



Strål  
säkerhets  
myndigheten

Swedish Radiation Safety Authority

# **Regulatory Information Conference 2012**

## **Regulatory Actions regarding Containment Venting and Filtration (TH34)**

### **Containment Filtered Venting in Swedish BWR Mark II**

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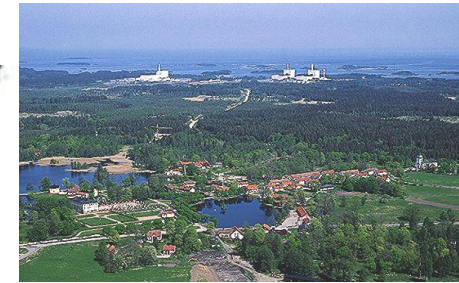
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# Swedish nuclear facilities

-  BWR  
ASEA Atom
-  PWR  
Westinghouse
-  Other



**Forsmark NPP**

Westinghouse SE  
Fuel manufacturing

SFR  
Final storage  
Low/intern. waste

Studsvik  
Research reactors  
closed



**Ringhals NPP**

**Oskarshamn NPP**



**Barsebäck NPP**  
Permanently closed

CLAB  
Central intermediate  
Spent fuel storage



# Background

## **Governmental report November 1979 - lessons learned from TMI (49 recommendations)**

- Further protection against releases of radioactive substance, particular those that cause ground contamination
- Use of Probabilistic safety analyses (level 1 and 2)



## **Governmental decision October 1981 for Barsebäck, February 1986 for the other units**

- Fatalities due to acute radiation disease should not occur
- Filtered containment venting shall be installed to reduce release to less than 0.1 % of Cesium 134, 137 and other ground contaminating isotopes in severe accidents

## **Severe accident release mitigating systems in place**

- Barsebäck in 1985
- Forsmark, Oskarshamn and Ringhals in 1988



## Design requirement

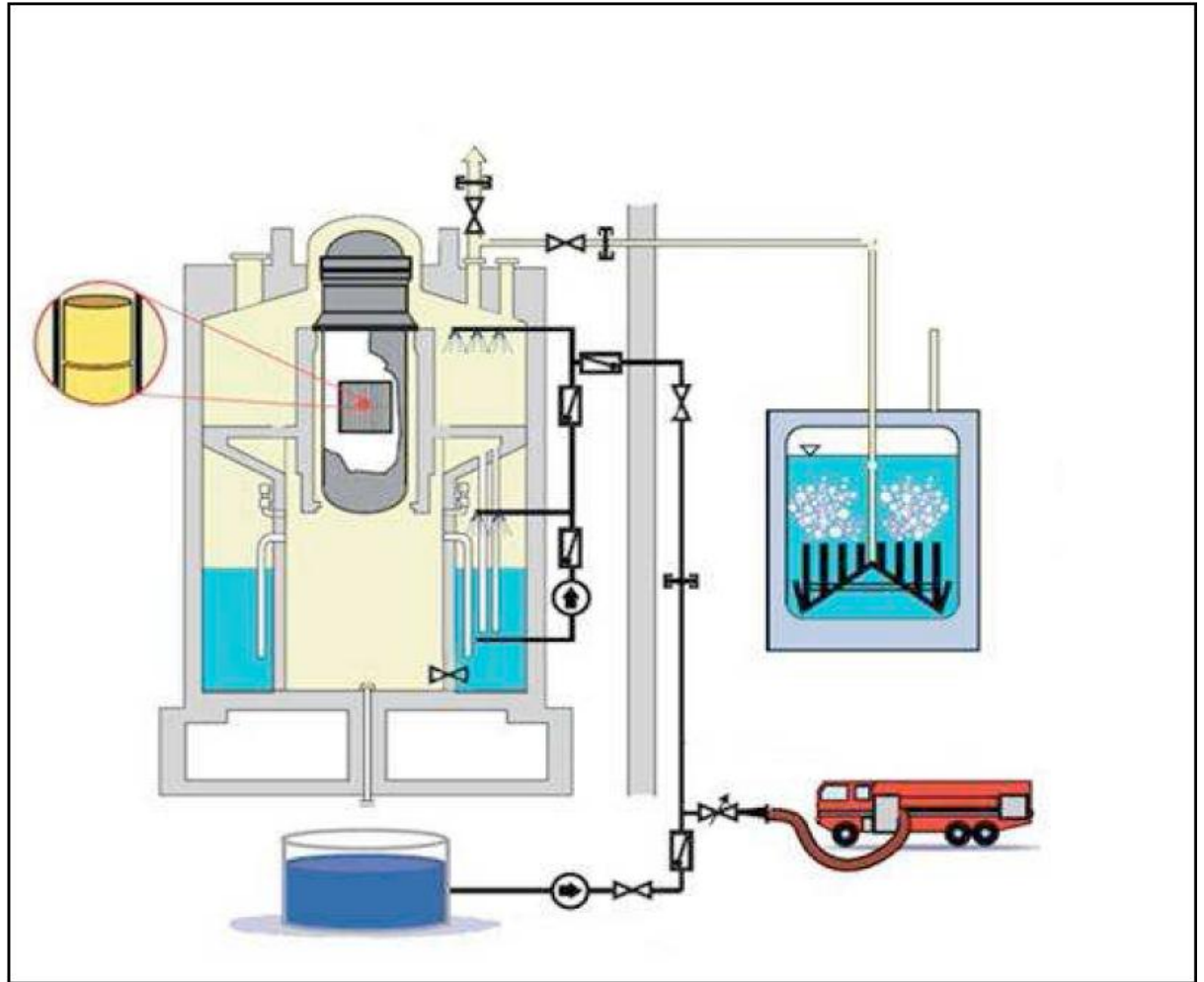
- ➔ Filtered containment venting system, decontamination factor of at least 1000 (BWR)
- ➔ Independent containment sprays
- ➔ Automatic filling of lower drywell with water (needed for some BWR)
- ➔ Containment pressure relief in events of LOCA and large degraded PS function (BWR)



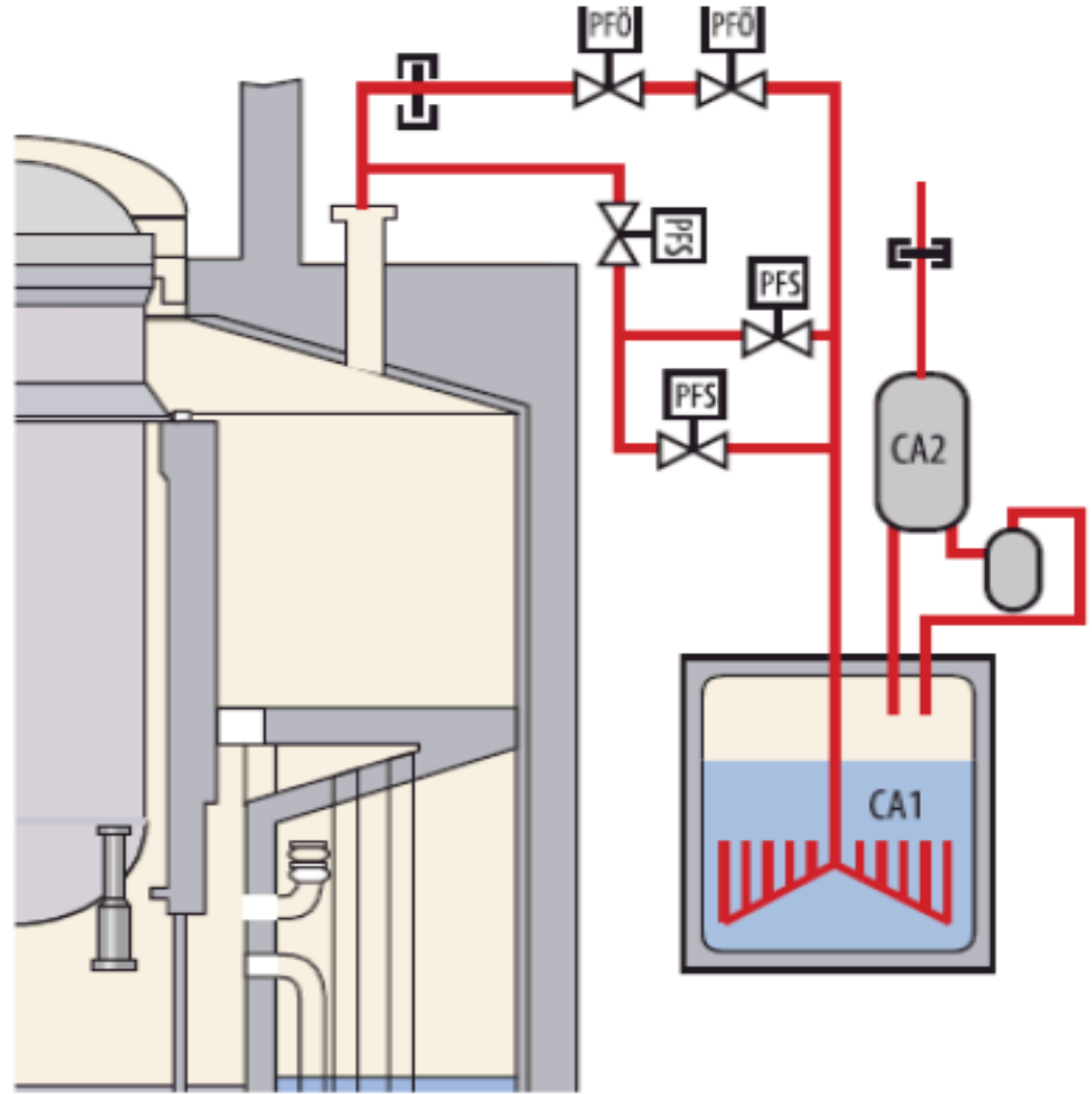
- ➔ Containment instrumentation for SA (activity, temp., pressure, water level, hydrogen content)
- ➔ A comprehensive set of severe accident management guidelines
- ➔ Organization fitted and trained to handle severe accidents
- ➔ Follow up and evaluate new international research results and experiences



**Severe accident  
management  
features installed  
at all Swedish  
reactors in the  
1980s.**



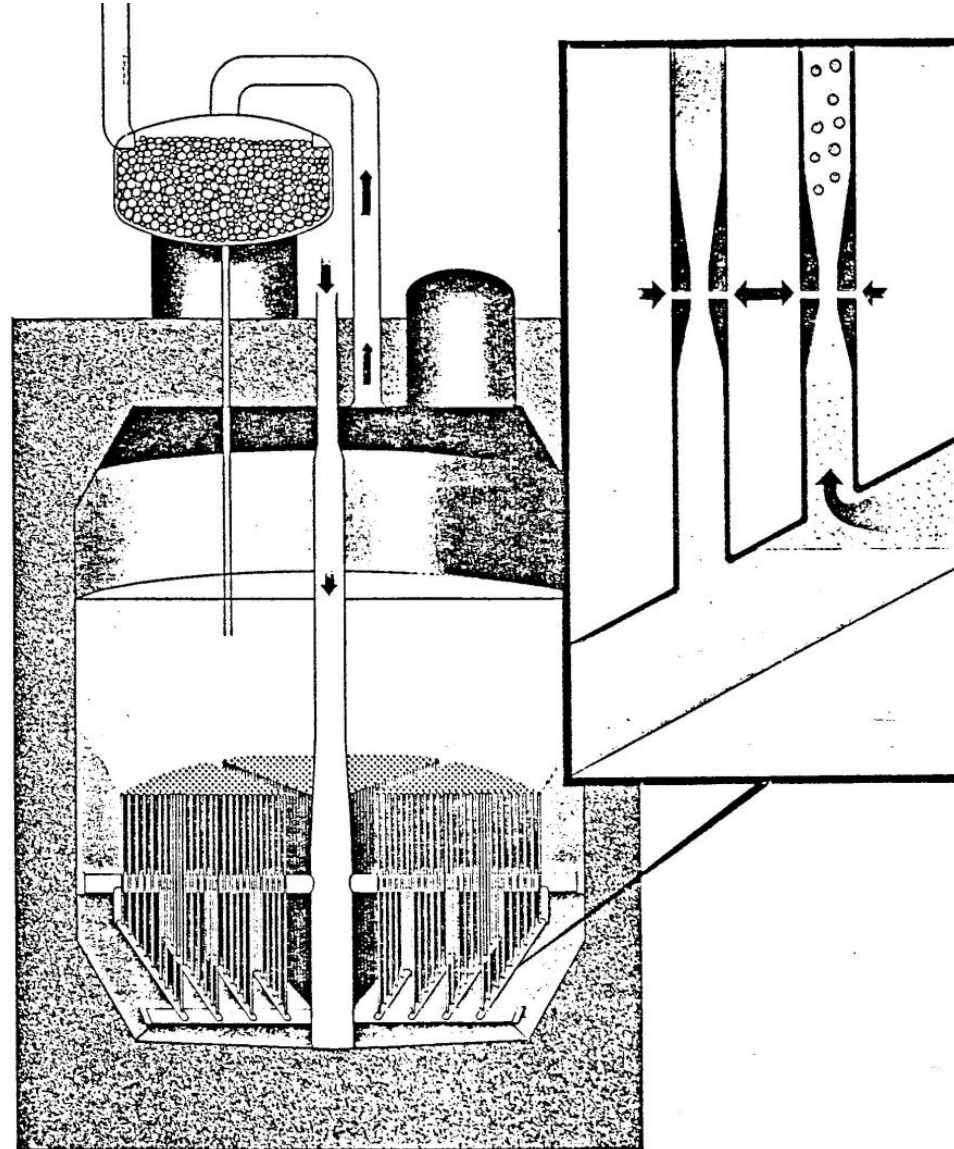




FÖ=fail open  
FS=fail closed



# Inerted multi-venturi scrubber system (MVSS)





## Design conditions and sequences

- ➔ Passive filtered venting system that activates through burst disc, close to design pressure
- ➔ Passive operation for at least 24 h
- ➔ Possibilities to manually open and close venting
- ➔ No manual action needed the first 8 h



- ➔ Design sequences involve:
  - Station blackout (SBO), battery power available
  - No turbine driven equipment available and no other passive core cooling means
  - Core melt including vessel melt trough
  - Vent and spray system independent of normal support system
  
- ➔ High pressure in a containment with a damaged core is not acceptable for any longer time
  
- ➔ A stable end state with water covered core/core melt and residual heat removal shall be achieved



## **SAM strategies**

- 1. Prevent over pressure of containment with independent spray system
  
- 2. Prefer manual pressure relief if venting necessary



## **Actions needed beyond 24 h**

- Adjustment of water level in the scrubber filter
- Charging of batteries by mobile diesel generator