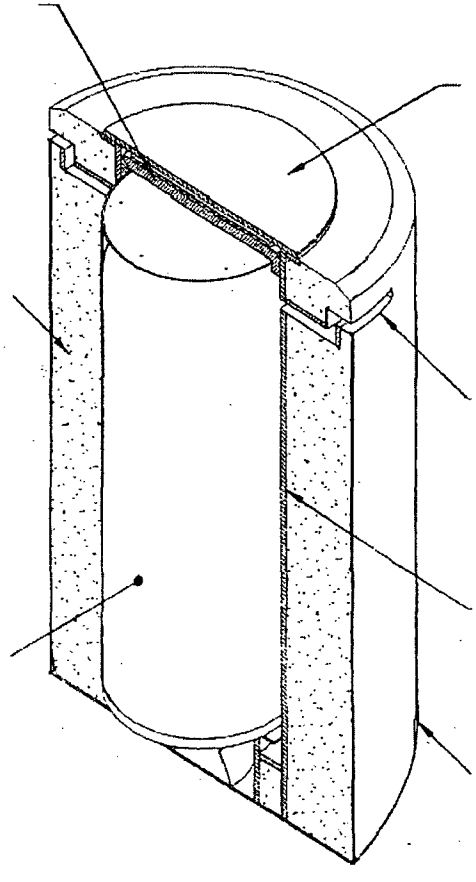
ENCLOSURE 3

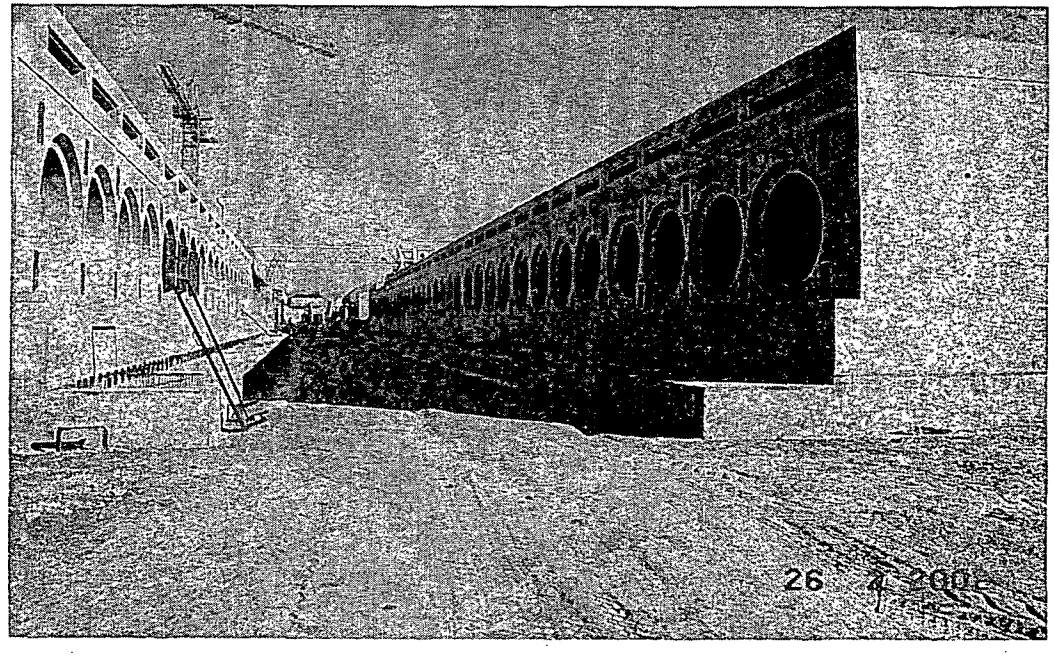
Thermal RAIs on HI-STORM 100U

Topic 1: Inclusion of Wind in the Normal Long-term Storage Condition Evaluation (RAI 4-1 and 4-2)

- All dry storage applications on all dockets approved by USNRC have used quiescent ambient condition for thermal evaluations of normal long-term storage.
- Inclusion of wind as normal storage condition event would be a radical change from the currently accepted licensing approach.
- For wind condition to be defined as an normal long-term event, the wind must maintain a constant velocity , i.e. uniform speed and same direction, over a long time duration (on the order of a week or more). Such a condition cannot be considered a credible normal event.
- Therefore, wind conditions are defined as off-normal conditions in Chapter 2.I of the HI-STORM 100U FSAR (Principal Design Criteria).
- Inclusion of wind as part of the long-term normal storage evaluations would have significant implications on the predictions of thermal performance of storage systems with discrete inlets and outlets.

Thermal RAIs on HI-STORM 100U





Thermal RAIs on HI-STORM 100U

Topic 1: Inclusion of Wind in the Normal Long-term Storage Condition Evaluation (RAI 4-1 and 4-2)

- Any dry storage cask system, and the spent fuel contained therein, is subject to changing ambient environment, e.g. day-to-night ambient temperature variation, seasonal ambient temperature variation etc.

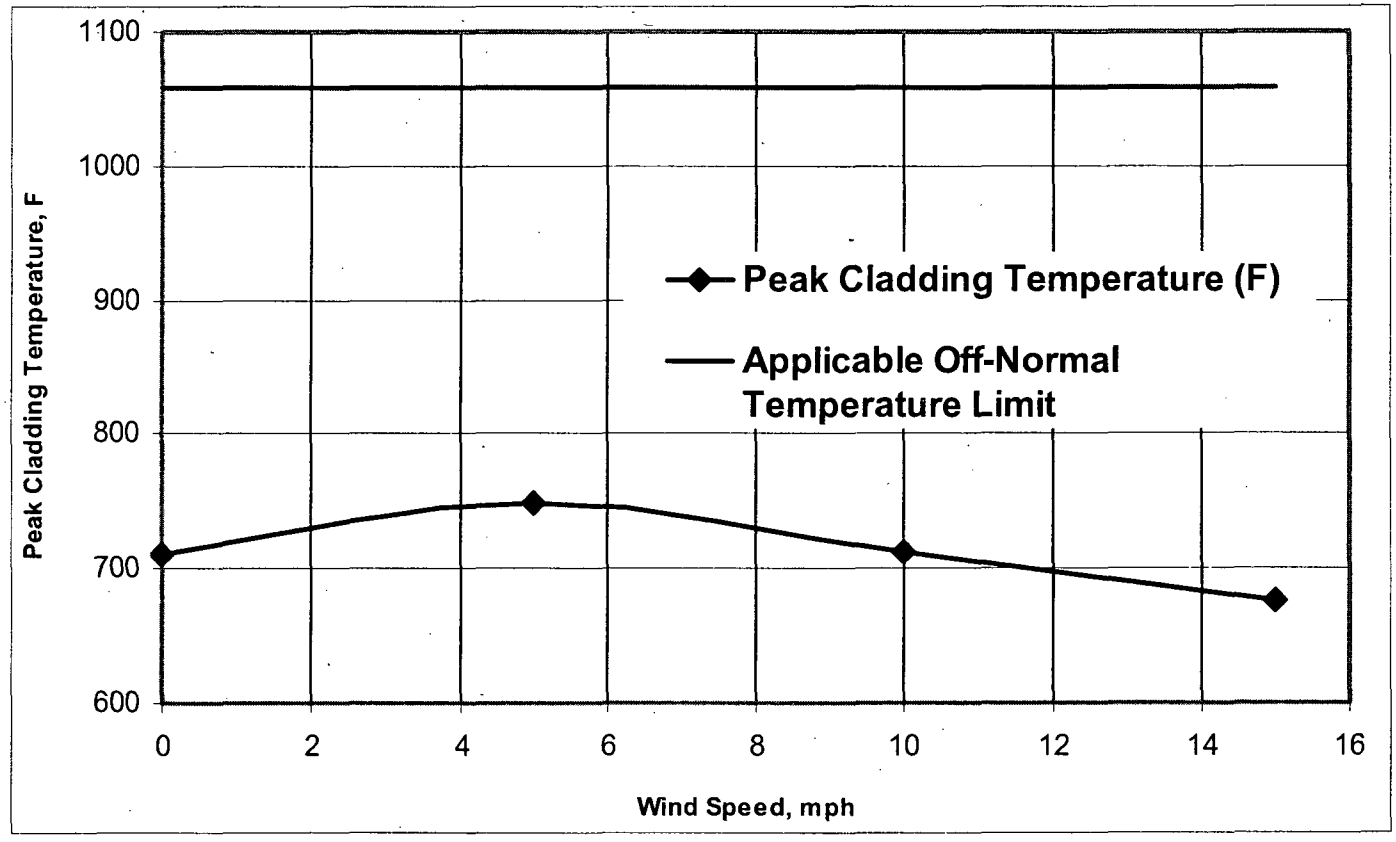
- These changes result in changes to the cask internal pressure and resulting cladding stresses. Time-varying stress fields can be represented by a combination of a mean stress plus a cyclic stress. The mean stress is the principal determinant of cumulative creep.

- Interim Staff Guidance 11 (Appendix A in Revision 3) states:
  "Creep is the dominant mechanism for cladding deformation under normal conditions of storage."

- Therefore, time-varying phenomena such as wind are not required to be considered as part of the long-term storage evaluations.

Thermal RAIs on HI-STORM 100U

Topic 1: Effect of Steady (Constant in Speed and Direction) Wind on Peak Cladding Temperature



Thermal RAIs on HI-STORM 100U

Topic 2: Effect of other VVMs on the Thermal Evaluation (RAI 4-1)

- Use of a hypothetical cylinder around a cask to restrict air flow to the cask has been previously reviewed and approved by USNRC for HI-STORM 100 System thermal evaluations.
- This approach was verified to be appropriate by PNNL, who performed analyses for a large cask array consisting of 4000 casks and defended by SFST in ASLB hearings on PFS.
- For the HI-STORM 100U thermal evaluations, a single HI-STORM 100U at design basis maximum heat load with a hypothetical cylinder around the cask above the concrete pad has been considered.
- To maximize the mixing between the hot and cold streams, the ambient air and exiting air from the HI-STORM 100U cavity are artificially confined within the hypothetical cylinder.
- In quiescent ambient condition, lateral mixing between air above adjacent VVMs will be very small.
- Only a small portion of the VVMs (lid areas) are in radiative exchange with each other and the view factor between adjacent VVMs is small. The lid surfaces essentially radiates heat to the ambient.

Thermal RAIs on HI-STORM 100U

Topic 3: HI-STORM 100U Storage Array Size (RAI 4-1)

- Evaluation of a single cask, with a hypothetical cylinder defining the air volume around it, is bounding for all cask array sizes.

- None of the figures or drawings in the Proposed Revised FSAR limits or specifies the array size or shape for a HI-STORM 100U ISFSI.

- Figure 1.I.3 is intended only to show how VVM Interface Pad is separated from Top Surface Pad by Expansion Joint.
- Typical array on Drawing 4501 is intended only to show minimum pitch and to show Radiation Protection Space.

- Section 1.I.4 discusses 100U arrays. Any number of VVMs can be placed on any pitch greater than or equal to 12 feet.
- Number of VVMs in an array is not limited, nor is the number of VVMs along any edge of an array.

Thermal RAIs on HI-STORM 100U

Topic 4: FLUENT Warning Message on Using Velocity Boundary Condition (RAI 4-3)

- Flow in and around a HI-STORM 100U VVM is incompressible.
- Compressibility effects are important at high fluid velocity, Ma ~0.2 or greater. The Mach Number at wind velocity of 15 mph on the VVM is ~ 0.02.
- Use of velocity inlet boundary condition is, therefore, appropriate for incompressible fluid flow problems.