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Technical Specifications (In-Cash Procurement)

Nuclear Analysis Framework Contract

This document is to define the objective of a new framework contract to perform a number of well-controlled nuclear analyses for ITER to support fulfilling some part of terms of reference of Radiation, Safety & Environment Group (RSE)

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1 Preamble

This Technical Specification is to be read in combination with the General Management Specification for Service and Supply (GM3S) – [Ref 1] that constitutes a full part of the technical requirements.

In case of conflict, the content of the Technical Specification supersedes the content of Ref [1].

2 Purpose

Purpose of this document is to define the objective of a new framework contract to perform several well-controlled nuclear analyses for ITER to support fulfilling some part of terms of reference of Radiation, Safety & Environment Group (RSE) [2].

3 Acronyms & Definitions

3.1 Acronyms

The following acronyms are the main one relevant to this document.

Abbreviation	Description
CRO	Contract Responsible Officer
GM3S	General Management Specification for Service and Supply
IO	ITER Organization
PRO	Procurement Responsible Officer
RSE	Radiation Safety and Environment group
SDDR	ShutDown Dose Rates

For a complete list of ITER abbreviations see: ITER_D_2MU6W5 – ITER Abbreviations.

3.2 Definitions

Contractor: shall mean an economic operator who have signed the Contract in which this document is referenced.

CDT-1 – Common Design Team 1 working on design development of shielding of PCR1154

RADWASTE- Radiation Waste.

4 Applicable Documents & Codes and standards

4.1 Applicable Documents

This is the responsibility of the Contractor to identify and request for any documents that would not have been transmitted by IO, including the below list of reference documents.

This Technical Specification takes precedence over the referenced documents. In case of conflicting information, this is the responsibility of the contractor to seek clarification from IO.

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Upon notification of any revision of the applicable document transmitted officially to the contractor, the contractor shall advise within 4 weeks of any impact on the execution of the contract. Without any response after this period, no impact will be considered.

Ref	Title	IDM Doc ID	Version
1	General Management Specification for Service and Supply (GM3S)	82MXQK	1.4
2	Quality Assurance for ITER Safety Codes Procedure	258LKL	3.1
3	Decree No. 2012-1248 dated 9 November 2012 authorizing IO to create a basic nuclear facility called “ITER"	CZK7M5	1.1
4	Provisions for Implementation of the Generic Safety Requirements by the External Interveners	SBSTBM	2.2
5	ITER Policy on Safety, Security and Environment Protection Management	43UJN7	3.1
6	SRO Surveillance Plan for NIU - Annex 2: Detailed list of PIAs	T6XFXM	1.0
7	Instructions for verification of input for radiation transport calculations	TP4LL9	1.5
8	Instructions for Nuclear Analyses	R7XRXB	5.3
9	Methodology for Determination of Safety Factor for Nuclear Analysis	TSZAB3	2.0
10	Propagation of the defined requirements for protection important components through the chain of external contractors	BG2GYB	3.3
11	List of ITER-INB Protections Important Activities	PSTTZL	2.2

4.2 Applicable Codes and Standards

This is the responsibility of the contractor to procure the relevant Codes and Standards applicable to that scope of work. The organisation conducting these activities should have an ITER approved QA Program or an ISO 9001 accredited quality system.

The detailed quality assurance requirements are given in section !! with a list of reference documents.

5 Scope of Work

This section defines the specific scope of work for the service, in addition to the contract execution requirement as defined in Ref [1].

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Background and Objectives

To ensure ITER commitment and compliance with article 14 of the ITER agreement, specifically the following "The ITER Organization shall observe applicable national laws and regulations of the Host State in the fields of public and occupational health and safety, nuclear safety, radiation protection, licensing, nuclear substances, environmental protection, and protection from acts of malevolence]" and to meet the requirement as per the order dated 7 February 2012 relating to the general technical regulations applicable to INB – EN (7M2YKF), several well-controlled and qualified nuclear analysis are to be performed.

This part of the document identifies and elaborates such analysis to update radiation maps for the period of 2024-2028.

This list is expected to partially meet the part of terms of reference of the RSE group [2], which is radiation safety scope. A transverse function TF02 "Radiation Safety", design plan [3], dealing with the ITER safety function "Limitation of the exposure": Workers' radiation protection and public's radiation protection is in place to carefully monitor at ITER levels those requirements and provide necessary justifications. A Nuclear Analysis roadmap for 2024-2028 is being prepared to illustrate the objective and plans to move forward.

The radiation safety requirements are the following:

- Respect the radiation zoning presented in RPrS and updated in Safety roombook for the 3 modes (Labour code focusing on workers) – if needed, based on radiation maps provided, radiation zoning may be updated with proper justifications.
- Respect the radiation requirements for unregulated area and at the fence of the INB site (Public & environment code)
- Respect the specific PR requirements PR355, PR1782 who have more stringent requirements for Yellow zone (<100µSv/h) and green zone (<10µSv/h) to enhance ALARA principle in mode 1 (Labour code focusing on workers)
- Respect the 2.5mSv/year in average for the worker (RPrS objectives)
- Collective dose <500 men.mSv/year in average and implement an ALARA approach (RPrS objectives)

The production of the nuclear analysis (at ITER level, at area level or for specific PBS) will have the objective to present the radiation conditions in order to meet those requirements.

In addition, nuclear analysis are providing :

- the radiation conditions to be considered for the qualification of equipment. Following nuclear responses are provided (Neutrons flux, 1 MeV equivalent neutrons fluence, dose to silicon, dose to polymers).
- The activation data for waste assessment with specific cooling time but with a coherent set of input used for radiation maps
- Nuclear heating response to confirm the nuclear load
- Damage (DPA), production of gas…

In the frame of this FWC, in coherence with INB order, it will be asked also to support IO regarding the identification of the uncertainties and the safety margins to be used to provide the data above.

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Currently the status is the following:

Radiation maps:

Mode	TF analysis	Baseline	Comments
0	ITER_D_RJLLFY	YES: PCR-755 (TWZA2X) in 2016	Discrepancies with [8] were identified in TP9T64. Therefore PIM-466 was launched with the aim to mitigate them. PIM-466 was converted in PCR-1154. RSE is not using this data for verification but ITER_D_7N5BRQ (see below).
	ITER_D_7N5BRQ	Not baseline, only additional shielding were baselined through PCR-1154 (2020) and following PCR daughters	PCR-1154 is the result of PIM-466. ITER_D_3QBAPQ radiation maps mode 0 was sent to ASN (ITER_D_3TPMBK) in 2021. Following ASN/IRSN instruction, IO proposed new radiation criteria who are those presented in ITER_D_7N5BRQ*. Radiation maps delivered in 2020, data used for verification of the radiation zoning
	ITER_D_3FM52L		Used to provide radiation conditions for equipment/electronics qualification program (use of RADAT tool) through A Deviation Request Process vs baseline
1	ITER_D_V35THE	YES: mPCR-384	Quite old data. Currently replaced by F4E and NIE scoping studies who are more up to date (see below). RSE is not using this data for verification but NIE documents.
	F4E_D_2QERK5	NO	In Bioshield mode 1 – scoping studies from 2021 (specific safety factors were considered – still under discussion)
	NIE: ITER_D_68VR7F	NO	13 representatives areas of the Tokamak complex (2020-22) – No safety factors used
2	ITER_D_F8UEXR, ITER_D_67CN24, ITER_D_HPX254	YES: PCR-755 (TWZA2X) 2016	Radiation maps delivered in 2015. RSE is not using this data for verification.
	ITER_D_67Q2VG	Not baseline, only additional shielding were baselined	Radiation maps delivered in 2022, data used for verification through a

		through PCR-1154 (2020) and following PCR daughters	Deviation Request Process vs baseline

Radiation maps mode 0 (ITER_D_7N5BRQ) and mode 2 (ITER_D_67Q2VG) are using similar input (Building models from 2019).

ALARA/ORE:

ALARA / ORE	Baseline	Comments
ITER_D_6ECUV5, ITER_D_6976LV, ITER_D_5U5ZK4	No	Scoping studies performed in 2020-22 on 13 representative TK areas. Status 12/2022

The latest version of the analysis results with radiation maps is available at ITER_D_7N5BRQ - Radiation conditions (RM2020) in/out of TC using ambitious thresholds for radiological zones for workers and ITER_D_3FM52L for equipment/electronics.

Updating radiation maps including updating following sources and models.

- Building and systems :
  - ITER_D_3FEA8J - Tokamak Complex MCNP Model Report
  - ITER_D_2SA24Q - Auxiliary Buildings Report - MCNP models
  - ITER_D_2SGT5W - NB Cell & HV Deck - MCNP model
  - ITER_D_2RLM3G - E-lite 360º MCNP model - Model Report
- Sources :
  - ITER_D_2YBFY3 - Plasma Radiation Source for Radiation Maps
  - ITER_D_YNWTFW - Water source modelling for ITER Radiation Maps

To update the source, the procedure of generation of auxiliary source also proposed to be updated.

The plasma source is built through a 360 degree ITER tokamak model called E-lite model. The Elite model is an accurate representation, with conservative approaches adopted to encounter the limit of knowledge. The details of the E-lite model are available at ITER_D_2RLM3G - E-lite 360º MCNP model - Model Report. The sources considered in the radiation maps calculations include :

- Pre-DT plasma neutrons : DD neutrons and subsequent photons
- Photo-neutrons from runaways Electrons
- DT neutrons from the plasma and the prompt gamma generated through (n,p) reactions
- ERID & calorimeter source
- The radioactive water sources (^{16}N, ^{17}N, ^{19}O).
- Activated corrosion Products
- Radioactive decay of activated components
- Activated dust (notably on filters, or in vessel/RH equipment)

Apart from the above, the proposed contract should also cover some of the important activities of CDT-1, especially design calculations of L4 shielding and Top lid. See the tracking table of CDT-1 on PCR1154 design plan 87VJQK.

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The proposed contract should also cover refining one of the important source term called Activated Corrosion Products (ACP). This includes evaluating and performing parametric/sensitivity studies on the ACPs contributions to the ORE and extrapolate a "rule of thumbs". Using the developed ACP sources, that will be provided by IO, we need to consider possible ORE "hot-spots" resulting from radiation calculations and the need to re-fine the 3D models to avoid/reduce errors due to the geometry simplification (e.g. HXs, systems with a larger number of pipes). Finally, a proper estimation of safety factor for ACP sources should be obtained through sensitivity studies.

Similarly, the dust sources will be assessed and properly considered in the different radiation maps concerned.

Stakeholders

We can identify external and internal stakeholders.

External are ASN and IRSN, radiation maps are used to demonstrate the respect of radiation safety regulation and requirements. Therefore, radiation maps are delivered in coherence with the need of the project to answer some technical prescriptions (Hold point) or according to safety milestones defined with ASN to get an authorization.

Internal are other entities within the project, such as:

- ENG :
    - ENG is in charge to provide the input (geometry, materials) through a process with a good traceability of the data used
    - Through TF02, radiation maps are used to provide indicators regarding the safety function "Limitation of exposure" at ITER level andto cross check the coherency between local nuclear analysis used to demonstrate radiation safety requirements in PBS design review (CDR, PDR, FDR), to support transverse entities (CDT-1, PWG) or to answer to NCR, DR or RFI
    - Radiation maps are used to provide radiation conditions for the PBS qualification program
- SCOD :
    - To provide data that used with Inspection/maintenance plans provided by PBS and validated by SCOD in order to assess the Occupational Radiation Exposure
    - To provide data to be able to prepare General rules of operation

Needs within IO and regulator.

ASN needs

- Current radiation maps mode 0/2 were used to answer to the Assembly Hold Point regarding B2 slab. Since those radiation maps, RSE is following carefully the evolutions of the project (gate reviews of PBS or PCR-1154 items, PWG progress…). A NCR was opened regarding TCWS source that should lead to a new radiation maps mode 0 where it will be verified the impact on radiation safety requirements.
- Radiation maps for mode 1 will be needed to demonstrate the radiation zoning and to be used to assess the ORE and individual dose target per year. At this stage, we have NIE scoping studies and some assessment provided to specific areas (Port cell in FDR). This will have to be updated and provided to ASN/IRSN and next RPrS update.
- The next update (radiation maps delivered) of the radiation maps is foreseen for the next safety milestone to get authorization to start the Tokamak and for RPrS update. The anticipated time line is :
    - T0: Next safety milestone – authorization to start
    - RPrS update : T0-2 years

- Radiation maps update: T0-3 years
- If **T0 is in 2033 (to be scaled, at present for indicative purpose)**

ASN needs
Closure of TCWS NCR / RC1 : Radiation maps update in 2024
Radiation maps mode 0, 1 and 2 to be provided 2030 for the RPrS update (TK complex and HCC) but also waste assessment

IO needs:

- Current radiation maps are used for qualification program
- Within the frame of Project rebaselining the project will need : In general the system and equipment designer's needs are Total integrated dose (AFP+DT1+Accident), Equivalent Neutron fluence, worst case TNF. Along with SDDR for maintenance scenario assessment, translates to the following:
  - DT1 radiation maps :
    - Mode 0: assume to be similar to the current radiation map mode 0, but to be updated according to building maturity (B14, end of HIT cycle, PCR-1154 items with higher maturity , updated status regarding penetrations) and the PBS maturity and DT1 machine configuration
    - Mode 2: According to DT1, response of in vessel systems will be significantly lower, thus could lead to local shielding optimization
    - Mode 1: According to DT1 configuration, radiations will be significantly lower, thus project will need to know the current situation
  - AFP radiation maps :
    - Mode 0: it should be provided the radiation maps for DD phase of AFP. In addition Runaways Electrons phenomena shall be properly captured with AFP configuration
    - Mode 1: it is expected to provide SDDR within the VV. It is expected low SDDR outside the VV (Port cell) after a certain cooling time, it is still under discussion the need to have such detailed radiation maps or only a local analysis (Port cell)

Project needs
Radiation maps mode 0 (DT1) to be provided in 2026 (6 years after current mode 0)
Radiation maps mode 0 (AFP) to be provided in 2024-25 (no radiation maps exist in DD)
Radiation maps mode 1 to be provided in 2028 (6 years after NIE assessment)
Radiation maps mode 2 to be provided in 2026 (4 years after current mode 2)

5.1 Scope of work #1

To meet the above objectives, Contractor shall provide neutronics analysis support to the ITER Nuclear Shielding Co-ordinator at the Contractor's premises, or on the ITER site with the location and type of support being detailed in the specific Task Order. The Contractor will assist

the ITER Nuclear Shielding Co-ordinator with the planning, preparation, documentation, management and execution of the activity as defined in the applicable Task Order.

5.1.1 Description

The scope of the specific support will include, but will not necessarily be limited to:

- Creation of computer models
    - Simplification of CAD models (various formats including CATIA, step etc.)
    - Conversion of CAD models to input to transport codes (various formats including e.g. MCNP, Attila)
    - Incorporation of models in to ITER reference models or combining of models. A specific effort will have be made to update/create a new ITER reference model architecture enabling to facilitate the ease of the ITER MCNP reference model with capability to extract/isolate representative areas easily.
    - Specification of materials
    - Variance reduction optimisation (e.g. weight windows)
    - Tally specification
    - Documentation of models
- Radiation transport calculations
    - Estimates of neutron flux with energy resolution when required
    - Estimates of gamma flux with energy resolution when required
    - Assessment of shut-down dose rates during mode 1
    - Assessment of uncertainties/safety margins and quality or results
    - Production of mesh tally results
    - Documentation of results
- Preparation of proposals on shielding design for:
    - Support in the analysis of the Hot Cell Complex
    - Dose reduction methods following ALARA approach during mode 1 (maintenance)
- Support in responses to ASN
    - to help reducing mode-1 dose during maintenance,
    - to help review the RPrS & rad chapters, confirming the radiological zoning
    - to help answer future ASN questions on radiation maps, etc.
- Determination of nuclear responses
    - Nuclear heating
    - Damage
    - Gas production
    - Material dose estimates
    - Biological dose estimates
- Activation calculations
    - Specification of materials including impurities
    - Activation and inventory calculations
    - Pathway analyses
    - Mapping of isotopic content
    - Evaluation of doses from activated material in tokamak buildings and Hot cell complex

- Definition of Sources
    - Production of neutron source models for
        - Deuterium (DD) and deuterium/tritium (DT) plasmas
        - Runaways Electrons
        - Activated water
    - Production of gamma source models for activated components
    - Production of gamma source models for ACP
    - Production of gamma source models for dust (Dust in Filters)
- Full reporting of analyses
    - Provision of input and output results
    - Provision of reports on all work undertaken

- The contractor is expected to have access to the following computer resources
    - ITER approved radiation transport codes (D1S-UNED, MCNP)
    - ITER validated activation code (FISPACT, ACAB, ORIGEN…)
    - CAD to MCNP conversion programs
    - CAD software
    - Provision of appropriate computer platforms for computations within the time-scales of the tasks orders.

- Supervision and planning
    - Provision of oversight and coordination for nuclear analysis activities performed by the Contractor
    - Provision of information on task durations, resources etc. to develop analysis schedules
    - Provision of various reports to record progress against the project plan, identifying issues and recommending solutions

5.1.2 Service Duration

The maximum expected duration for this activity is 48 months.

6 Location for Scope of Work Execution

Contractor shall provide neutronics analysis support to the ITER Nuclear Shielding Co-ordinator at the Contractor's premises, or on the ITER site with the location and type of support being detailed in the specific Task Order.

7 IO Documents

The work will require many inputs including various configurations and other information depending upon the specific task orders. The list of such documents will be provided in the technical specifications of related task orders at time to time.

8 List of deliverables and due dates

The Supplier shall provide IO with the documents and data required in the application of this technical specification, the GM3S Ref [1] and any other requirement derived from the application of the contract.

The detailed list of deliverables and the schedules will be specified in the technical specifications of individual task orders.

Supplier is requested to prepare their document schedule based on the list provided as above, and using the template available in the GM3S Ref [1] appendix II (click here to download).

9 Quality Assurance requirements

The Quality class under this contract is expected to include all quality classes, [Ref 1] GM3S section 7 applies in line with the defined Quality Class.

The specific quality requirements are detailed below.

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 the following ITER document: ITER_D_22MFG4 - ITER Procurement Quality Requirements.

Neutronic analyses have to be performed following the ITER QA requirements for analyses and calculations: ITER_D_22MAL7 - Analyses and Calculations and ITER_D_R7XRXB - Instructions for Nuclear Analyses.

Prior to commencement of the task, a Quality Plan (see ITER_D_22MFMW - Requirements for Producing 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.

Deviations and Non-conformities will follow the procedure detailed in the IO document: ITER_D_22F53X - Requirements for DA / Supplier / Subcontractors Deviations & Nonconformities.

Prior to delivery of any manufactured items to the IO Site, a Release Note must be signed:

ITER_D_22F52F - Requirements for Producing a Contractors Release Note.

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, it should fulfil IO document on Quality Assurance for ITER Safety Codes (ITER_D_258LKL-Quality Assurance for ITER Safety Codes Procedure).

10 Safety requirements

The scope under this contract covers for PIC and/or PIA and/or PE/NPE components, [Ref 1] GM3S section 5.3 applies.

10.1 Nuclear class Safety

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.
In order to successfully perform the tasks in these Technical Specifications, the Contractor shall:

- **Strictly implement the IO procedures, instructions and use templates;**
- **Strictly implement the requirements specified in** ITER_D_SBSTBM - Provisions for Implementation of the Generic Safety Requirements by the External Interveners**;**
- **Implement a technical control for each PIA defined in** ITER_D_WQKUHQ – Surveillance Plan for the Design, Integration and Construction of TAPB and HCC - Annex 2 List of PIA**;**
- **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.**

Specific surveillance (similar to audit) will be performed by IO to verify that the above requirements as well as those in chapter 15.1 are respected by the contractor. Contractor will be informed by IO in the Task order.

11 Specific General Management requirements

Requirement for [Ref 1] GM3S section 6 applies in full requirement

11.1 Contract Gates

The contract gates are defined in [Ref 1] section 6.1.5, the specific gates will be specified in the individual technical specifications.

11.2 Work Monitoring

The mechanism for the work monitoring if required will be specified in the specific technical specifications of individual task orders.

11.3 Meeting Schedule

The meeting schedule will be specified in the technical specifications of future task orders.

11.4 CAD design requirements

If this contract requires for CAD activities, those will be specified in the individual task orders, then [Ref 1] GM3S section 6.2.2.2 applies"

11.5 Profiles and skills

The Contractor's team shall cover all disciplines that may reasonably be required to carry out the scope of work.

As guidance, the following personnel profiles are expected to be required for work at the contractor's site and at the ITER site:

- Analyst
- CAD Operative
- Project Manager
- Person(s) for technical checking and reviewing the work.

The following minimum required professional competencies are necessary to fulfil the scope of work for each of the profiles listed above:

- proven experience in the nuclear physics or engineering and nuclear analysis
- Demonstrated experience of nuclear issues/sources related to fusion experiments
- ability to use CAD packages and to convert it for MCNP
- Demonstrated experience to use massive MCNP model (>1, 000, 000 surfaces), large number of penetrations (>4000) and high power computation capabilities
- Demonstrated experience with MCNP/D1S
- Demonstrated experience with activation codes (e.g. FISPACT,ACAB etc)
- knowledge of INB order 2012 and PIA requirements
- knowledge of Quality Assurance systems ISO 9001 and their practical application,
- fluent in English both written and oral,
- ability to communicate effectively and to write clear and concise reports in English,
- proficient in the use of Microsoft Office suite of software,
- good interpersonal, communication and organizational skills,
- ability to read engineering drawings

11.6 Anticipated level of requirements

The anticipated level of support corresponding to each of the profiles is given below as guidance. The numbers quoted correspond to the estimated workforce needed to support nuclear analysis tasks. However, this level of support will not necessarily be achieved during the life of the contract.

- 2024-2025 1.89 man-years
- 2025-2026 1.89 man-years
- 2026-2027 1.89 man-years
- 2027-2028 1.89 man-years

11.7 Responsibilities

Access and regulation:

Contractor will be responsible for all work visas and other required documentation and their respective costs associated with working at the ITER site.

IT equipment and licences:

Where the task order includes the supply of IT equipment, the contractor shall have and maintain the necessary IT equipment and licenced software tools required. All deliverables shall be supplied in a format acceptable to IO.

Where licensing or Export Control issues exist, the Contractor will be responsible for supplying the code and licenced users and abiding to all the relevant legal obligations and any costs associated with them.

The IO uses Microsoft Office Suite for general purpose document preparation, Catia/Enovia V5 for design work and Primavera for Scheduling. AutoCAD software is also available (used primarily for integrating third party Installations into the ITER CATIA models).

11.8 Acceptance Criteria

Documents must be prepared according to applicable IO policies and procedures. The tasks will be considered complete and acceptable once the tasks have been performed in accordance with this specification and submitted to, reviewed by and accepted by the IO. The IO will review the deliverables and provide comments to the Contractor within 2 weeks from when the deliverables are submitted to IO. Revision iterations will follow as necessary.

11.9 Licensing requirements

In application of the ITER agreement, article 14, ITER follows the French Regulation for Nuclear safety. Because of its inventory in nuclear materials, ITER has been classified in France as a nuclear facility “Installation Nucléaire de Base” and in particular numbered as INB no.174 per the French Decree [**3]** and the associated decision from the ASN (French Safety Authority) [4]. ITER Organization (IO) is the nuclear operator of this INB and understood like that in the framework of this contract.
As required by the INB Order, and notably its article 2.2.1, the nuclear operator (IO) must notify the external interveners of the necessary provisions for application of the INB order.
The supplier must comply with the all requirements expressed in “Provisions for implementation of the generic safety requirements by the external interveners” **[4]**.
The contractor must be aware of **[6]** and must be also known, understood and applied by all staff of the contractor and cascaded down in the managerial lines of the contractor and all of their sub-contractors (when applicable).

11.10 Protection important activities

As per articles 1.3 and 2.5.2 of the Order of 7 February 2012:

“Activity important for protecting the interests mentioned under Article L. 593-1 of the Environmental Code (nuclear security – i.e. nuclear safety, radiation protection, the prevention and fight against malicious acts, and also civil security actions in the event of an accident –,

public health and sanitation or protection of nature and the environment), i.e. activity that falls under the technical or organizational provisions mentioned under the second paragraph of Article L. 593-1 of the Environmental Code or that is liable to affect them;”

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In practice, and according to **[6]**, the calculations to be carried out in the scope of this contract are a PIA. The defined requirements associated to this PIA are also included in **[6]** and defined below:

Defined Requirement	Provisions to be implemented in this contract
The input data shall be: o Up to date o Validated o Consistent with safety demonstration For undefined input data: o Clearly identified and referenced assumptions o Sensitivity study to assess the impact of the range of assumptions or use of non-arguable conservative assumptions o Formally validated baseline or conservative input data in the document in support of the safety analysis	o Input data to be provided by IO to ensure that the input is formally validated baseline or conservative input data in the document in support of the safety analysis. o The contractor shall apply the instructions for verification of input for radiation transport calculations **[7**] as per section 7. o The contractor shall apply the instructions for nuclear analysis **[8]** as per section 7. The contractor shall clearly define and identify the assumptions taken
The calculation model used shall always be equally or more conservative than the Configuration Management Model (CMM).	Input data to be provided by IO to ensure that the input is formally validated baseline or conservative input data in the document in support of the safety analysis
The method and code shall be qualified according to **[2]**.	The contractor shall apply the instructions for nuclear analysis **[8]** as per section 7.
The method and code shall be used within its qualification domain	The contractor shall apply the instructions for nuclear analysis **[8]** as per section 7 and the requirements stated in this specification.
The uncertainties associated with the methods shall be estimated, or additional margins shall be added and substantiated, through sensitivity studies.	The contractor shall apply the instructions for nuclear analysis **[8]** as per section 7 where the estimation of uncertainties is part of the output data and acceptance criteria.
The parameters (including input data) that have strong impact on the results shall be identified.	As part of this contract, the contractor shall identify the parameters (including input data) that have strong impact on the results and provide it in the final report.
All input data, methods codes and their validity domain and uncertainties shall be included in the report.	The contractor shall apply the instructions for nuclear analysis **[8]** as per section 7 and the requirements stated in this specification.
Intermediate and final results shall be expressed in international units.	Intermediate and final results shall be expressed in international units.
A sensitivity studies shall be performed for covering uncertainties or additional safety factor in the results and the results shall be integrated in the report.	The contractor shall apply the instructions for nuclear analysis **[8]** as per section 7 where the estimation of uncertainties is part of the output data and acceptance criteria.

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The acceptance criteria shall be included in the report; all margins and safety factor shall be expressed in safety limits.	All margins and assumed safety factors shall be given in the final report.

As required by the INB Order **[2]**, and notably its article 2.2.1, the nuclear operator (IO) must notify the external interveners of the necessary provisions for application of the INB order.

1) The supplier must comply with the all requirements expressed in "Provisions for implementation of the generic safety requirements by the external interveners" **[4]**.
2) For each requirement, the external intervener must explain in its quality system the dispositions taken to implement the requirements stipulated in this document.
3) **All external interveners must be informed that ITER is a nuclear facility (an "INB", for Installation nucléaire de base, "Basic nuclear installation" in French regulation) identified in France by the number "INB no. 174".** In application of the ITER agreement, article 14, ITER follows the French Regulation for Nuclear safety. Because of its inventory in nuclear materials, ITER has been classified in France as a nuclear facility "Installation Nucléaire de Base" and in particular numbered as INB no.174 per the French Decree No. 2012-1248 dated 9 November 2012 authorizing IO to create a basic nuclear facility called "ITER" (ITER_D_CZK7M5) and the associated ASN Decision 2013-DC-0379 dated 12 November 2013 establishing the prescriptions applicable to ITER Organization for the design and construction of the licensed nuclear facility INB No. 174 called ITER (ITER_D_MU6PP3). ITER Organization (IO) is the nuclear operator of this INB.
4) In every contract involving PIA and PIC, disregarding the level in the supply chain of the contracting parties, it must be clearly stated that defined requirements on PIC and PIA have to be fulfilled. For PIC and their defined requirement, the procedure **[10]** applies. For PIA and their defined requirement, the document **11]** applies.
5) The external intervener must explain in its quality system:
    - What are the dispositions taken to implement the requirement as per point number 4 above.;
    - What are the verifications made to check the appropriate propagation of the defined requirement;
    - What are the records used to document this verification.
6) The ITER Policy on Safety Security and Environment Protection Management (ITER_D_43UJN7) must be circulated, known, understood and applied by all staff of the external intervener and cascaded down in the managerial lines of the external intervener and of contractors and sub-contractors.
7) The external intervener must be aware of the ITER dispositions for application of the INB Order, which are implemented:
    - Through the IO Integrated Management system "MQP" for the organizational and managerial matters;
    - Through the configuration management system for the technical matters.

    The list of IO applicable documents for the contracts is provided in a specific annex of each contract.
    a. On this basis, the external intervener must implement its own quality assurance program (QAP) and must demonstrate that it is compliant with the IO quality management requirements, in particular for the application of INB order.
    b. The external intervener's QAP is submitted for approval to IO before initiating any activity related to this contract.
    c. For each step of this contract, external intervener must provide the corresponding

Quality Plans.

8) The external intervener must grant access rights to the IO and French nuclear regulatory authorities representatives to its facilities and records **and those of its suppliers and subcontractors** for the purposes of surveillance of defined requirements during the design, construction/manufacturing, commission, assembly, maintenance and surveillance of a PIC. This surveillance also includes the examination of all PIA and the follow-up and verification of all corrective actions which are to be implemented.
9) The external intervener must establish a supervision plan for its own external interveners.
10) The external interveners must establish and/or must request to its contractors to establish their manufacturing inspection plans (MIP) following IO procedure Requirements for Producing a Manufacturing and Inspection Plan (ITER_D_22MDZD).
    - Activities classified as PIA's must be clearly identified in the corresponding MIP templates and in agreement with IO PIA definitions after IO review and acceptance.
    - The type of the intervention points on the PIA's are marked up after acceptance by IO and are properly tracked after the execution of the required technical controls.
11) For each PIA performed by the external intervener or one of its sub-contractor (disregarding the level in the supply chain), the external intervener must ensure that:
    - The PIA is performed in accordance with procedure and using means for meeting *a priori* the related defined requirement.
    - The PIA is traced to check *a posteriori* whether the defined requirement were met.
12) For each PIA performed by the external intervener, the external intervener must performs also a technical control to ensure that:
    - The PIA is carried out in compliance with the appropriate defined requirements.
    - The appropriate corrective and preventive actions have been defined and implemented.
13) The external intervener must put in place an organization to guaranty that the persons carrying out the technical control for PIA's are distinct from the individuals who have accomplished the activities.
14) For each PIA performed by a sub-contractor of the external intervener (disregarding the level in the supply chain), the external intervener must ensure that the subcontractor make analogous provisions.
15) The external intervener must ensure that the PIA and their technical controls are carried out by persons with the appropriate competences and qualifications. For that purpose, the external intervener must notably apply the procedure [6]. The external intervener must ensure that its sub-contractors (disregarding the level in the supply chain) make analogous provisions. The external intervener must explain in its quality system the dispositions taken to implement this requirement.
16) The external intervener must ensure that each PIA and the related technical controls:
    - Are documented to demonstrate a priori that they comply with the defined requirements,
    - Are traced to check a posteriori that they comply with the defined requirements,

    This applies to every PIA and technical controls performed by the first external contractor in the contractual chain or any one of its sub-contractor (disregarding the level in the supply chain).
17) The external intervener must keep updated records of the results of implemented PIA and their technical control, the related action of verification and the assessment when

requested by IO and must provide them to IO per the specific IO procedures for documentation management.

The external intervener records must be easily accessible and legible by IO, protected, kept under appropriate conditions and archived for an appropriate and justified period of time.

18) The external intervener must implement the same criteria in its Quality Assurance System for categorization and remedial actions. In particular the detection of NC must be immediately communicated to IO and registered in the record system of the external intervener and of IO (per section 5.9 “Records”).
19) The external intervener must implement a management system in accordance with the requirement defined under (18) above, allowing in a short delay (less than one month):
    - The opening and categorization of a NC;
    - The performance of root cause analysis of the NC;
    - The establishment of the remedial, preventive (PA) and corrective actions (CA);
    - The follow-up of the evolution of the NC, PA and CA;
    - The proper close-out of the NC.
20) The external intervener must be in charge of the management of its NCR, including the tentative deadlines for the closure of the NC. If the deadline for NC management cannot be respected, the external intervener must communicate to IO the cause for this delay (managerial, technical, human reasons) and searches for solutions, in agreement with the importance of the discrepancy.
21) Before releasing any control milestones such as hold points or notification points in the MIP’s, or any milestones indicated in the contract as release notes, each external intervener must check that:
    - All NC’s have been resolved;
    - Objective evidences of remedial actions performance are available;
    - All NC’s are properly close-out.
22) Each external intervener must:
    - Raise preventive and correctives actions when required, and scheduled them within an implementation program, following IO procedures.
    - Tracked their evolution until they are closed-out.
23) Each external intervener must require its contractors to apply the above management of NC’s, PS’s and CA’s.
24) The external intervener, aware of this classification, must provide skilled personnel able to immediately alert IO in case of possible significant event, as soon as detected.
25) In addition to individually managing each one of its discrepancy, the external intervener must periodically reviews the discrepancies in order to assess the cumulated effect of as-yet-uncorrected discrepancies and to identify and analyse the recurrence propensity for similar types of discrepancies. If need be, any preventives and correctives actions must be identified and scheduled within an implementation program.
26) The external intervener must systematically collect, analyse and communicate to IO the information that is likely to help IO improving the PIA activities.
27) On a monthly basis, the external intervener must provide follow-up status of nonconformities, correctives actions and preventive actions scheduling, resolutions and efficiency of such activities.
28) Any safety demonstration must be in compliance with the Authorization basis.
29) For detailed design or construction studies and calculation related to complementary safety demonstration, the external intervener must provide results based on a solid safety demonstration as per article 3.8 of the INB order and the instructions provided by IO for its application.

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30) For any deviation, the external intervener must raise a deviation request under the IO procedure conditions.
31) The external intervener must require its contractors to raise a deviation request as soon as detected.
32) The external intervener and its contractors must provide together the deviation request evidences of compliance with the authorization basis. The external intervener must check that the provided evidences are based on a solid safety demonstration as per article 3.8 of the INB order and the instructions provided by IO for its application.

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