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VERSION CREATED ON / VERSION / STATUS
12 Dec 2023 / 1.1 / Approved

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 Manayement 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 Radi/lion, Safety & Environment Group (RSE) [2].

3 Acronyms & Definilions

3.1 Acronyms

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

CRO	Contract Responsible Officer
GM3S	General Manayement Specification for Service and Supply

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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

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Currently the status is the following:

Radiation maps:

Mode	TF analysis

		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

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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

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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 p

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,

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

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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

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