Use of MELCOR for PSA L-2 (LWRs) - Limitations and Problems

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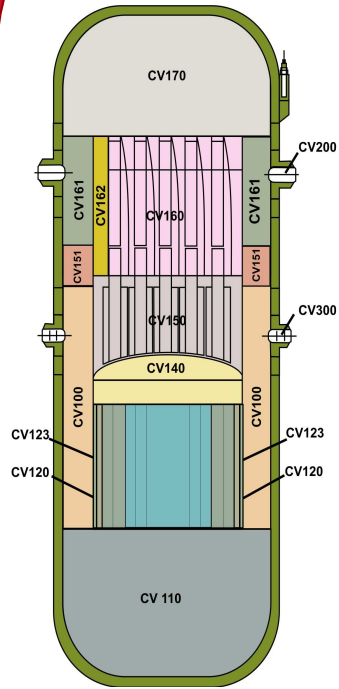
- **Applications of MELCOR 1.8.5 and 1.8.6 at *AREVA NP***

- **Essential MELCOR Results for PSA – L2**
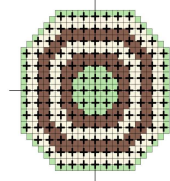
- **Problems**

- **Limitations**

- **PSA – L2 Studies for PWRs and BWRs (Whole Plant calculations)**

- **Supporting Analyses in frame of students´ master degree work (benchmarks with other codes – e.g. COSACO/CORCON, ATHLET, discretization studies)**
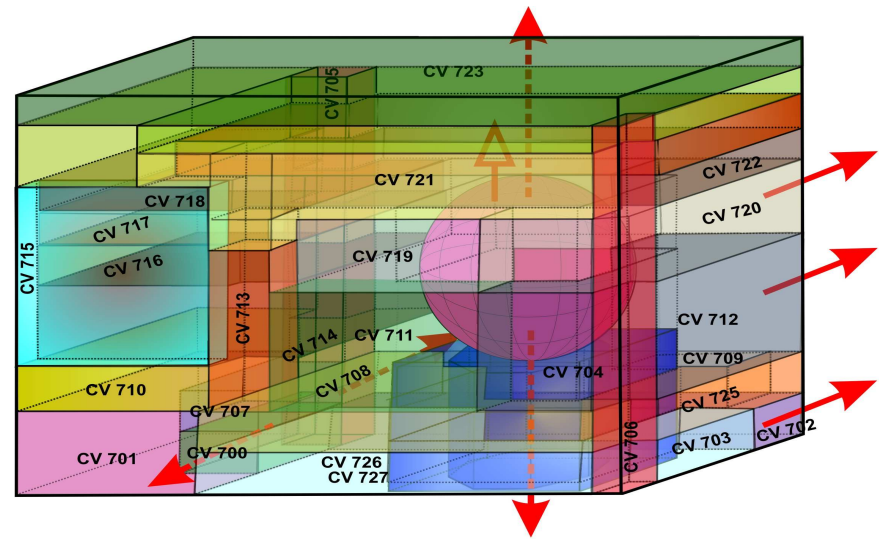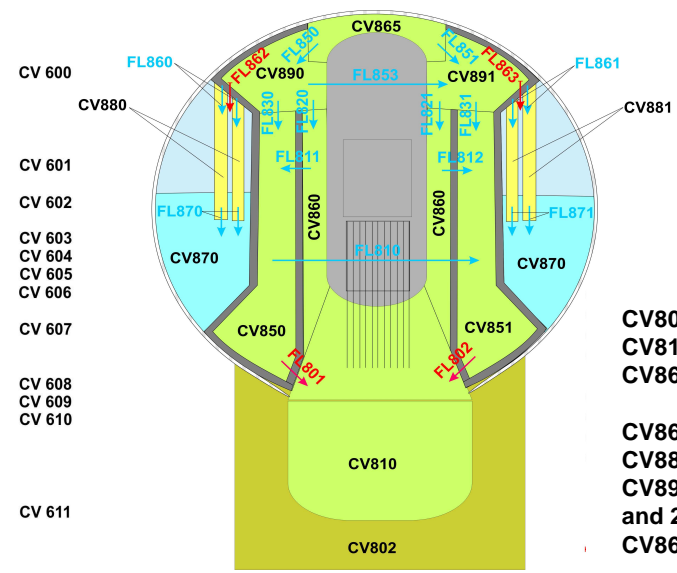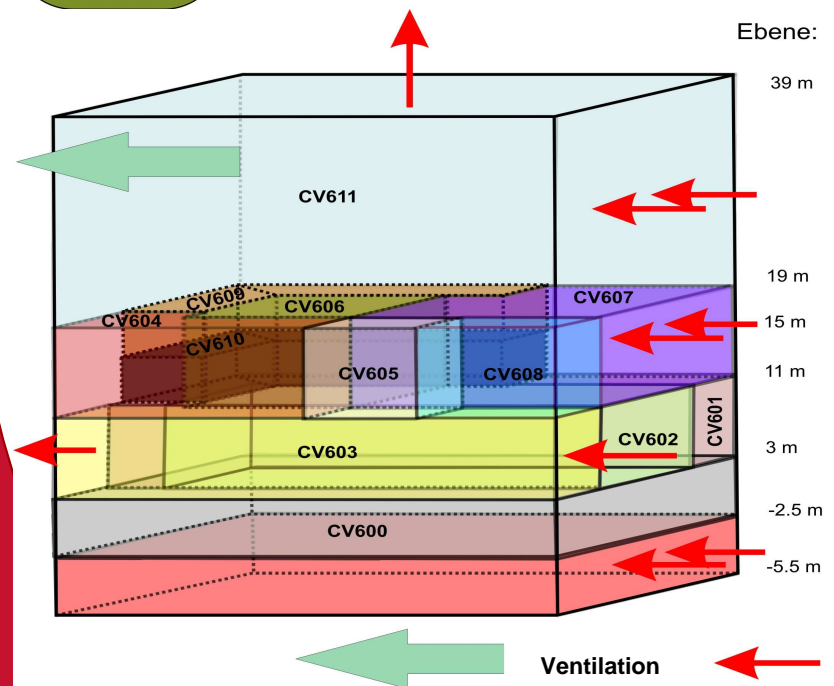
Applications at AREVA NP (2)

BWR-Analyses

CV100 annulus
CV110 upper plenum
CV120 bypass lower
CV121-123 core
CV140 mixture accumulator
room
CV150 Separator
CV151 outer separator room
CV160 Steam Dryer
CV161 Dryer Outer Room
CV170 Dryer Bypass
CV200 Steam Tube
CV300 Feed Water

6 radial zones
21 axial zones

Release paths: Flaps, Doors etc.

Ebene:

39 m   CV 600
        CV 601
        CV 602
19 m   CV 603
15 m   CV 604
        CV 605
        CV 606
11 m   CV 607
        CV 608
3 m   CV 609
        CV 610
-2.5 m
-5.5 m CV 611

CV802 Lining Room
CV810 control rod drive room
CV860 lower annular room between
RPV and biological shield
CV860 condensation chamber
CV880/881 condensation tubes
CV890/891 upper annular rooms 1
and 2
CV865 Cover Room

Ventilation   Release paths: Flaps, Doors etc.

- **Main Sequences : Leaks and Transients (Station Black Out, Failure of the feed water pumps)**

- **Standard Problem Time 5 d**

- **CPU Time ~ 4 – 7 d**

- **Grace Time until RPV failure**

- **Grace Time until Containment Failure and deposited Fission Products**

- **Release of Fission Products to the Environment after Containment Failure**

Problems (1)

- **Numerical Instabilities of the pressure for one-phase flows resp. of the gas or water velocity using *QUICK-CF* or *FAN* for pumps/fans (Solution: Damping Constants in the calculation of the pressure change)**

- **Numerical Instabilities in the progression of the erosion fronts (**Solution: Suppression of Oxidation Reactions of the melt -> undesirable impact on FP release from melt pool in the cavity, modification of the height of the reference point of the ray system was not always successful**)**
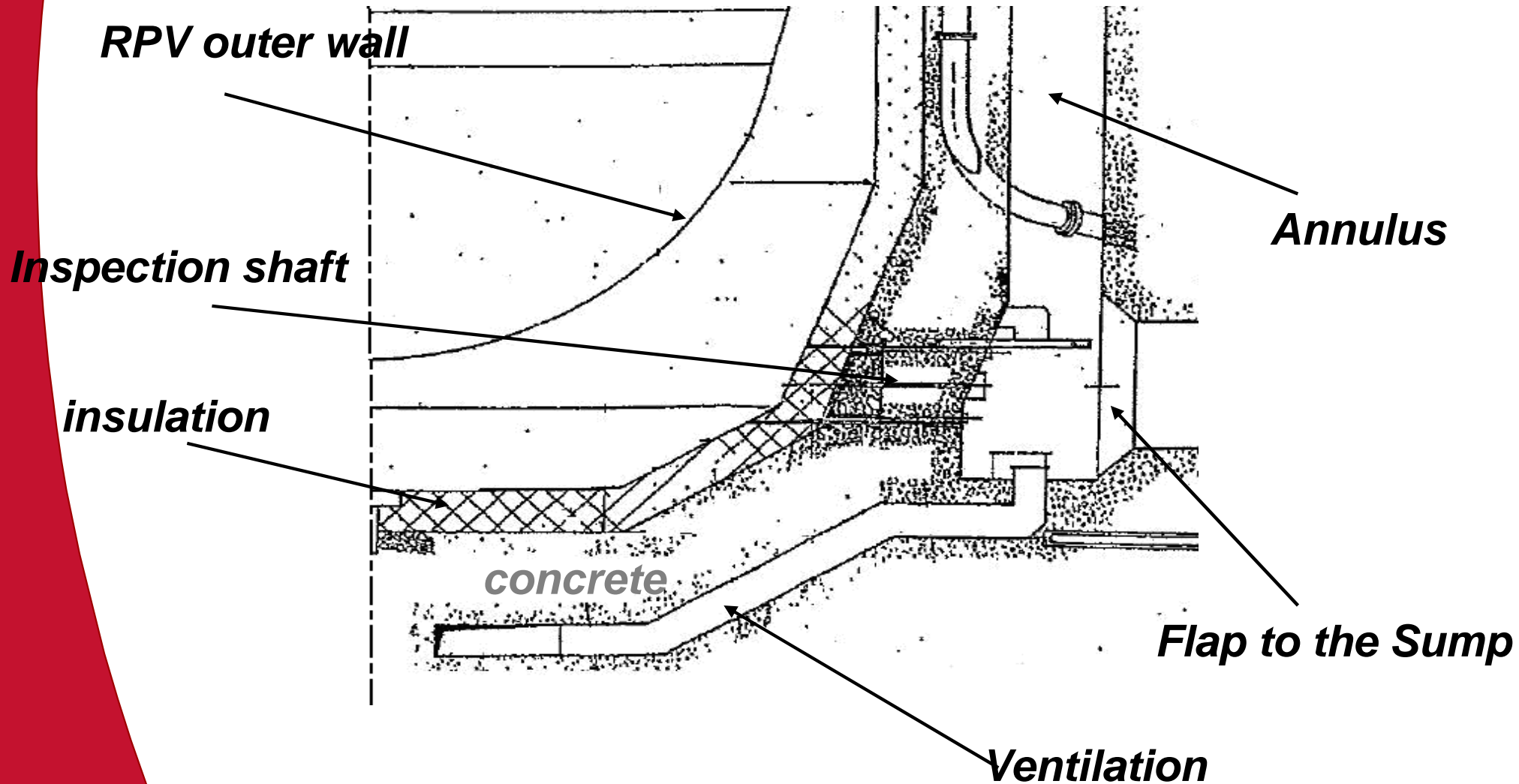
Erosion Profiles
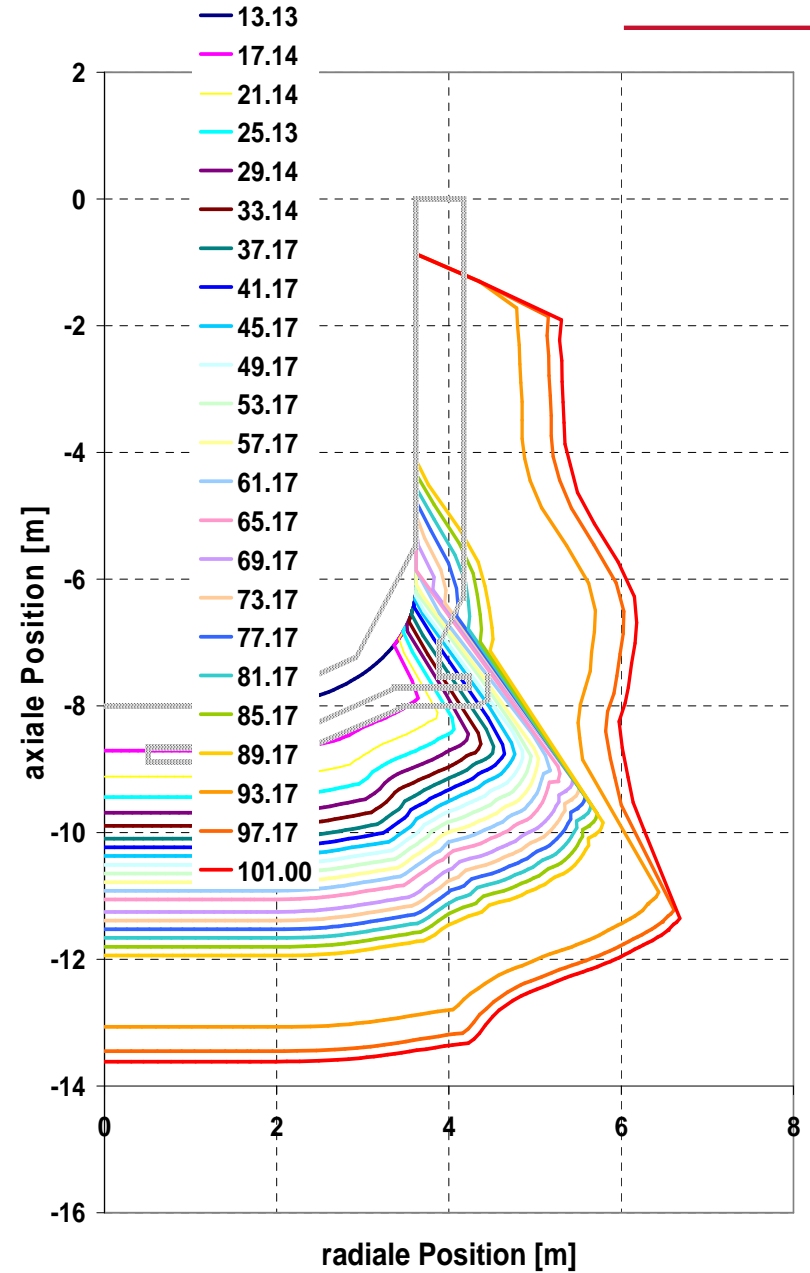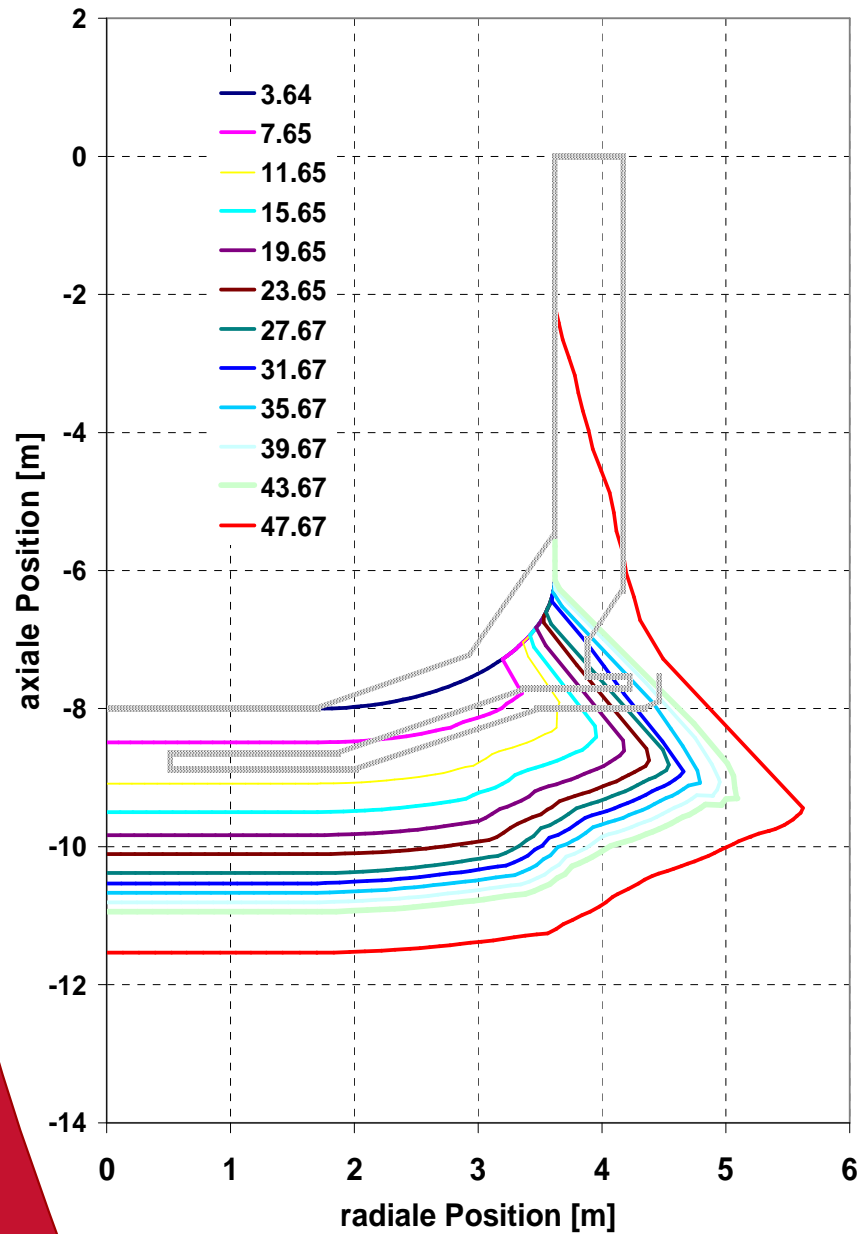
Limitations in Modelling (1)

- **Iodine Chemistry in the Atmosphere**

- **Melt Fragmentation in water pools**

- **Melting of the control rod drive tubes (BWR)**

- **Cylindrical geometry of the cavity (more complex geometry, e.g. annular rooms)**

- **Melt Spreading in neighbored rooms**

Limitations in Modelling (2)

PWR Geometry of the reactor pit

RPV outer wall

Inspection shaft

insulation

concrete

Annulus

Flap to the Sump

Ventilation

Limitations in Code Performance (1)

- **Number of external FUNctions**

- **Capability for modification of code parameters (via Control functions limited)**

- **Bandwidth of sensitivity parameters should be given (references to the experimental data base including analyses for validation would be desirable)**