Radioactive release from VVER-1000 reactors after a terror attack

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One of the terror scenarios for nuclear power plants is a severe damage of the reactor containment caused by a plane crash or a missile. Due to the loss of electric power the cooling of the core is not maintained leading to a core melt accident. Normally in the course of severe accidents an intact containment has the ability to retain a large part of the radioactive inventory. The goal of this work is the investigation of the behavior of the radioactive release from a VVER-1000-type reactor during a severe accident with a large containment leak from the beginning of the accident. The results are compared with the release in a severe accident via a very small leakage due to the untightness of the containment.

This work supplements a series of studies investigating the behavior of a VVER-1000-type reactor during severe accidents under different accident management strategies. The focus in this study is on the „Station Blackout"-sequence (or TMLB' in the WASH-1400 nomenclature). The calculations were performed using the Source Term Code Package (STCP), hydrogen explosions are not considered. Up to the melt-through of the cavity bottom the thermal-hydraulics phenomena are almost identical to the TMLB'-case with an intact containment from the beginning. The phenomena occur slightly delayed due to the large containment leak. When the core-concrete-interaction begins the resulting gases leave the containment through the large leak and do not cause a pressure increase. The containment pressure remains at ambient pressure. Due to the different behavior and to the different release times of the nuclides the deviations to the scenario with an intact containment show a great variety. From this comparison it can be shown that the intact containment retains the nuclides up to a factor of 6000.