THE STORM FACILITY

The STORM (Simplified Test On Resuspension Mechanism) facility [1] was operated by JRC-Ispra. The facility was designed to work with high concentration of soluble and insoluble aerosol materials (up to 25 g/m3), a wide range of aerosol compositions, size distribution and density and high carrier gas and steam flow rate (about 1 kg/s). The test section was located downstream of the mixing vessel; it consisted of four steel pipes connected in series and/or parallel (Figure 1). The first pipe between the mixing vessel exit and the test pipe inlet (total length ≈4 m) was thermally insulated in order to reduce thermophoretic deposition and heat losses as well as to avoid steam condensation. The 63-mm inner diameter test pipe was 5 m long and was surrounded by an oven to keep the pipe wall temperature at the required levels during the deposition and resuspension phases. In the deposition phase, the carrier gas and aerosols pass through the mixing vessel a first straight pipe into the test section and then straight to the wash and filtering system. In the resuspension phase, the clean gas was injected through the resuspension line directly into the test section and the resuspended aerosols were collected in the main filter before the gas goes through the wash and filtering system.

The aerosol concentration and size distribution were measured upstream of the test section in the deposition phase of the experiment and downstream of the test section in the resuspension phase.

The gas flow temperatures at the vessel outlet and in the test section were generally stabilized within one hour. Figure 2 shows that thirteen thermocouples are located on the outer wall surface (TETP1, TETP2 … TETP10, TETPVin1, TETPVin2 and TETPVout). At the test pipe exit, along the inner radius of the pipe, the gas temperatures were measured in three locations: in the centreline of the pipe (TGTP1); at a distance of ≈10 mm (about one third of the pipe radius) from the inner wall surface (TGTP2); and on the inner wall (TGTP3). In each test, the absolute fluid pressure was set at 0.1 MPa. STORM tests can be subdivided into four phases: (1) heat-up phase, (2) temperature stabilization phase, (3) aerosol deposition phase, and (4) aerosol resuspension phase.

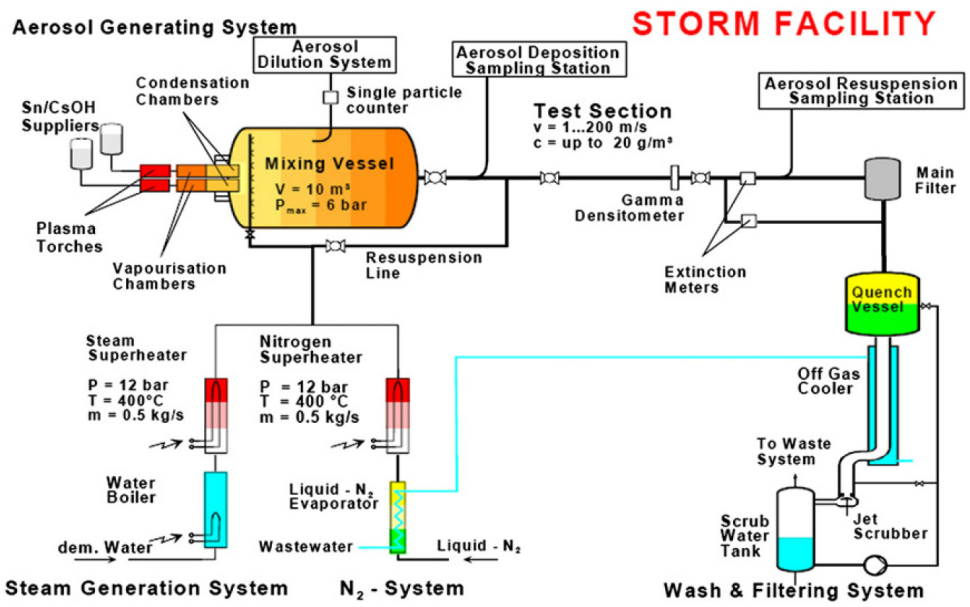

Figure 1 - Sketch of STORM Test facility [from JRC STRESA database].

International Standard Problem ISP-40 [2] was set up to address aerosol deposition and resuspension phenomena in the reactor cooling system and was based on test SR11 of the STORM series performed in 1997. The scenario was one of nuclear aerosol deposition in the relief lines of a PWR during a steam blackout followed by resuspension of the deposits by the steam surge resulting from a core slump. Like other STORM tests the experiment upon which this ISP was based took place in two phases. In the deposition phase SnO2 simulant aerosol was transported through a horizontal test section (diameter 63 mm, length 5000.5 mm) by a carrier gas consisting of a mixture of steam, N2, air, Ar and He. In this resuspension phase, nitrogen gas was passed through the test section in a series of mass flow rate plateaux, and the mass resuspended during each phase and its size distribution were measured by downstream sampling stations.

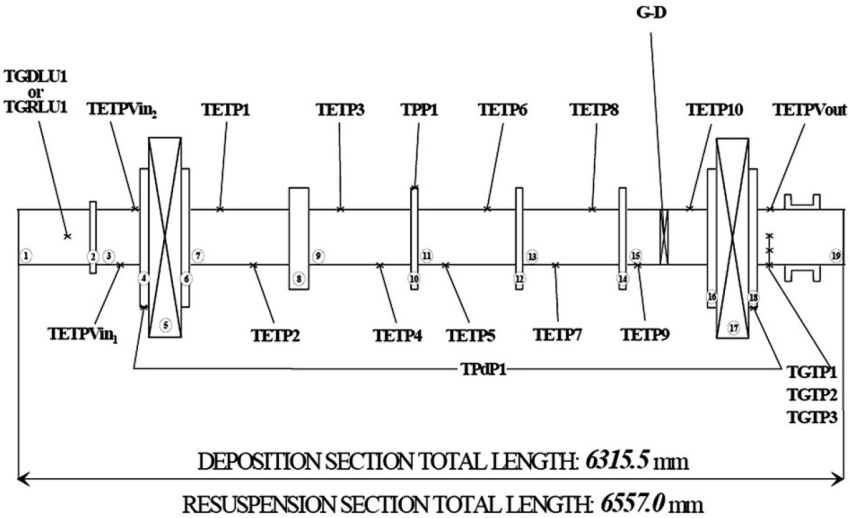

Figure 2 - Test section in STORM facility.

[1] A. Bujan, L. Ammirabile, A. Bieliauskas, B. Toth, ASTEC V1.3 code SOPHAEROS module validation using the STORM experiments, Progress in Nuclear Energy 52 (2010) 777-788.

[2] A. de los Reyes Castelo, J.A. Capitão, G. De Santi, International Standard Problem 40 Aerosol Deposition and Resuspension, EUR 18708 EN, February 1999.