

MELCOR1.8.5 ANALYSIS OF HELIUM/WATER/AIR INGRESS INTO ITER CRYOSTAT AND VACUUM VESSEL

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In this paper, the helium/ water/air ingress into ITER cryostat and vacuum vessel event (vacuum vessel(VV)+cryostat consequence of failure event), which is classified in Category V, is analyzed based on the latest design evolutions. The purpose of this paper is to evaluate the amounts of radiological releases during the event. The concern relating to the radiological releases is the amount of Tungsten(W) dust(hereinafter referred to as dust) and Tritium as a form of HTO(hereinafter referred to as Tritium). In this paper, it is also the purpose to extract parameters which would affect amount of radiological releases and to evaluate the influence of parameters.

A modified MELCOR version, based on the nuclear reactor severe accident analysis program MELCOR 1.8.5, was used for this analysis that allows for the treatment of temperatures below the triple point of water. This model was used to calculate the resulting coolant flow, pressure, and temperatures within the VV, VV pressure suppression system (VVPSS), drain system, cryostat, cryostat air space room, gallery, and VV-PHTS. The MELCOR model was also used to calculate structure temperatures of cryostat, magnet, vacuum vessel, and FW & DV components and the condensation of steam on these structures. In the model, the heating, ventilating, air conditioning system (HVAC), the vent detritiation system (VDS) and the environment are included as well.

The parameter studies include:

- The base case
- The very conservative case
- Helium mass released from the TF system into the Cryostat Vessel
- Fraction of total water from the VV-PHTS entering the Vacuum Vessel
- Cross-sectional area of the hole in the Vacuum Vessel wall
- Cross-sectional area of the hole in the Cryostat Vessel wall
- Delay time of S-VDS actuation
- Delay time of HVAC ducts closure
- Elevation of the hole in the Vacuum Vessel wall
- Pressure threshold used in leak rate model

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