

Contract for Development of Tritium Accountancy and Tracking Program

SUMMARY

Purpose

The purpose of this contract is to provide strategies and procedures for tritium accountancy and tracking in ITER.

Background

Tritium is a radioactive isotope and a nuclear material in France, thus tritium accountancy is required from the viewpoints of nuclear material control and prevention of malicious use of radioactive isotopes. By IAEA's definition, nuclear materials accounting is the activities carried out to establish the quantities of nuclear material present within defined areas and the changes in those quantities within defined periods. From the viewpoint of tritium security, a material balance area (MBA) is defined, which is an area into or out of which the quantity of tritium in each transfer can be determined and in which the physical inventory of tritium can be determined when necessary in accordance with specified procedures in order to establish the nuclear material balance for IAEA safeguards purposes. For the ITER nuclear facilities, a two MBA approach is more practical, one (MBA 2) is the Tritium Depot for tritium transport containers located at the Tritium Plant Building (B1 floor), and the rest belongs to MBA 1. When a tritium transport package with the maximum capacity of 70 g tritium arrives at the site, the amount of tritium in the metal tritide will be measured by a calorimeter. Then, tritium in the metal tritide bed will be unloaded into Storage and Delivery System (SDS) and the amount of tritium will be measured initially by PVTc method and verified by calorimetry of the unloaded bed. A well scheduled tritium transport plan should be prepared from the viewpoint of tritium decay. For MBA 2, the accuracy of tritium accountancy depends only on the number of transfers and the accuracy of calorimetry as well as calculation accuracy of tritium decay. For MBA 1, on the other hand, the accuracy of tritium accountancy depends also upon the accuracy of measurements and/or calculations for burned tritium, bred tritium and measured discards (waste and discharge to the environment). The tasks on physical inventory taking are as follows:

- Identifying KMP (Key Measurement Points) for MBAs in ITER (Determining which MBA the Tritium Loading Station belongs to, MBA 2 or MBA1?);
- Proposing strategies and procedures for Physical Inventory Taking (PIT) and Booking, including tritium recovery operations for preparing PIT;
- Determining the accuracy of MUF (Materials Unaccounted For) and evaluating cause of MUF.

In addition, tritium inventory shall be kept below certain amounts in a confinement zone and in some particular components such as vacuum vessel from the viewpoint of radiological protection of both workers and the public. Thus MBA 1 is divided into three Material Sub

Accounts (MSAs) from the view point of tritium safety. The first is the tokamak fuel cycle system (TFCS), the second is the hot cell and radwaste buildings and the final MSA is the tokamak vacuum vessel including heating and current drive systems (H&CD). Furthermore, since tritium is the fuel of fusion reactors, it is necessary to track tritium in the fuel cycle systems ensuring plasma discharges. The tasks on tritium accountancy and tracking within MSAs are as follows.

- Reviewing the dividing of MSA for the tritium accountancy and tracking of safety purpose particularly by taking safety limit of tritium inventory in vacuum vessel into account;
- Proposing strategies and procedures for tritium accountancy and tracking in the vacuum vessel;
- Proposing strategies for tritium accountancy and tracking in the Hot Cell;
- Proposing strategies and procedures for tritium accountancy and tracking in the TFCS, especially SDS.

Depending on the physical or chemical appearance of tritium, the following four categories can be classified: (1) tritium in process; (2) tritium retained; (3) tritium lost; and (4) tritium bred. The various categories of tritium require different techniques of measurements or estimations. The tasks on optimizing techniques for tritium measurements and estimations are as follows.

- Proposing procedures for shipper / receiver measurements and evaluating their accuracies;
- Optimizing dynamic techniques for gaseous tritium measurements and evaluating their accuracies;
- Proposing strategies and procedures for the in-situ measurements and sampling / ex-situ measurements of tritium in the vacuum vessel and evaluating their accuracies;
- Proposing strategies and procedures for the sampling and measurements of tritium in the retrieved divertor cassettes and other tritium-contaminated solid components and evaluating their accuracies;
- Proposing strategies and procedures for the measurements of burned tritium and evaluating their accuracies;
- Proposing strategies and procedures for the measurements of bred tritium and evaluating their accuracies;
- Proposing procedures for the calculation of decayed tritium and evaluating the accuracy;
- Providing estimation on the uncertainty of tritium inventory in the vacuum vessel as a function of the discharge number.

Scope of work

This contract is foreseen to perform:

- (1) To establish strategies and procedures for physical inventory taking;
- (2) To establish strategies for tritium accountancy and tracking in MSAs;
- (3) To optimize techniques for tritium measurements and estimations.

Export control

The technical specifications are not sensitive, but the outcomes of this contract may be sensitive and there may be Export Control considerations.

Estimated Duration and Timetable

The duration of the Contract will be 12 months from the date of the signature.

The tentative timetable of the applicable Call for Tender procedure is as follows:

Call for Pre-qualification	June 2010
Call for Tender	August 2010
Tender submission	October 2010
Contract placement	December 2010
Completion of contract	December 2011

Experience

The potential tenderers should have proven experience in the following areas:

- Recognized competence in nuclear materials accounting, in particular tritium accounting and tracking.
- Handling of large amount of tritium (grater than a few grams).
- Calorimetric measurements of tritium
- Measurements or estimations of tritium in large components

The potential tenderers should expect to spend a significant amount of time at the ITER site to facilitate regular meetings with members of the ITER Organization.

Candidature

Participation is open to all legal persons participating either individually or in a grouping (consortium) which is established in an ITER Member State. A consortium may be a permanent, legally-established group or a grouping, which has been constituted informally for a specific tender procedure. All members of a consortium (i.e. the leader and all other members) are jointly and severally liable to the ITER Organization.