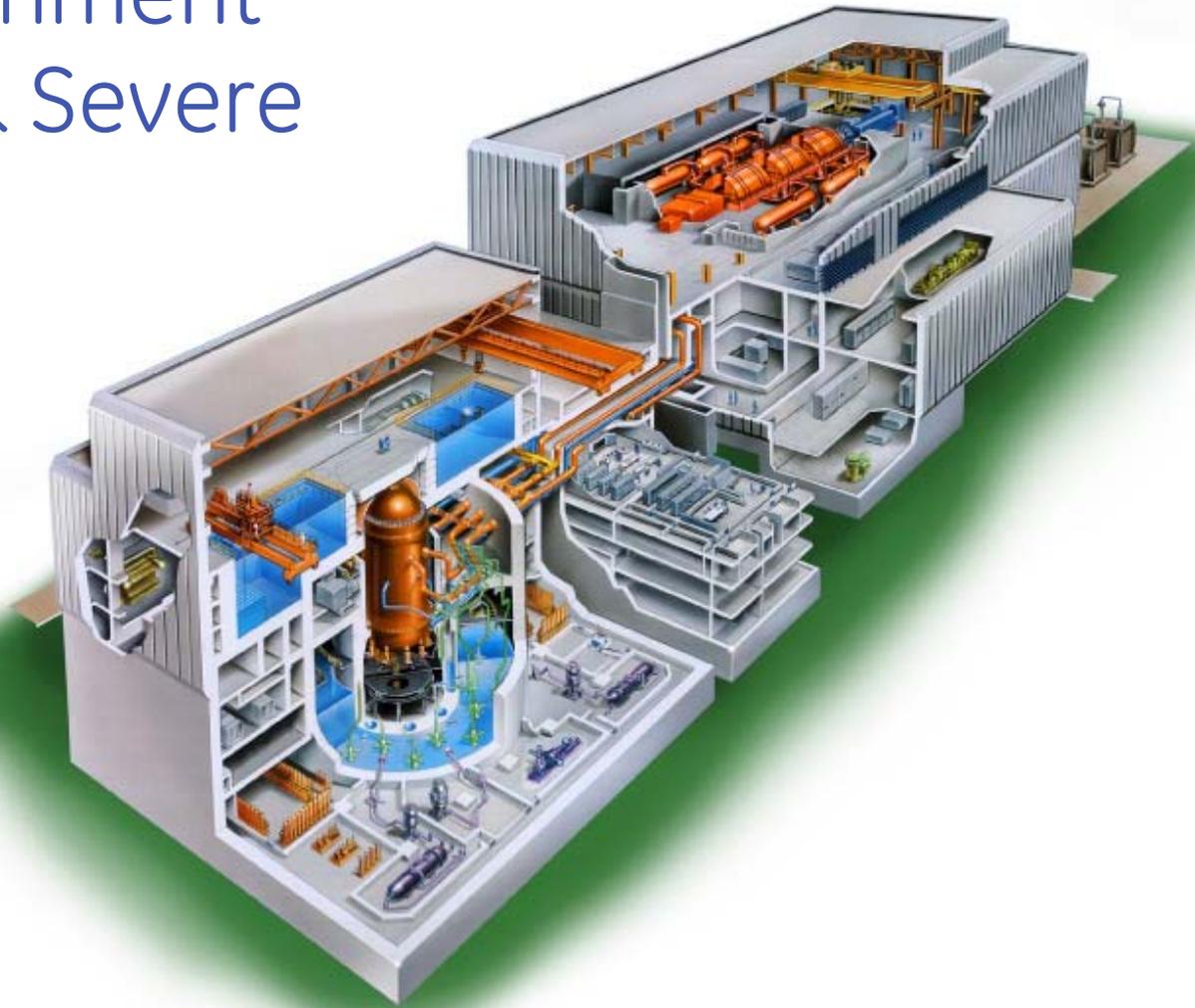


ABWR Safety

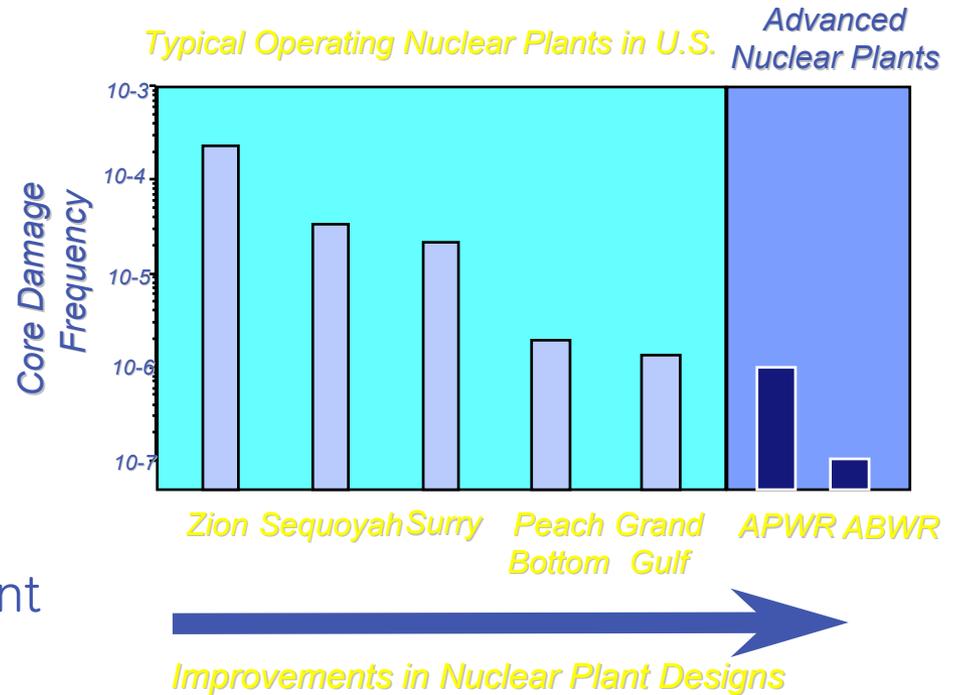
PRA, Containment Response & Severe Accidents



J. Alan Beard
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Enhanced Safety

- Rugged and simplified design
- Modern C&I systems and control room
- Safety systems are more redundant and diverse
- Meet USNRC requirement for Severe Accidents
- Meet utilities' ALWR requirements
- Pre-engineered, pre-licensed total plant design
- Shorter, predictable construction schedule
- Reduced capital and O&M costs



Source: "Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants, NUREG-1150, June 1989.

ABWR Safety Challenges Reduced

- LOCA challenges reduced
 - > Eliminated external recirculation loops
 - No large pipes below core
 - > Increased rating of low pressure piping (ISLOCA)
 - > Added backup Reactor Water Cleanup System shutoff valve
 - > Core always covered for DBAs
 - > High Pressure Core Flooder has capability even with inlet water at saturation

ABWR Safety Challenges Reduced

- ATWS challenges reduced
 - > Accumulator-driven scram without Scram Discharge Volume
 - > FMCRD electric run-in
 - > Alternate Rod insertion
 - Diverse logic for scram function
 - > Automated mitigation
 - Recirculation and feedwater runback
 - boron injection

ABWR Safety Challenges Reduced

- Shutdown challenges reduced
 - > 3 dedicated RHR shutdown loops
 - > 2 trains of Fuel Pooling Cooling
 - RHR can be manually aligned to provide cooling of the Spent Fuel Pool
 - > All core cooling pumps potentially available
 - > Large water inventory over fuel

PSA Scope

- Internal Events, Power Operation
 - > Level 1, 2, and 3
- Internal Events including Low Power and Shutdown
 - > Level 1
 - > 99% SD CDF in mode 6, so no level 2 required
- External Events
 - > Does not include seismic
 - > Fire Using the FIVE Methodology
 - > Internal Floods
 - Screening shows no impact on risk

PSA Scope (cont)

- Seismic

- > Seismic margins analysis identified no outliers
 - High Confidence Low Probability of Failure (HCLPF)
 - At least 1.67 times design
 - 0.6 g
- > Most critical equipment is located low in their buildings
 - Even greater capability

PSA Quality

- Follows ASME Standard Principles
 - > Where applicable, meets capability category 3
 - > Some plant specific information not available until COL or construction
- PSA Capability
 - > Determine that ABWR meets risk goals
 - > Determine importance at a system level
 - > Determine overall importance of operator action
- Can be used for operational assessments

Design Features Resulting from PRA

- 3-division ECCS
- AC independent water addition
- Combustion turbine generator
- RWCU filter demin bypass to permit decay heat removal at high pressure
- Containment overpressure protection
- Automation of Suppression pool cooling
- Automation of ATWS mitigation

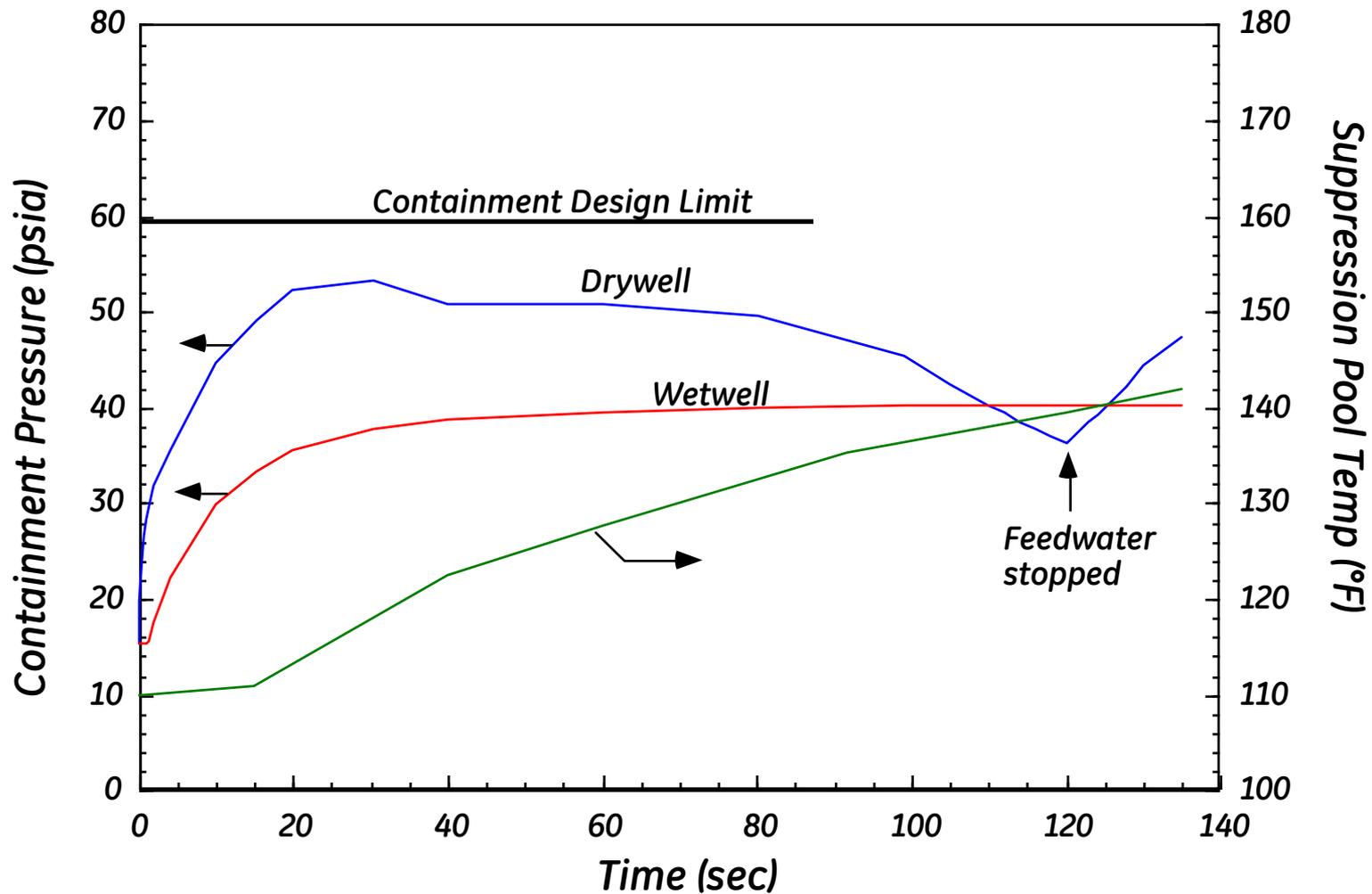
Design Features Resulting from PRA (cont)

- ADS drywell pressure bypass timer
- RCIC capability for local control
- 4th SRV added to Remote Shutdown Panel
- Increased rating of low pressure piping to eliminate ISLOCA concerns
- RWCU drain line isolation valve
- Service Water and Circ Water pump trips and isolation on flood
- Improved RHR heat exchanger supports

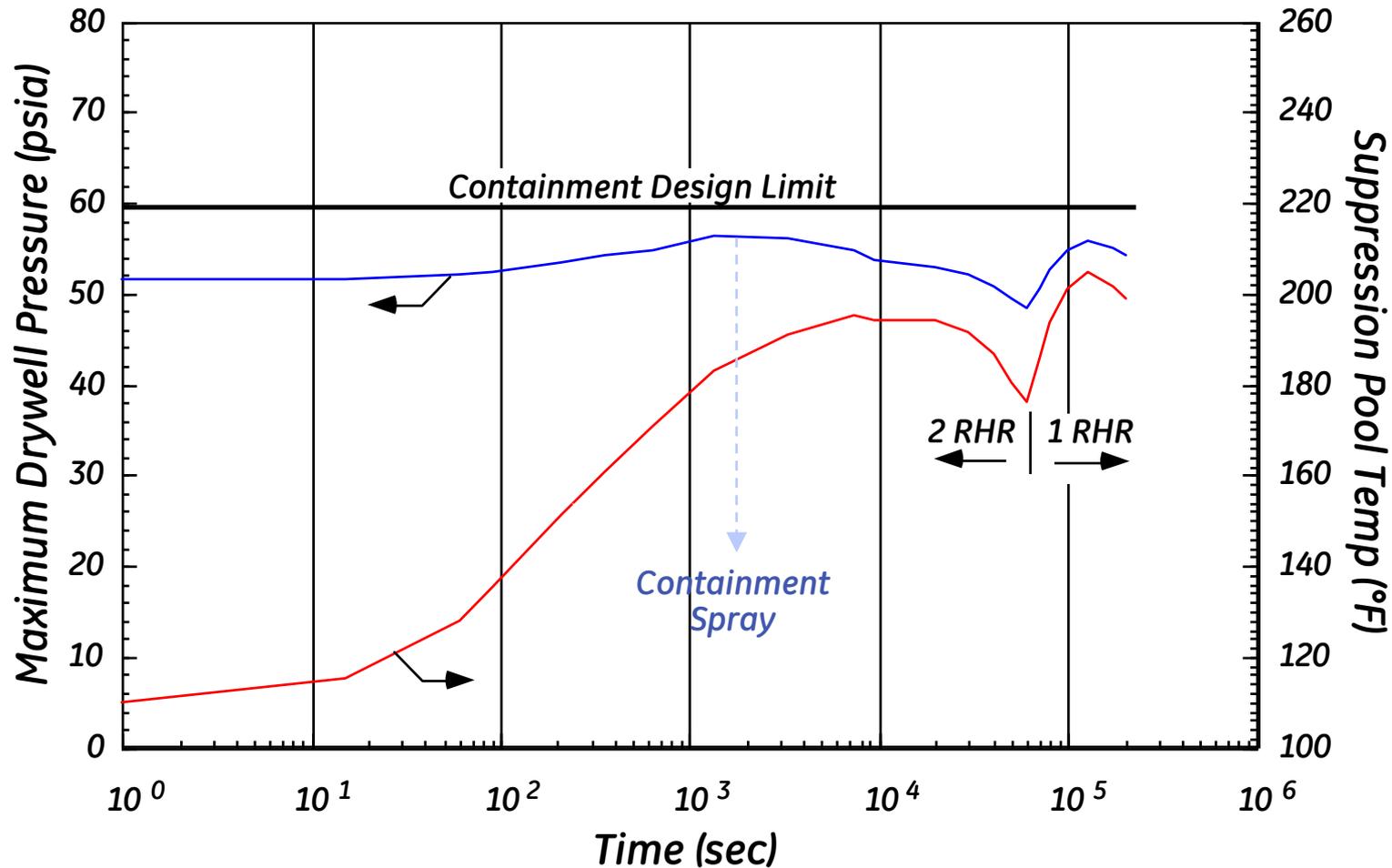
ABWR Internal Events CDF

Event	Frequency/yr	%
Station Blackout	1.1×10^{-7}	71
Transients	4.5×10^{-8}	29
LOCA	6.9×10^{-9}	<1
ATWS	2.7×10^{-10}	<1
Total	<hr/> 1.6×10^{-7}	

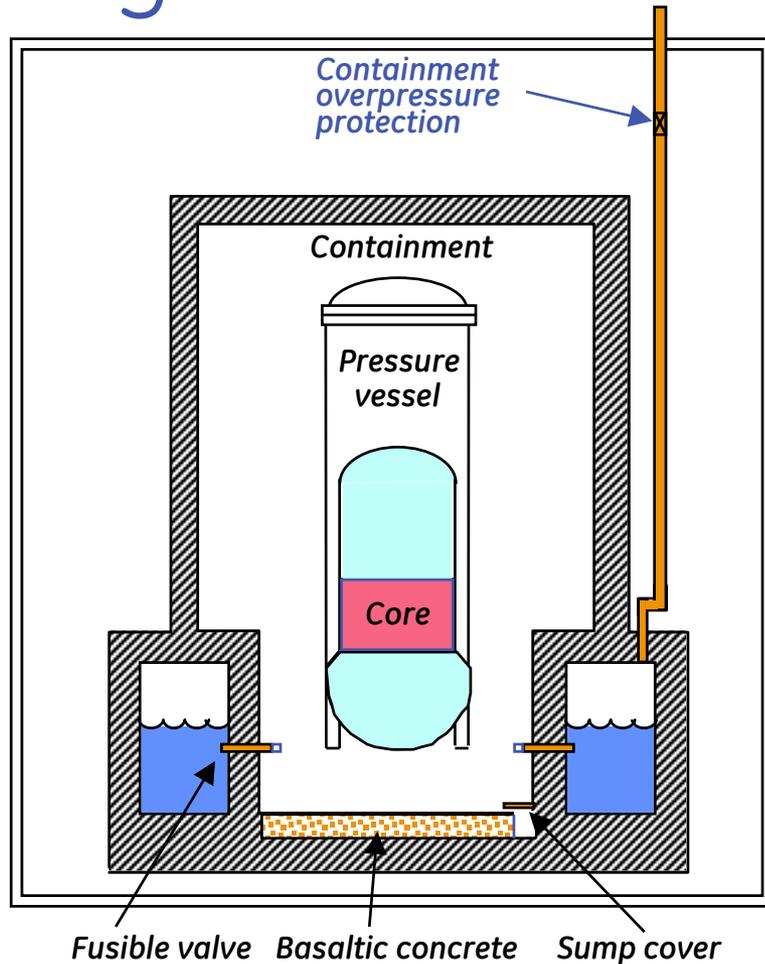
ABWR Response to Feedwater Line Break- Short Term



ABWR Response to Feedwater Line Break



ABWR Passive Severe Accident Mitigation Features

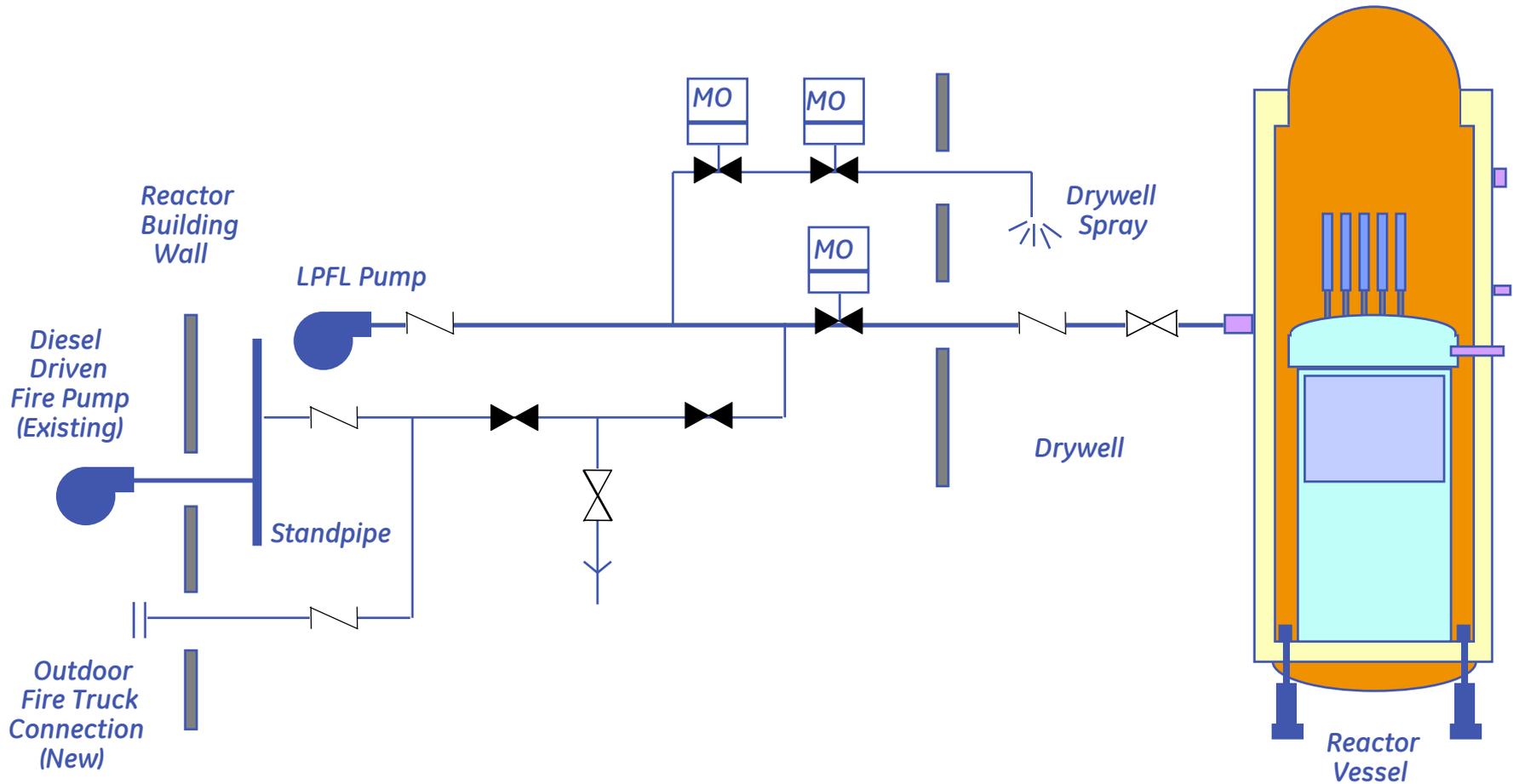


ABWR passive features which mitigate severe accidents:

- *Inerted containment*
- *Lower drywell flood capability*
- *Lower drywell special concrete and sump protection*
- *Suppression pool - fission products scrubbing and retention*
- *Containment overpressure protection*

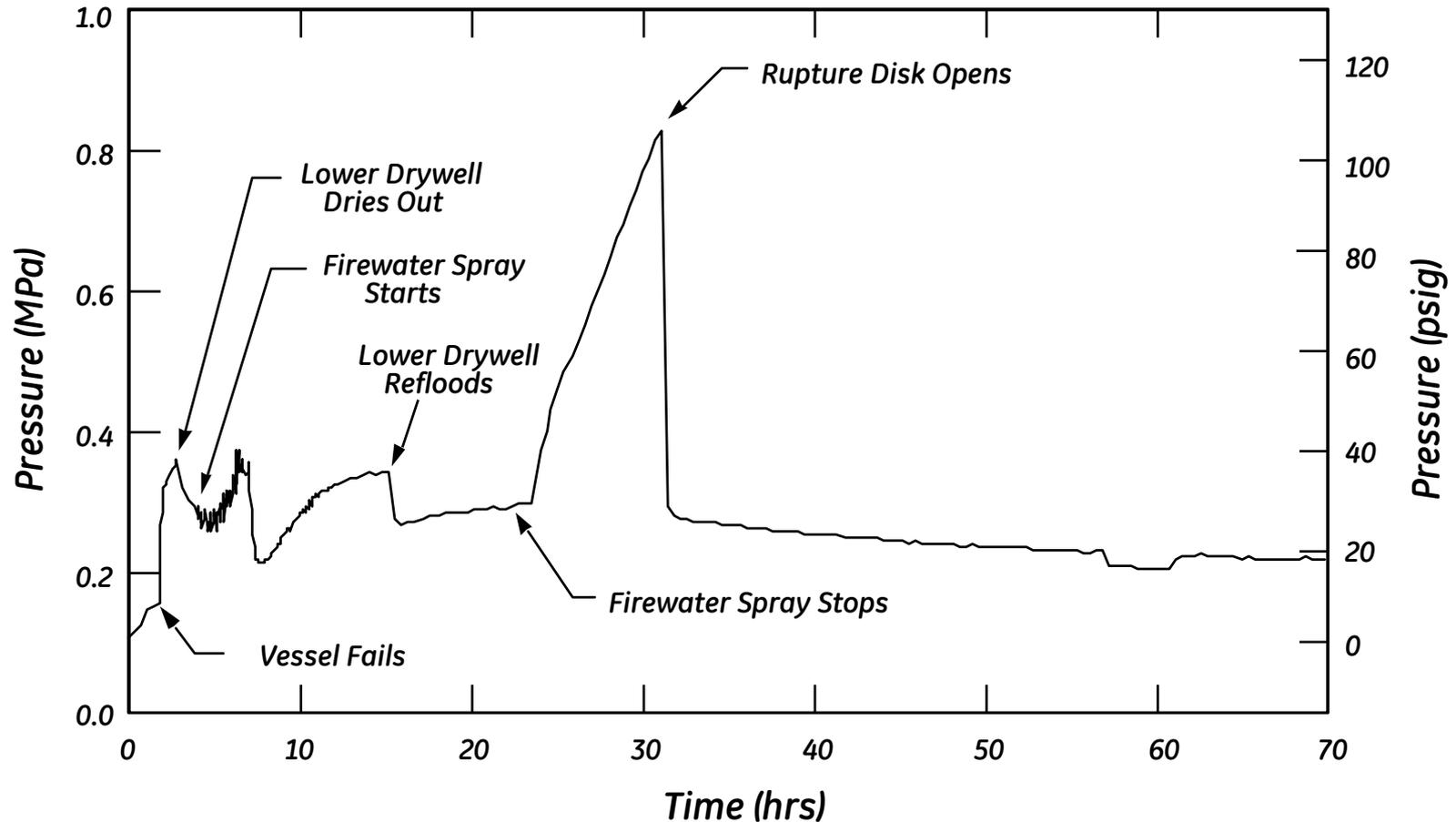
High degree of public protection

AC Independent Water Addition

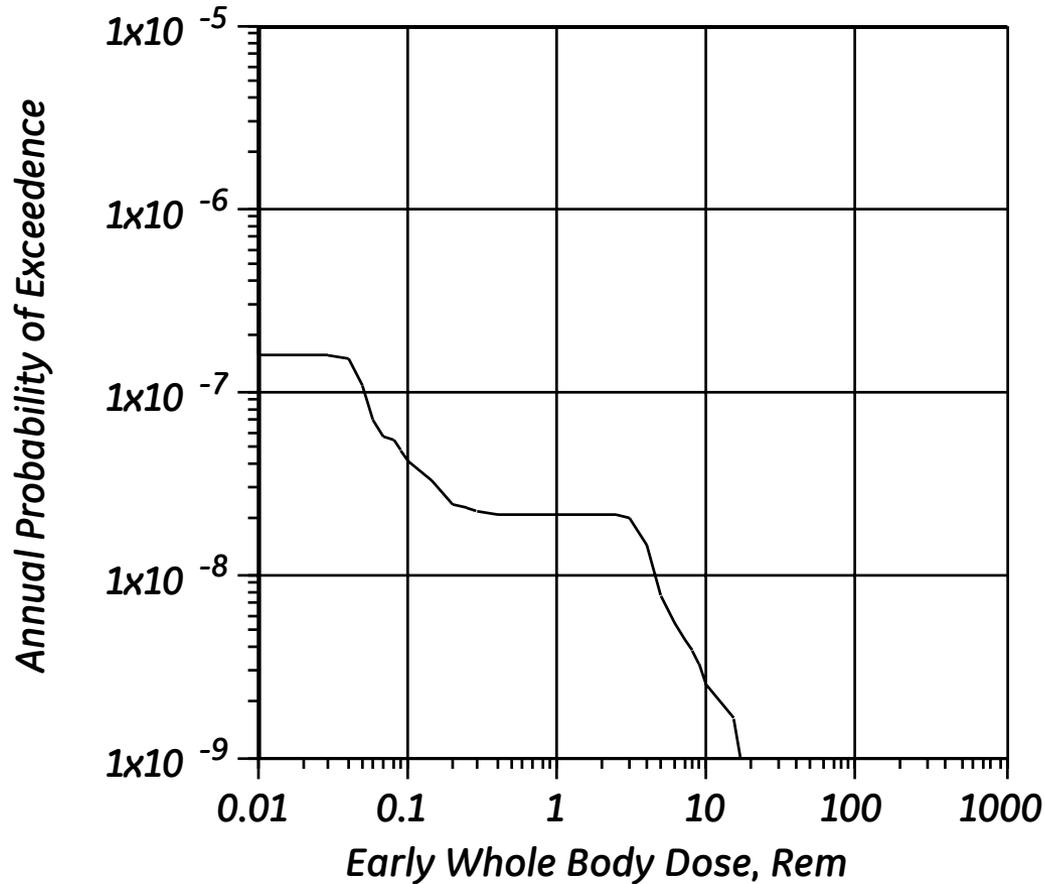


ABWR Severe Accident

- Fire Water Addition



ABWR Whole Body Dose at 1/2 Mile



- Minimum 48 hours
- Nominal site weather

Probability of large release is < 1 in a billion