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NUMERICAL STUDY ON THERMAL-HYDRAULIC CHARACTERISTIC DEPENDING ON OUTLET ORIFICE SIZE UNDER ACCIDENT CONDITION IN CFVS

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The Containment Filtered Vented System (CFVS) is installed in nuclear power plant to protect the integrity of containment building against the over pressurization and to remove fission products which are in aerosol, vapour and gaseous forms release from the fuel into the containment during sever accidents. For a Korea OPR-1000 pressurized water reactor NPP, the CFVS is designed as a wet type with a venturi scrubber and metallic fiber filter. During the venting process, iodine and aerosol are quantitatively separated inside the throats of venturi scrubber and stored in the scrubbing water pool but the amount of scrubbing water is continuously reduced by evaporation due to the high temperature steam and the decay heat due to fission products from containment building. Therefore, the vent line size which determines the steam flow rate from containment building is a very important to design parameter in CFVS, because the CFVS should be maintain performance passively over 72 hours after operation.
This study investigated the thermal hydraulic characteristic depending on outlet orifice size under accident condition in the CFVS for a long operating time using the FLOWNEX which is 1D simulation software. The modeling of the CFVS, including the models for venturi scrubber, scrubbing pool, the cyclone and the metal fiber filter as shown Figure 1. OPR-1000 was selected as a target nuclear power plant, and a Station Blackout (SBO) was chosen as an accident scenario. The isolation valves open/close set-point is 9/2.5 bar for the containment pressure. The simulation calculated according to four different orifice size on the exhaust pipe: 0.1m, 0.13m, 0.15m and 0.3m. Orifice sizes with 0.15m only met the design criteria because depressurization range in the containment building dropped to 50% of the design pressure within 24 hours and maximum (6m) / minimum (1.4m) water level of scrubbing solution was satisfied under accident condition.

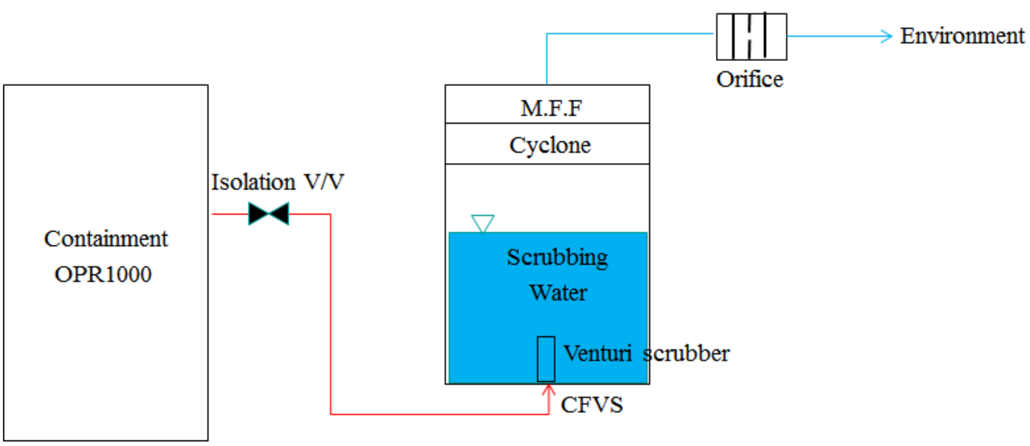

Figure 1. Modeling of CFVS