ENCLOSURE 2

KGO-ENO-LD1-18-120

River Bend Station Spent Fuel Pool Criticality Analysis of Boraflex Storage Racks with NETCO-SNAP-IN® Rack Inserts

Non-Proprietary Information

IMPORTANT NOTICE

This is a non-proprietary version of Enclosure 1, from which the proprietary information has been removed. Portions of the enclosure that have been removed are indicated by an open and closed bracket as shown here [[ ]].

Non-Proprietary Information

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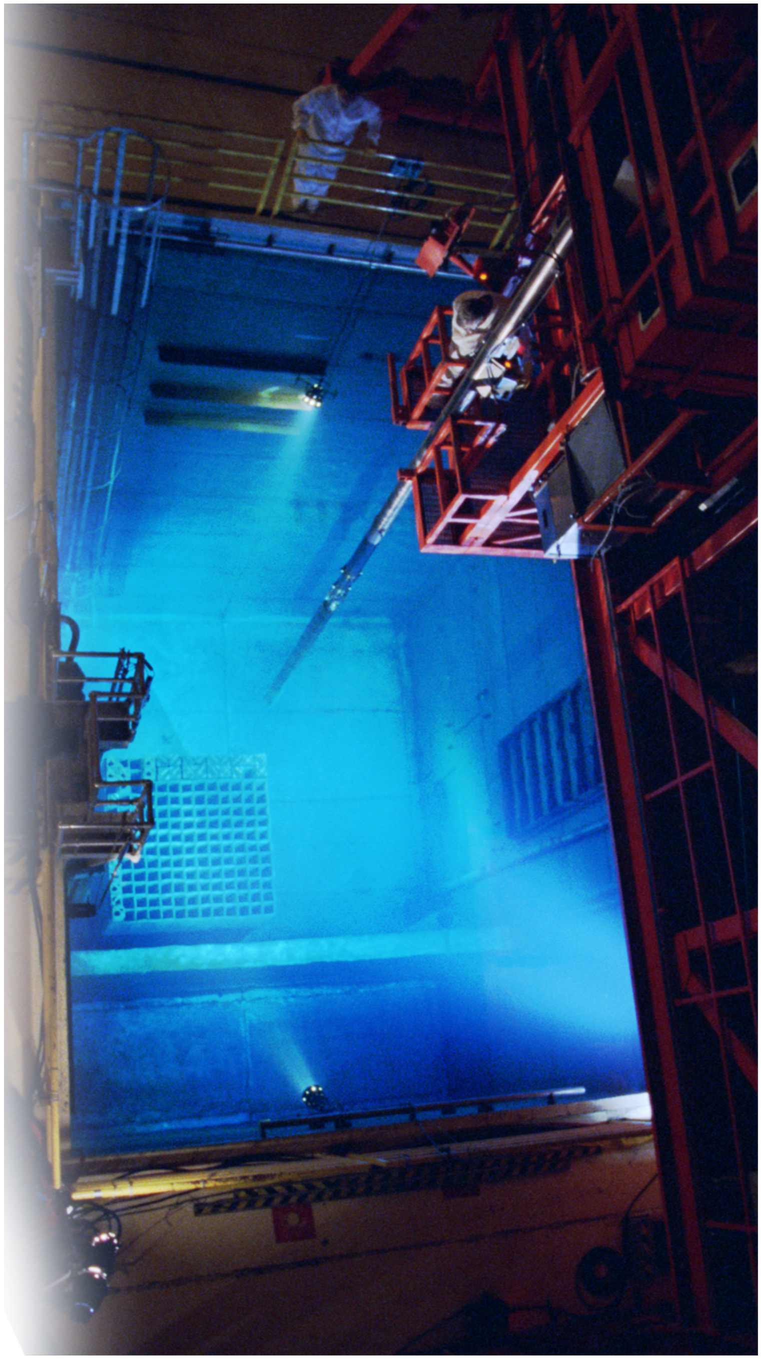
River Bend Station Spent Fuel Pool Criticality Analysis of Boraflex Storage Racks with NETCO-SNAP-IN® Rack Inserts



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Regulatory Requirements

10 CFR 50.68 (b) (4)

"The k-effective of the spent fuel storage racks loaded with fuel of the maximum fuel assembly reactivity must not exceed 0.95, at a 95 percent probability, 95 percent confidence level, if flooded with unborated water."

$$K_{\max(95/95)} \leq 0.95$$

General Design Criterion 62, Appendix A to 10 CFR 50

"Criticality in the fuel storage and handling system shall be prevented by physical systems or processes, preferably by use of geometrically safe configurations."

Methodology Overview

- Consistent with NEI 12-16 Revision 3, "Guidance for Performing Criticality Analyses of Fuel Storage at Light-Water Reactor Power Plants."
- Peak reactivity analysis with most limiting (bounding) lattice in every rack cell location.
- No credit for the Boraflex neutron absorber (modeled as water).
- B-10 areal density used for rack insert analysis (0.0115 g B-10/cm^2) is 10% less than the certified minimum areal density (0.0129 g B-10/cm^2).
- Quantification of credible normal and abnormal conditions with consideration of biases, rack/fuel tolerances and computational uncertainties.
- Covers current and future (GNF3) fuel product lines at River Bend Station.

Analysis Uncertainty Quantification

$$k_{\max(95/95)} = \Delta k_{Nominal} + \Delta k_{Bias} + \Delta k_{Tolerance} + \Delta k_{Uncertainty}$$

The contribution from the biases are:

$$\Delta k_{Bias} = \sum_{i=1}^{n} \Delta k_{B_i}$$

The contribution from the tolerances are:

$$\Delta k_{Tolerance} = \sqrt{\sum_{i=1}^{n} \Delta k_{T_i}^2}$$

The contribution from the uncertainties are:

$$\Delta k_{Uncertainty} = \sqrt{\sum_{i=1}^{n} \Delta k_{U_i}^2}$$

Computer Code Calculations

TGBLA06 [a]

- NRC-approved lattice physics code (NEDE-30130-P-A).
- TGBLA solves Two-Dimensional (2D) diffusion equations with diffusion parameters corrected by transport theory to provide system multiplication factors and perform burnup (depletion) calculations.
- Uses ENDF/B-V cross-section data.
- Performs coarse-mesh, broad-group, diffusion theory calculations; including thermal neutron scattering with hydrogen using an S(α,β) light water thermal scattering kernel.

a) [[

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MCNP-05P [b]

- Monte Carlo N-Particle code used for in rack reactivity (keff) calculations.
- Uses point-wise (i.e., continuous) ENDF/B-VII cross-section library, and all reactions in a given cross-section evaluation are considered.
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- [[

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b) MCNP-05P is the GNF controlled production version of the Los Alamos National Laboratory code MCNP5.

Boraflex Rack Cell Model with Inserts

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- No credit taken for Boraflex neutron absorber.
- [[ ]]
- Assumes every rack cell contains a design basis bundle with the worst rack reactivity suppression capability (i.e., highest rack efficiency) [[ ]]
- [[ ]]
- Stainless steel rack modeled.
- B-10 areal density used in the rack insert model is 10% lower than the certified minimum (95/95).
- [[ ]]

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Design Basis Bundle

[[

- [[ ]] bounds current and future fuel types at River Bend Station.
- Design basis bundle is selected to be the bundle with the worst rack reactivity suppression capability (i.e., highest rack efficiency) [[ ]]
- The design basis bundle is used to:
  - Define the nominal in rack k_{eff} result.
  - Used for performing all biases, manufacturing tolerances, computational uncertainty calculations, and all credible abnormal/accident condition calculations.

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Fuel Storage Conditions Analyzed

Credible Normal Conditions

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- No inserts along the rack periphery

Credible Abnormal Conditions

- Dropped/Damaged assembly
- Misloaded or mislocated fuel assembly
- Missing insert

Analyzed Tolerances and Biases

Bundle and Rack Tolerances

- [[

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- Rack pitch
- [[ ]]

Fuel Depletion Bias

- [[ ]]

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Analysis Uncertainties

- [[

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Summary

- Analysis complies with requirements in 10 CFR 50.68 and GDC 62.
- Follows guidance in NEI 12-16 Revision 3.
- Consideration given to all credible abnormal conditions, manufacturing tolerance implications, and computational uncertainties in determining maximum in-rack eigenvalue.
- The analysis resulted in a storage rack maximum k-effective less than the 0.95 limit from 10 CFR 50.68 for normal and credible abnormal operation with tolerances and computational uncertainties taken into account.