Severe Accident HCVS Capability

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Discussion Topics

- Postulated Mark II bypass scenario
- Severe Accident Conditions of Interest
- Conclusions

Postulated Mark II Bypass Scenario

- Postulated bypass failure mode:
  - Core debris flows into pedestal drain line, flow outside containment, and fails in Reactor Building resulting in containment bypass
- Mark II designs vary significantly
  - Drain tank in primary containment – no bypass potential
  - Pumped transfer to drain tank – no bypass potential
  - Drain tank in RB with isolation valves – merits evaluation
- ORNL studied the potential bypass failure mode in 1990s
- EPRI work on instrument or drain line failure modes also relevant

Postulated Mark II Bypass Scenario (Cont.)

- Conclusions:
  - Presence of water in drywell may preclude drain line attack altogether (ORNL)
  - Freezing in drain line likely, especially if drain line contains water (EPRI)
  - Failure mode not a dominant contributor to Mark II containment bypass
  - Element 4.1 of draft revised Order should be removed

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Drywell Venting

- Wetwell vent addresses majority of containment venting strategies
- Drywell venting, to be effective, requires water management as part of filtering strategies and should be part of the Rulemaking

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Severe Accident Conditions of Interest

HCVS Design Feature	Condition of Interest
Vent path sizing	• Magnitude of pressure demand • Vent path pressure losses
Component functionality	• Radiation levels • Differential pressure • Containment temperature • Hydrogen
Long-term vent operations	• Number of vent cycles • Hydrogen mitigation • On-site radiation exposure

HCVS component functionality should be based on the pressure and temperature and radiation capability of the primary containment .

Sizing of Vent Path

- Sizing for 1% decay heat (steam) will result in considerable margin for hydrogen and other non-condensable gas generation associated with a severe accident.
- Reviewed SECY 12-0157 Enclosure 5A to obtain range of gas generation during severe accidents

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Enclosure 5A - MELCOR

- Figure 16: In-Vessel hydrogen generation
- Figure 17: Hydrogen generation due to MCCI
- Figure 18: CO generation due to MCCI

Gas	Generation Rate (lb/hr)	Capacity for 8” Vent (lb/hr)
Hydrogen in-vessel	1100	26,300
Hydrogen ex-vessel	238	26,300
CO ex-vessel	3790	118,000

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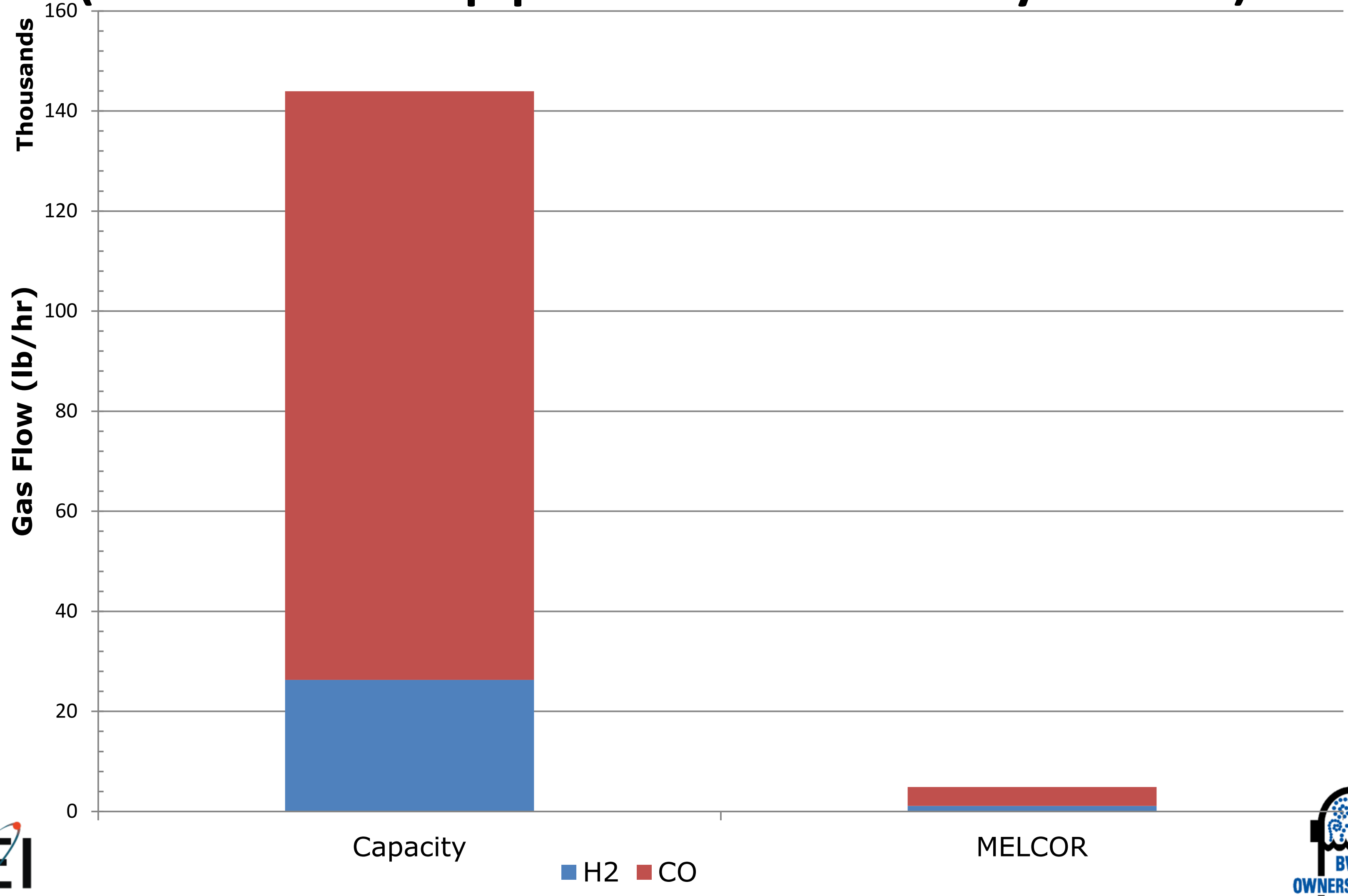
Gas Flow for 8” Vent (sized for approx. 1% decay heat)



Conclusion on Vent Sizing

- Sizing for 1% decay heat is sufficient to address non-condensable gas generation during a severe accident

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Design Consistent With Containment Capability

EA-12-050 R0

RHV → **SACV**

EA-12-050 R1

RHV — Conditions
- Steam at saturated conditions

Within Design Envelope

SACV — Conditions
- Steam
- Hydrogen
- Radionuclides
- Temperature

Outside Design Envelope

Design Requirement Changes
- Size
- Routing
- Reliable Operation
- Allows Injection (FLEX)

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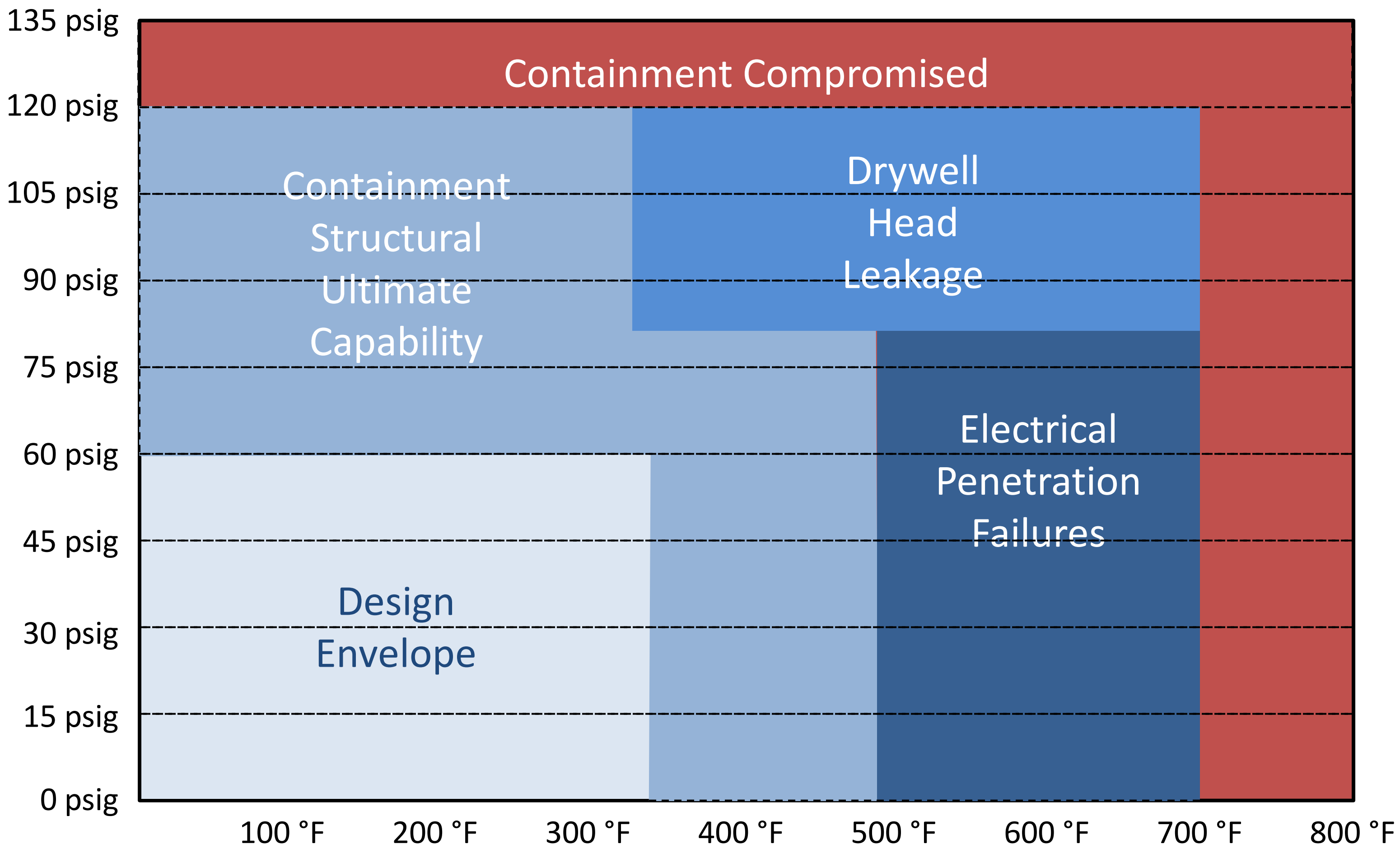
Example Representation of Containment Capability



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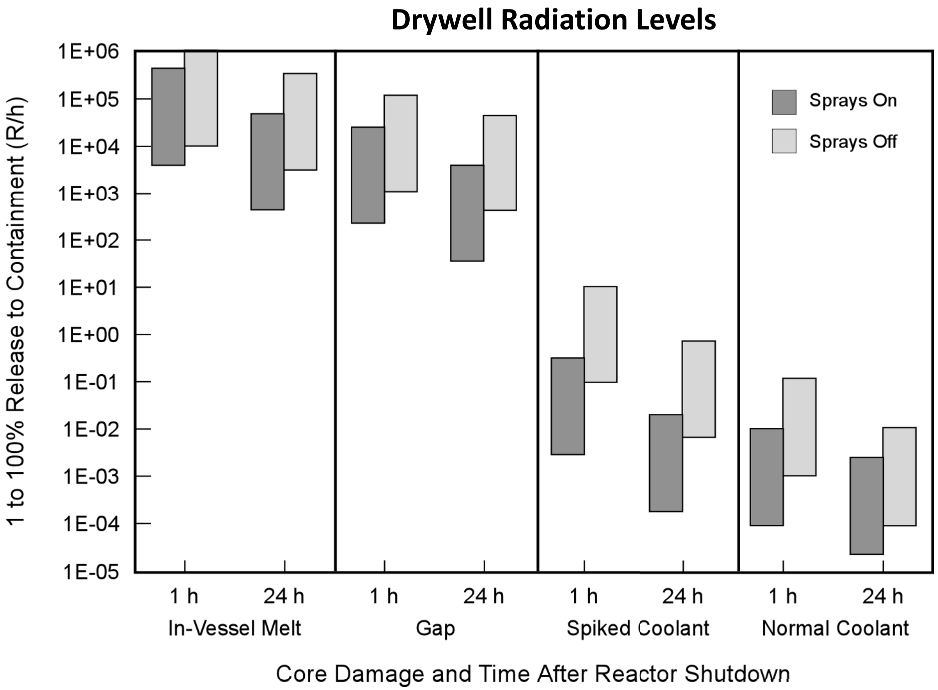

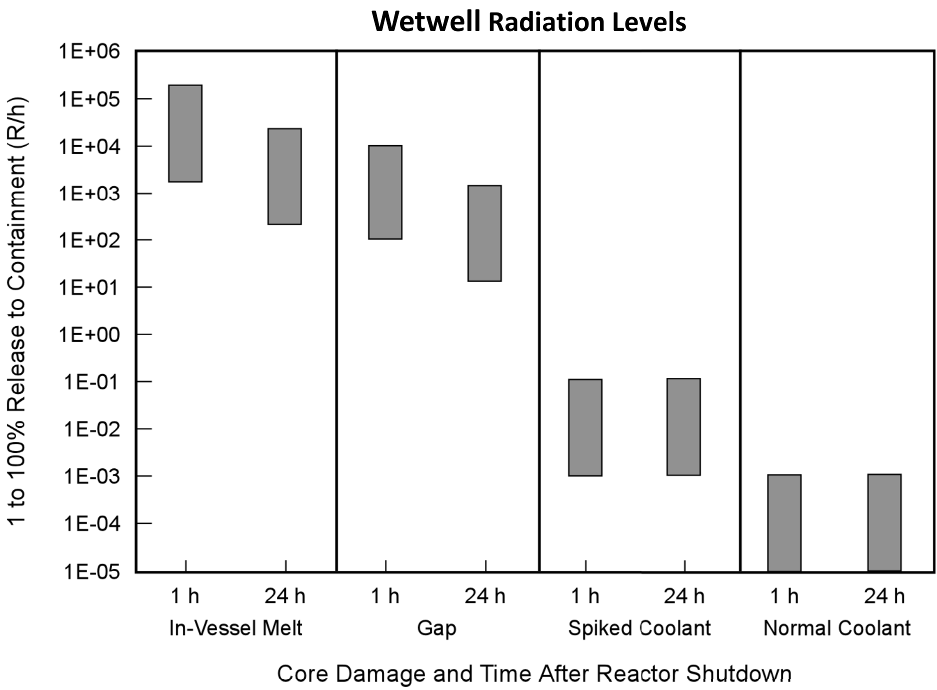

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Influence of SAMG Actions

- Relevant SAMG strategies
  - RPV injection
    - Capacity/conditions
  - Containment venting due to PSP
    - Plant-specific
  - Containment venting due to PCPL
    - Plant-specific
  - Containment flooding
    - Capacity/conditions

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Conclusions

- Mark II bypass scenario not risk significant
- Drywell vent conditions inextricably linked to accident scenarios, capabilities, and severe accident management actions
- Suppression pool makes wetwell vent conditions more identifiable
- Bounding assessments not a useful concept for beyond design basis events

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