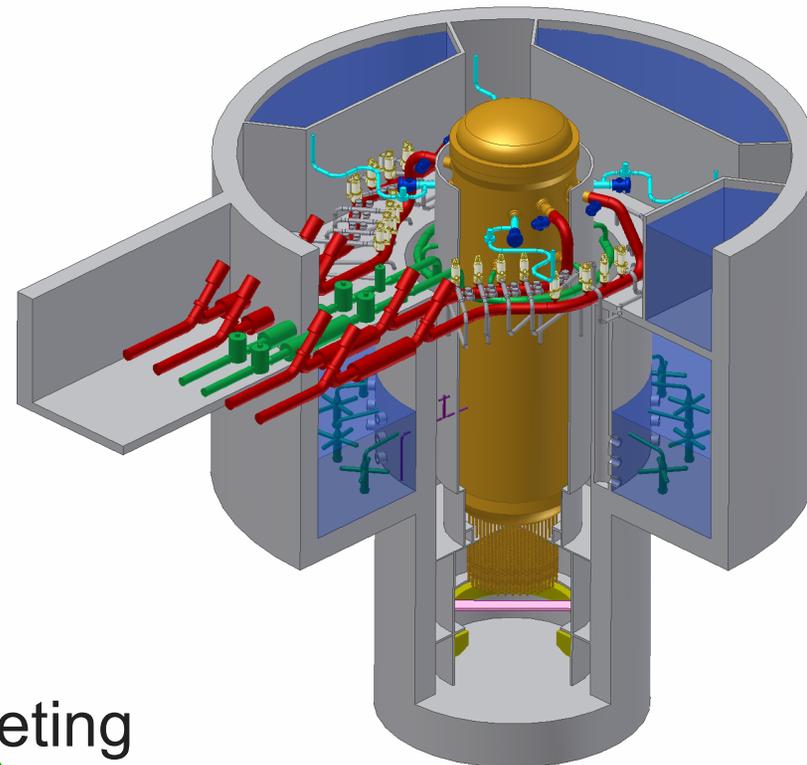


# Hydrogen Control



ESBWR Pre-application Meeting  
October 12 and 13, 2004

# Hydrogen Control

- 10 CFR 50.44 governing regulation
  - > Amended 1 year ago
  - > Significant NRC effort
  - > Tremendous simplification of a complicated rule
  - > New plants are covered under sub-section (c)
- No precedent for a new plant with a pressure suppression containment design

# Hydrogen Control (cont)

- 10 CFR 50.44(c)(1) *Mixed atmosphere*
  - > *All containments must have a capability for ensuring a mixed atmosphere during design-basis and significant beyond design-basis accidents.*
- ESBWR compliance
  - > Non-safety-related drywell cooling (DWC) ensures a mixed environment during operation
  - > In an accident, mixing is provided by air flow which is induced by steam condensation and thermal convection

# Hydrogen Control (cont)

- 10 CFR 50.44(c)(2) *Combustible gas control*
  - > All containments must have an inerted atmosphere, or must limit hydrogen concentrations in containment during and following an accident that releases an equivalent amount of hydrogen as would be generated from a 100 percent fuel clad-coolant reaction, uniformly distributed, to less than 10 percent (by volume) and maintain containment structural integrity and appropriate accident mitigating features.
    - Definition of fuel clad interaction is inconsistent in this subsection [see (3) and (5)]
- ESBWR will utilize an inerted containment

# Hydrogen Control (cont)

- 10 CFR 50.44(c)(3) *Equipment Survivability*
  - > Containments that do not rely upon an inerted atmosphere to control combustible gases ....
  - > .... fuel clad-coolant reaction involving 100 percent of the fuel cladding surrounding the active fuel region.
- Not Applicable to ESBWR
  - > ESBWR will utilize an inerted containment

# Hydrogen Control (cont)

- 10 CFR 50.44(c)(4) *Monitoring*
  - > (i) Equipment must be provided for monitoring oxygen in containments that use an inerted atmosphere for combustible gas control
  - > (ii) Equipment must be provided for monitoring hydrogen in the containment.
- ESBWR will include equipment for monitoring H<sub>2</sub> and O<sub>2</sub> inside the primary containment
  - > The H<sub>2</sub> and O<sub>2</sub> equipment will be classified as commercial grade equipment

# Hydrogen Control (cont)

- 10 CFR 50.44(c)(5) *Structural Analysis*
  - > An applicant must perform an analysis that demonstrates containment structural integrity.
  - > The analysis must address an accident that releases hydrogen generated from 100 percent fuel clad-coolant reaction accompanied by hydrogen burning.
- GE will perform a structural analysis to demonstrate that containment structural integrity is maintained following the prescribed reaction
  - > Analysis will not include the effects of hydrogen burning

# Summary of ESBWR compliance

- ESBWR complies with the regulations
  - > Compliance is due to the application of an inerted containment
  - > No hydrogen recombination equipment is included in design
  - > Proposed Technical Specifications will include 24 hour windows that allow the containment to be not inerted during start-up and shutdown

# NRC responses requested

- GE would like to solicit NRC reaction and/or response to the following issues
  - > Clarification of definition 100% interaction in (2), (3) and (5)
  - > Acceptance of 24 hour window of non-inerted operation during start-up and shutdown
  - > Confirmation that the structural analysis does not need to include effects of burning hydrogen
  - > There is no requirement that provisions be provided for the connection of portable hydrogen recombination equipment