Some answers to NRC questions on filtered containment venting systems in Swedish NPPs

(1) What are they and what experience had the Europeans had with them?

Filtered containment venting consists of a wet Multi Venturi Scrubber System (MVSS). The system can be activated automatically, via a rupture disk, or manually. There are two separate venting lines from the containment for these two modes of operations (see Fig. 1.3 in the attached report). Please, note that the venting line with the rupture disk is always open so that no operator actions are needed to vent this way. The design principle of the system is the same for BWRs and PWRs. The system is inerted to avoid hydrogen combustion.

For more information, please see chapter 1.8 in the attached Swedish National Report, prepared for the European stress tests.

It is a passive system. The maintenance of the system consists mainly in changing water in the scrubber and keeping right chemistry in the scrubber.

(2) Do they provide filtering and venting for all accidents, or just some?

The system is design to protect containment integrity due to slow pressure increase, as a result of decay heat steam production or (in BWRs) as a result of compression of containment atmosphere (mainly nitrogen and hydrogen) when BWRs containments are filled with water (filling of containment with water up to the core level, in PWRs and BWRs, is a part of accident management). The chosen design scenario is station blackout and loss of steam-driven pumps with no manual actions credited during the first 8 hours. For more information, please see chapter 1.8 in the national report.

(3) What kind of decontamination factors (DFs) (of releases) do they provide?

The decontamination factor is at least 500 for BWRs and at least 1500 for PWRs.

(4) Would releases that pass through a filtered vent results in minimal land contamination such that long term evacuation would not be necessary?

No land contamination requiring evacuation is foreseen in the case of no rain. If it is raining, than long term evacuation will be necessary in a relatively small area (tens of square km) close to the power plant (approximately 15 km).

(5) What is estimate cost of a filtered vent (capital cost plus maintenance cost over the life of the equipment)?

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It is not easy to answer this question today (filters were installed in the late 80's). The best cost estimate I have now is 50 - 100 million dollar per reactor. I have no information on the maintenance costs but it is rather small.

(6) How is land contamination costs are considered in regulatory analyses, and what cost-benefit analyses have been performed and conclusion reached?

The fundamental policy guidelines for the Swedish program on severe accident management and release mitigation were given in the 1980/1981 Energy Bill to the Swedish parliament and in a 1981 Governmental Decree. According to the guidelines, "simple cost-effectiveness consideration shall not be applied to release mitigation measures required to prevent land contamination".

According the decision by the Swedish government from 1981 "such measures should be taken even if they involve a not insignificant cost for the owners, as seen in relation to the reduction of the release risk".

I assume that the cost-benefit issue was addressed in some form but I have no information on this.

(7) What type of nuclear power plants have filtered vent implemented?

All Swedish NPPs, i.e. both BWRs and PWRs, have filtered containment venting since 1989. Two BWRs at the Barsebäck site, which have been closed in 1999 and 2005, had filtered containment venting installed in 1985, but of different design - it was a big gravel bed filter.