

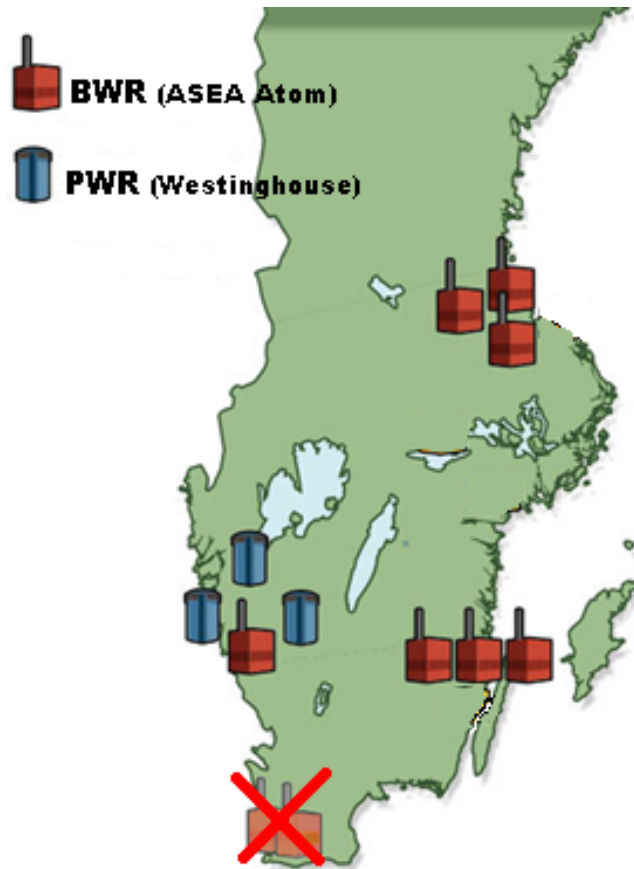
# Background for Vattenfall's interest in MACCS

IMUG meeting, Bethesda

September 10-11, 2014

Confidentiality - None (C1)

# Swedish NPPs



- 10 operating units:
  - 7 BWR (Asea Atom Swedish Design)
  - 3 PWR (Westinghouse 3 loop)
- 2 decommissioned units (BWR), by 1999 and 2003

## Large efforts during the 80's

- implementation of MAAP code
- ambitious research programs initiated
- development of emergency response guidelines
- development and implementation of filtered venting devices



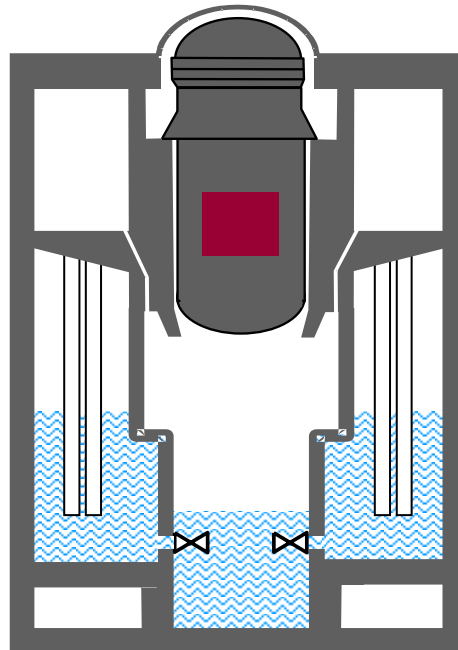
Gravel filter bed at Barsebäck 1985



Multi venturi scrubbers at all other units 1989

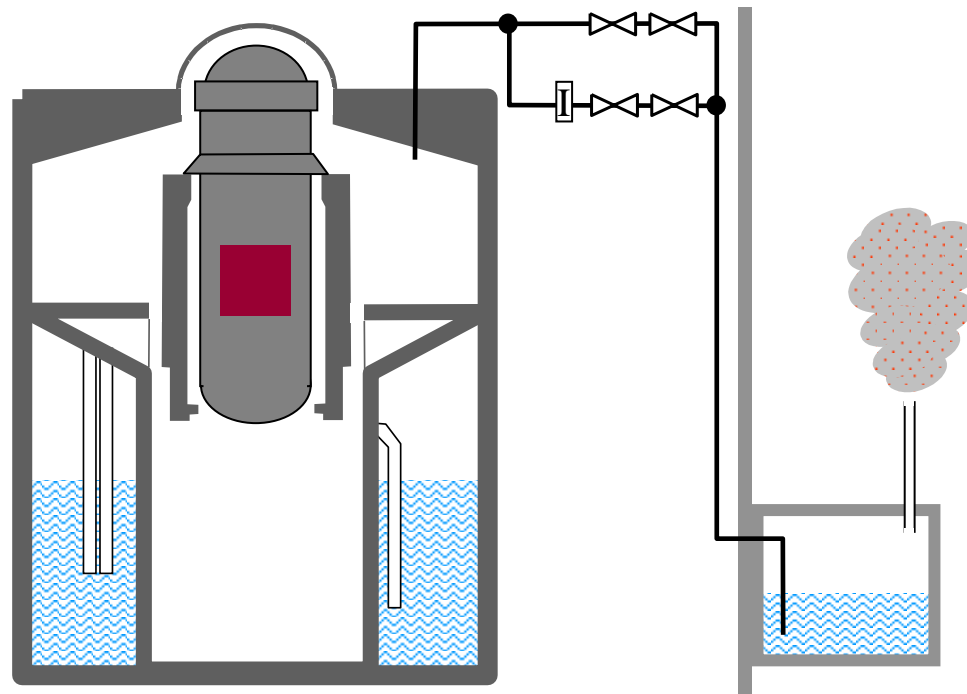
## The basic strategy in a severe accident

- Fill lower drywell with water (initiated 30 minutes after containment isolation)



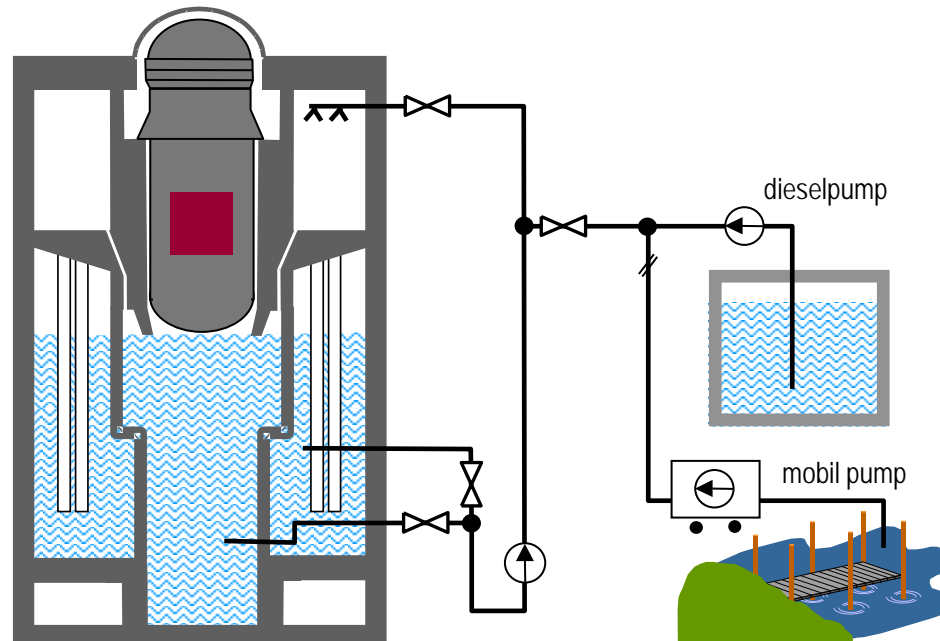
## The basic strategy in a severe accident

- Vent containment to protect its integrity



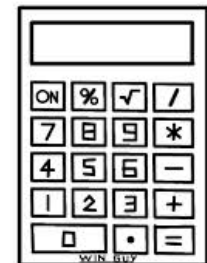
## The basic strategy in a severe accident

- Fill containment with water for cooling of core debris in the vessel



# Present SA analyses

- The licensees analyse severe accident progression using the MAAP code.
  - licensing purposes (deterministic studies)
  - PSA level 2 studies
- Source terms for radiological consequence analyses are calculated using Excel®.
  - assumptions and guidance are taken from NUREG-1465
- Dose response is calculated using Matlab® codes or LENA (tool developed by the Authority).
  - weather type, deposition velocities etc. are specified by the Authority in a separate decision paper



# PSA level 3

- Studies are not done at present.
- Pilot study in early 2000 for Ringhals 4:
  - The objective was to calculate health effects only.
  - Input from MAAP calculations and PSA level 2.
  - No dedicated tool was used
  - Several parameters were highly simplified:
    - composition of source term
    - weather parameters simplified and constant in space and time
    - limited to an area of 50 km around the reactor
    - only limited uncertainty calculations done
  - No calculations of economic impact.
- Still a matter of debate within Vattenfall, but there is interest!



# Economic consequence analyses

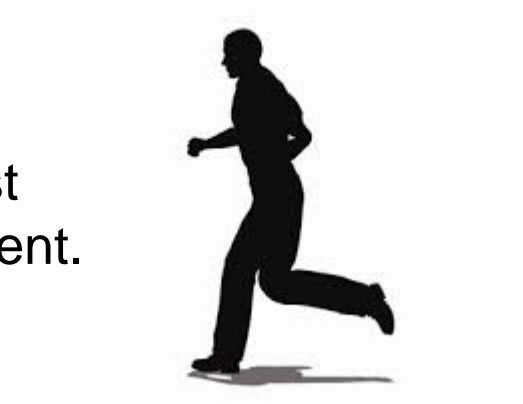
- Cost estimates have been done previously in order to conclude on insurance costs
  - limited to costs for the clean-up work of the reactor
  - only one accident sequence was evaluated ("mid-conservative")
  - releases of activity to the environment were ignored



# Emergency planning

## Fast running tools

- The Authority requires the Licensees to provide fast estimates of the source term during a severe accident.
- At present no codes are used.
- Very simple tools in paper form have been developed
  - based on plant information, a limited set of realistic source terms can be given



# Expectations on IMUG 2014

- Hear **user experiences**
- Be more familiar with the **code** and its **abilities**
- Understand if and how the code can be **coupled to MAAP?**
- How to **implement** local **weather** statistics in the code?
- How to **implement local geography** in the Network Evacuation Model?
- How can MAACS be used in **emergency planning?**
- Can MACCS be used as a **"fast running tool"**?