# IFERC Newsletter

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**Status of DEMO Design Activity**

## Highlights on Safety Studies

In the Task 5, there are four sub-tasks: (5-1) The identification of the source terms, (5-2) The completion of the first set of dominant accident sequences or Postulated Initiating Event (PIE): identification and analysis, (5-3) Radioactive waste management, and (5-4) Promote development of standards for Fusion plants.

In task 5-1, for the safety of DEMO plant, the determination and definition of the main inventories are key transverse activities within several stakeholders. In EU, in order to provide inventories that will be used for baselining any further DEMO safety studies, a working group involving several experts from both DEMO central team and different DEMO research units has been set up. The necessary inventories are radioactive inventories (tritium, activated products from solid, liquid or gaseous products), but also all the types of inventories that may have an impact on the safety demonstration. In Japan, experimental data of the tritium behavior for tungsten (W) are acquired for the identification of tritium inventory assessment in vacuum vessels for JA DEMO. Specifically, diffusion and recombination coefficient data from plasma-driven permeation experiments in deuterium and deuterium/helium plasmas and solubility data from deuterium gas-driven permeation experiments were organized for neutron-irradiated W materials.

In the task 5-2, in EU DEMO, the main safety functions have been further analysed and have been described and discussed in IAEA Consultancy Meeting on Gathering Experience on Design Principles for Future Fusion Power Plants. At the top level, fundamental safety functions are the confinement of radioactive and hazardous materials and the limitation of internal and external exposure to ionizing radiation, using ALARA principle. In JA DEMO, the PIEs have been constructed based on FMEA (Failure Modes and Effects Analysis) for internal events. Equipment layout and weight distribution in the JA DEMO plant were evaluated in order to carry out seismic analysis regarding the external event. Moreover, the benchmark between TRACE code (a De Facto Standard code in Japan) and MELCOR code (a regulatory code for ITER) has been performed on JA DEMO. It was found that the maximum reaching pressure in the vacuum vessel against in-VV LOCA obtained by the MELCOR code is almost in agreement with the evaluation result in the TRACE code. EU PIE deterministic safety analyses have been mainly concentrated on in-VV and ex-Vessel LOCA and on the relevant mitigation systems.

In the task 5-3, an assessment is on-going to demonstrate that no High Level Waste will arise from EU DEMO. This is essential for the public acceptance and to ensure the attractivity of fusion against new fission power plant design. The operational and decommissioning waste preliminary assessment and relevant management is being continued with the assessment of the various types of waste expected from operation and with the identifications of the waste processes to be developed to enable a safe storage and easier acceptance in disposal sites. In Japan, the decommissioning plan of “Fugen” as a prototype of the advanced thermal reactor with a heavy-water-moderated was used as a reference for the study of the decommissioning plan of the JA DEMO.

In the task 5-4, in EU, a working group involving several nuclear safety experts in the fusion and fission fields has been set up to draw the principles of development of a new regulation tailored to the safety challenges of a fusion facility in EU. The work of the working group includes the review of the experience of licensing the ITER project, the regulation applied to ITER design and safety demonstration, the French regulator position on the application of the French regulation to ITER specificities vs fission plants, the EU study on the applicability of the regulatory framework for nuclear facilities to fusion facilities - towards a specific regulatory framework for fusion facilities -, the related IAEA technical documents on fusion power plant regulation, and the public expectations of safety and risk. It will lead to the development of a proposal for high level principles for the regulation of fusion power plants. In JA, in order to establish safety regulations for JA DEMO, a survey of the safety regulatory frameworks related to CANDU reactors in Canada and JET in the UK has been initiated.

*(DEMO Design Task-5 TROs)*