimension	HCB
Length (North-South)	63 m up to 79 (for the truck bay) at L1
Width (East-West)	72 m up to 82 (for the cask rotation) at L1
Total Height	38m
Height above ground	25 m (+ roof installations)

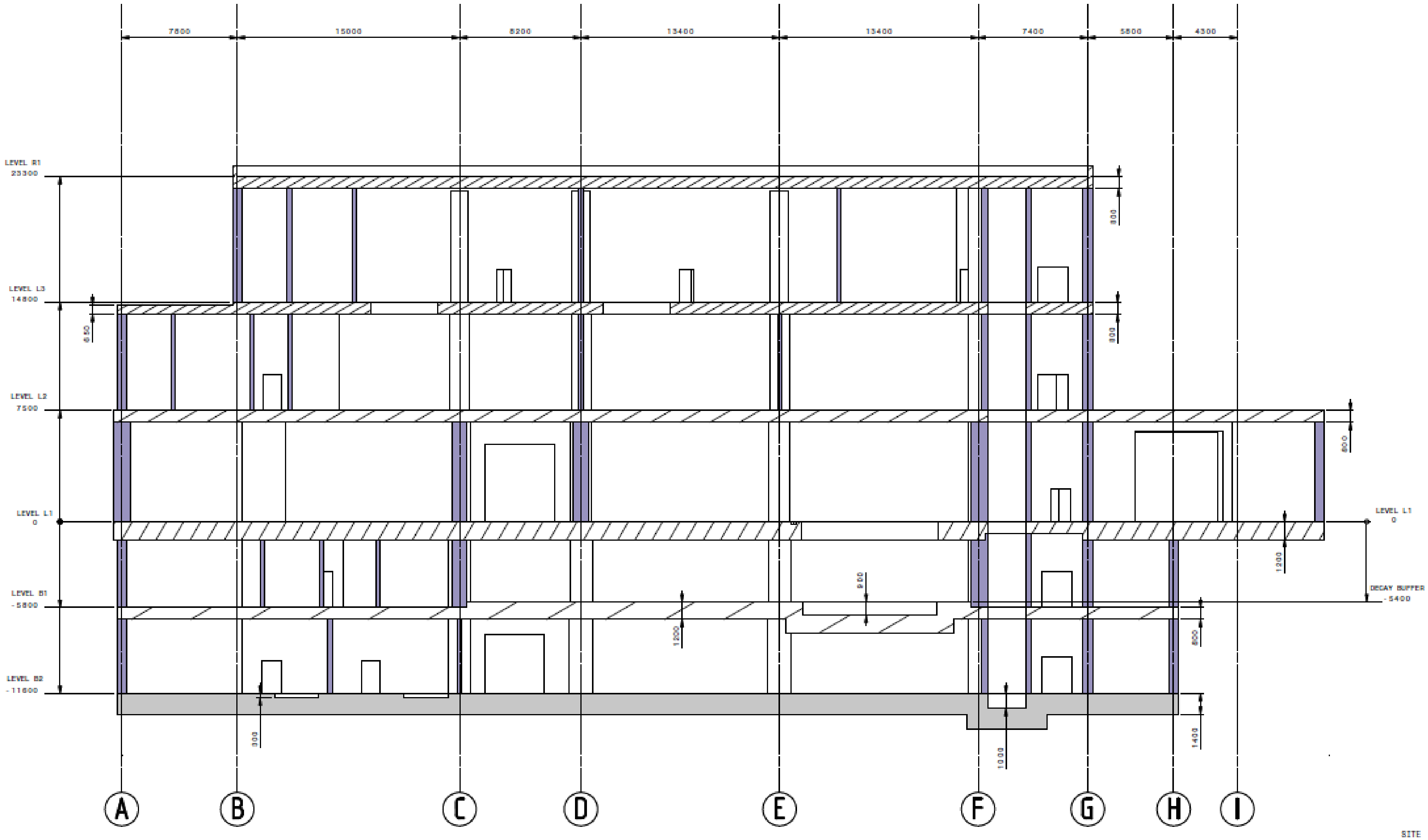
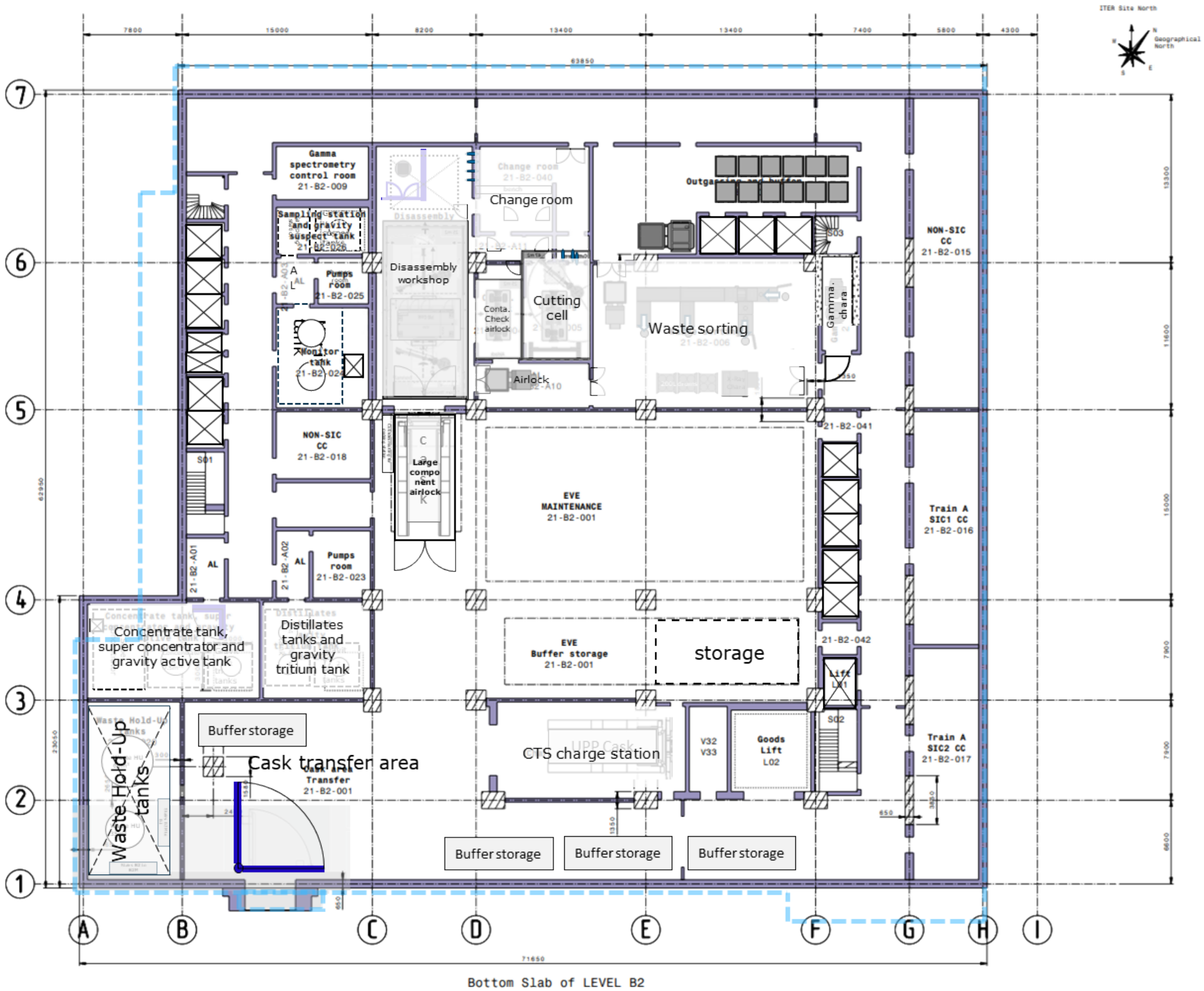
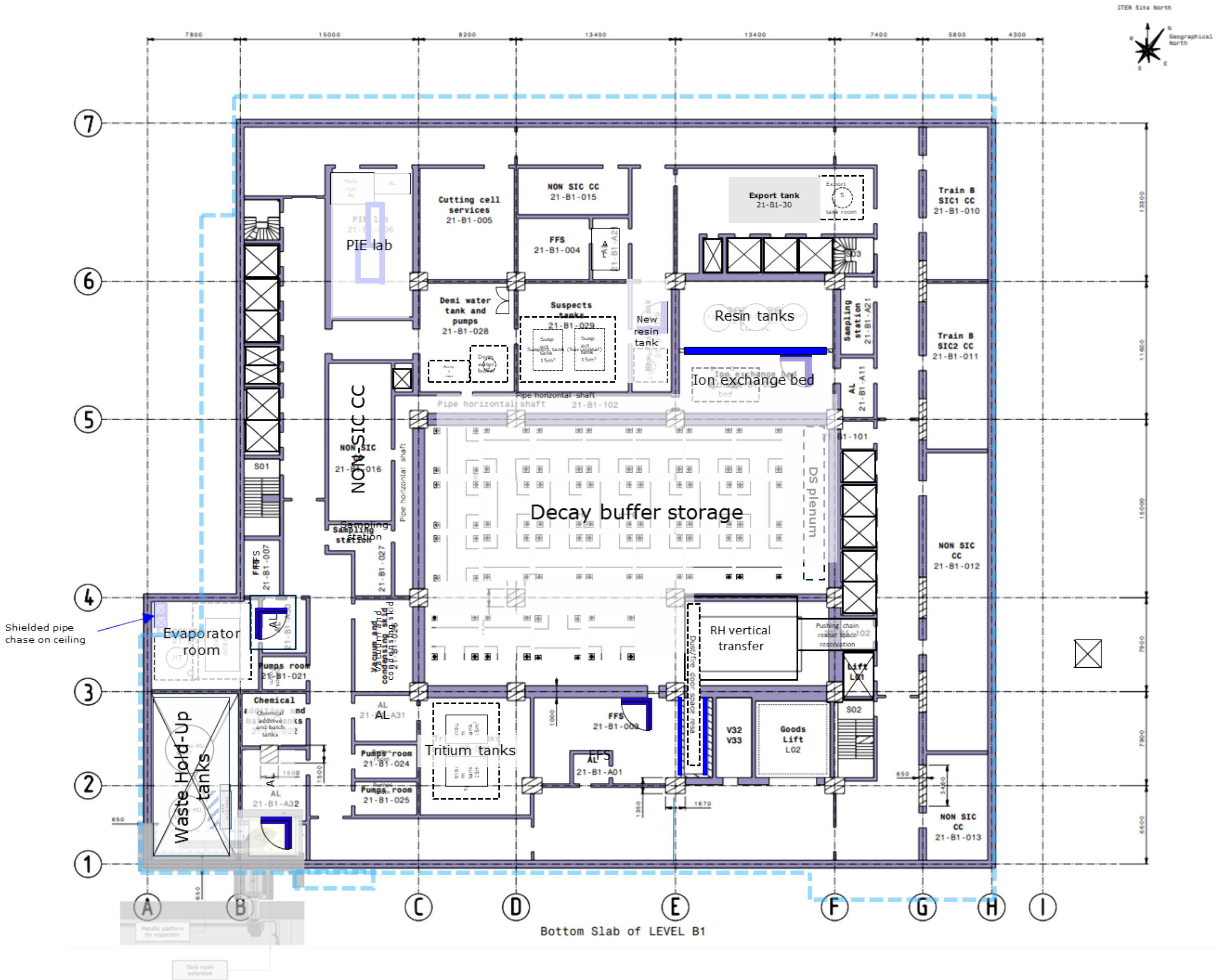
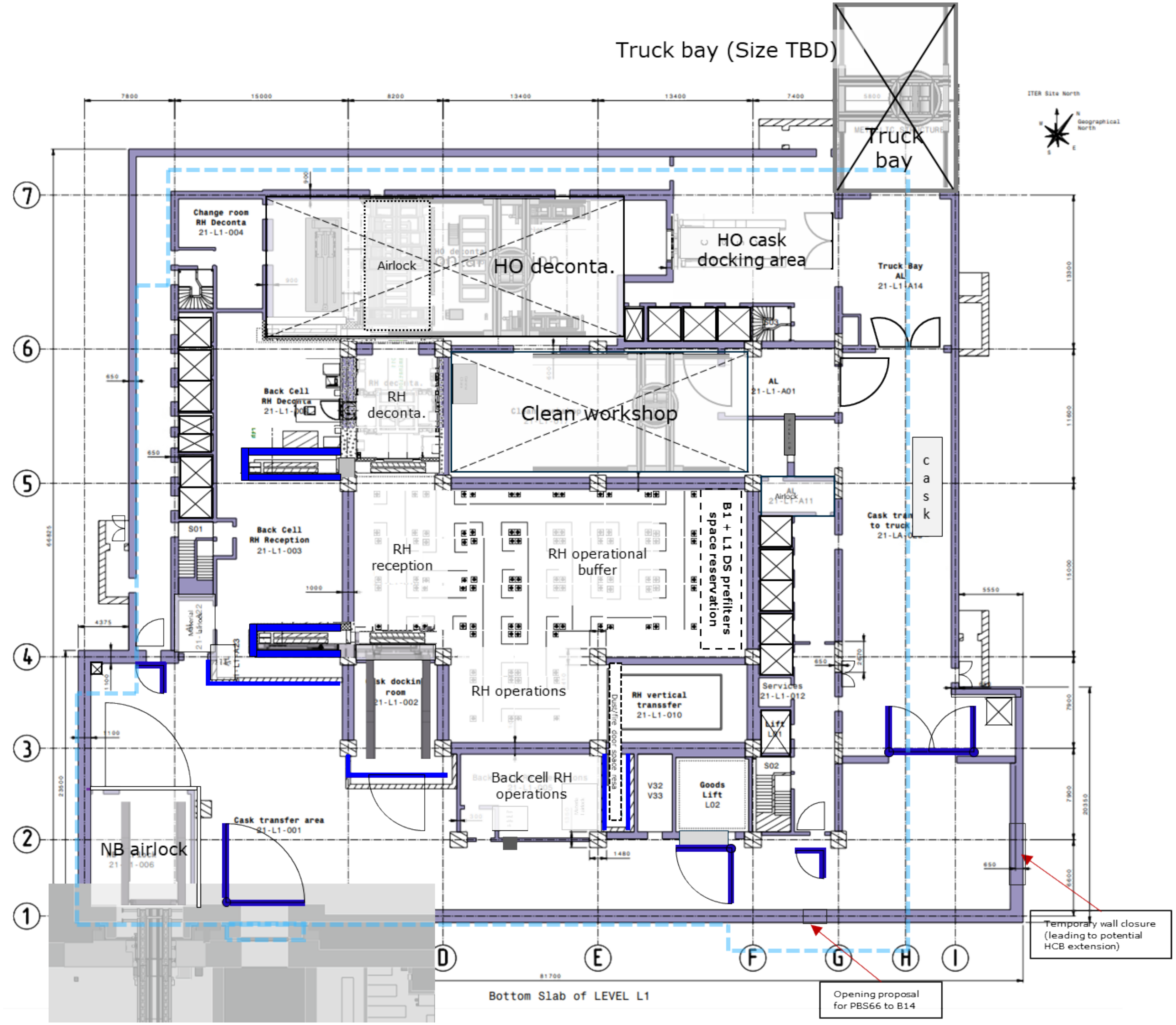


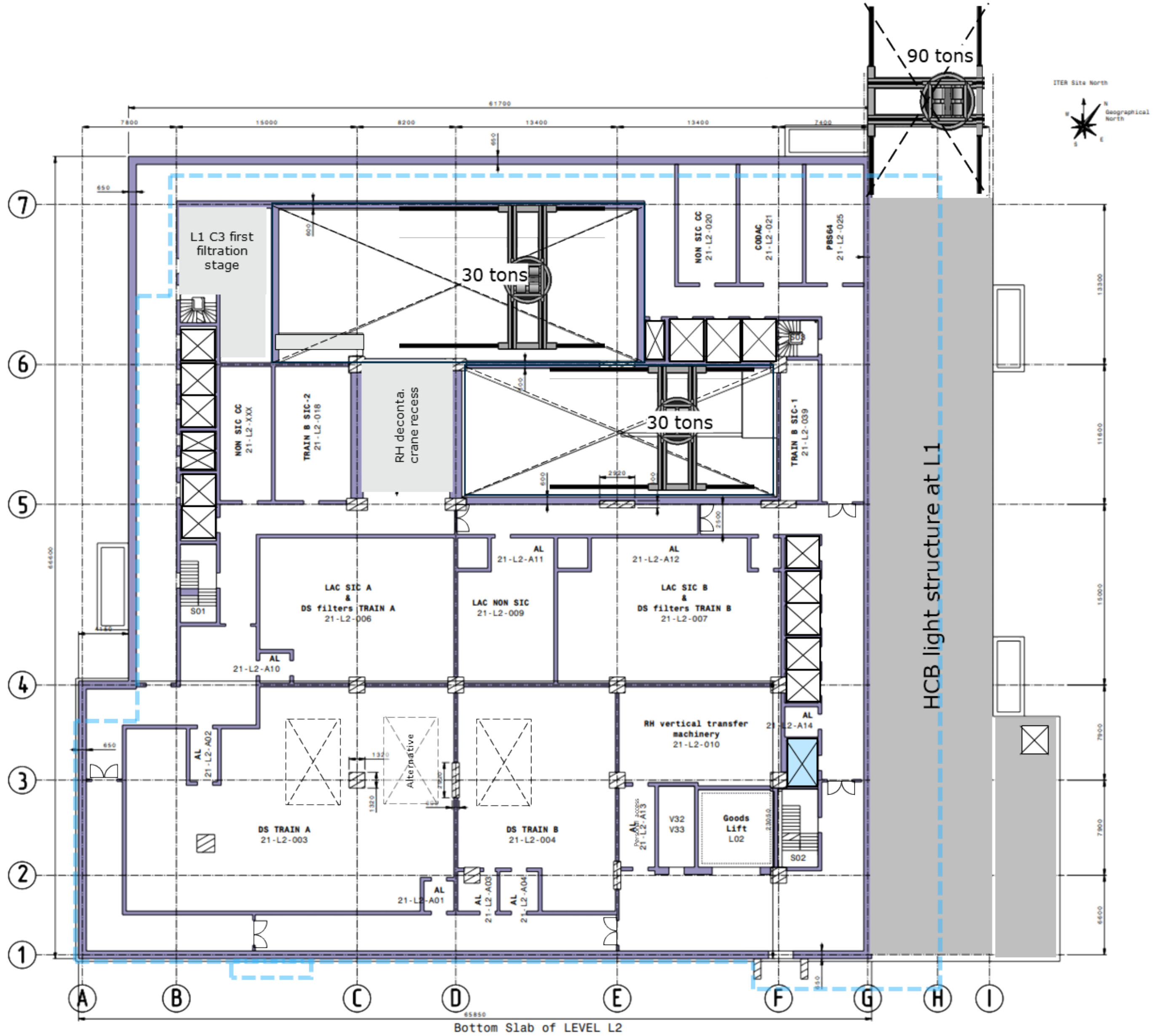
Figure 19 : Elevation view


Gamma spectrometry control room 21-B2-009
Sampling station and gravity suspect tank
Pumps room 21-B2-025
Monitor tank 21-B2-024
Disassembly workshop
Change room
Conta. Check airlock
Cutting cell
Airlock
Outgassing and buffer
Waste sorting
Gamma chara
NON-SIC CC 21-B2-015
NON-SIC CC 21-B2-018
Large component airlock
EVE MAINTENANCE 21-B2-001
Train A SIC1 CC 21-B2-016
Pumps room 21-B2-023
Concentrate tank, super concentrator and gravity active tank
Distillates tanks and gravity tritium tank
EVE Buffer storage 21-B2-001
storage
Lift
Waste Hold-Up tanks
Buffer storage
Cask transfer area
CTS charge station
V32 V33
Goods Lift L02
Train A SIC2 CC 21-B2-017
Buffer storage
Buffer storage
Buffer storage
Bottom Slab of LEVEL B2

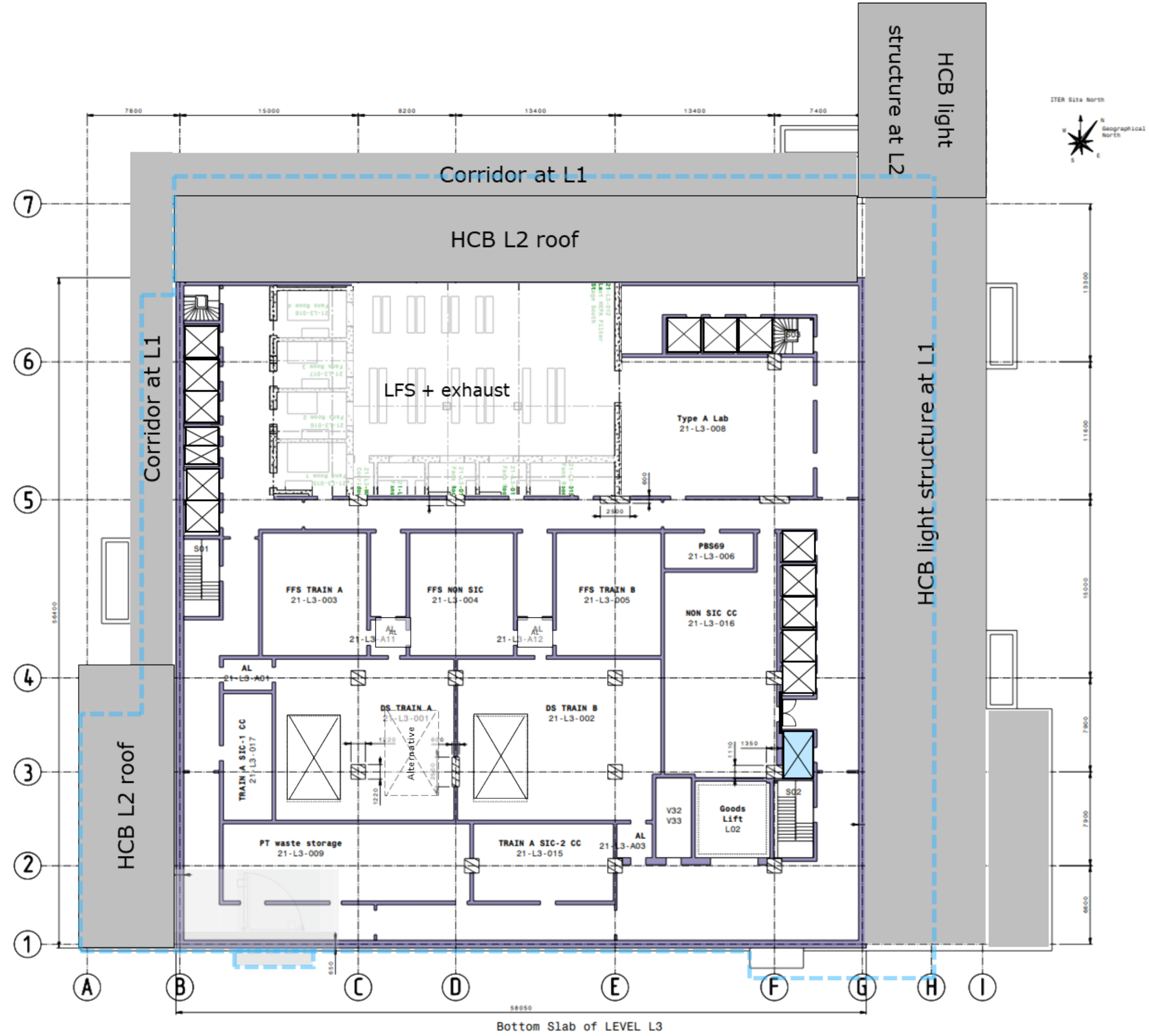

ITER Site North
Geographical North
Shielded pipe chase on ceiling
Evaporator room
Waste Hold-Up tanks
Chemical
PIE lab
Cutting cell services
21-B1-005
NON SIC CC
21-B1-015
FFS
21-B1-004
Export tank
21-B1-30
Train B SIC1 CC
21-B1-010
Demi water tank and pumps
21-B1-028
Suspects tanks
21-B1-029
New resin tank
Resin tanks
Ion exchange bed
Sampling station
Train B SIC2 CC
21-B1-011
NON SIC CC
Pipe horizontal shaft
21-B1-102
Decay buffer storage
DS plenum
NON SIC CC
21-B1-012
S01
S02
S03
Pumps room
21-B1-021
RH vertical transfer
Pushing chain
Lift L01
Tritium tanks
FFS
21-B1-008
V32
V33
Goods Lift L02
Pumps room
21-B1-024
Pumps room
21-B1-025
21-B1-A01
21-B1-A32
NON SIC CC
21-B1-013
Bottom Slab of LEVEL B1



Truck bay (Size TBD)
Truck bay
HO cask docking area
HO deconta.
Airlock
Change room RH Deconta 21-L1-004
Truck Bay AL 21-L1-A14
RH deconta.
Back Cell RH Deconta
Clean workshop
AL 21-L1-A01
cask
Cask transfer to truck
B1 + L1 DS prefilters space reservation
RH reception
Back Cell RH Reception 21-L1-003
RH operational buffer
RH operations
RH vertical transfer 21-L1-010
Services 21-L1-012
Back cell RH operations
V32 V33
Goods Lift L02
S01
S02
NB airlock
Cask transfer area 21-L1-001
Temporary wall closure (leading to potential HCB extension)
Opening proposal for PBS66 to B14
Bottom Slab of LEVEL L1
7
6
5
4
3
2
1
D
E
F
G
H
I



90 tons
30 tons
30 tons
L1 C3 first filtration stage
NON SIC CC 21-L2-020
CODAC 21-L2-021
PBS64 21-L2-025
NON SIC CC 21-L2-XX
TRAIN B SIC-2 21-L2-018
RH deconta. crane recess
TRAIN B SIC-1 21-L2-039
HCB light structure at L1
AL 21-L2-A11
AL 21-L2-A12
LAC SIC A & DS filters TRAIN A 21-L2-006
LAC NON SIC 21-L2-009
LAC SIC B & DS filters TRAIN B 21-L2-007
AL 21-L2-A10
S01
RH vertical transfer machinery 21-L2-010
AL 21-L2-A14
AL 21-L2-A02
Alternative
DS TRAIN A 21-L2-003
DS TRAIN B 21-L2-004
AL 21-L2-A13
V32 V33
Goods Lift L02
S02
AL 21-L2-A01
AL 21-L2-A03
AL 21-L2-A04
Bottom Slab of LEVEL L2



Corridor at L1
HCB L2 roof
HCB light structure at L2
HCB light structure at L1
Corridor at L1
HCB L2 roof
LFS + exhaust
Type A Lab
21-L3-008
PBS69
21-L3-006
FFS TRAIN A
21-L3-003
FFS NON SIC
21-L3-004
FFS TRAIN B
21-L3-005
NON SIC CC
21-L3-016
DS TRAIN A
21-L3-001
DS TRAIN B
21-L3-002
TRAIN A SIC-1 CC
21-L3-017
PT waste storage
21-L3-009
TRAIN A SIC-2 CC
21-L3-015
Goods Lift
L02
V32
V33
Alternative
Bottom Slab of LEVEL L3

Appendix 6: Retaining wall

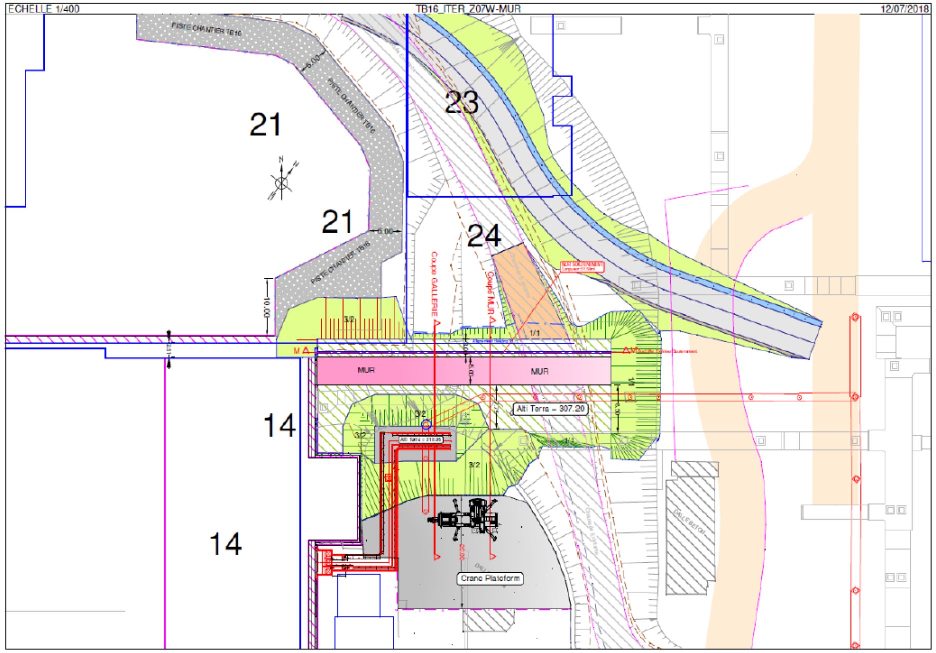


Figure: Retaining wall footprint

Figure: Retaining wall location