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Your ref: Docket No. 52-006
Our ref: DCP_NRC_002688

November 9, 2009

Subject: AP1000 Response to Request for Additional Information (TR 44)

Westinghouse is submitting responses to NRC requests for additional information (RAI) on Technical Report No. 44. This RAI response is submitted in support of the AP1000 Design Certification Amendment Application (Docket No. 52-006). The information included in this response is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification and the AP1000 Design Certification Amendment Application.

Enclosure 1 provides the response for the following RAI(s):

RAI-TR44-016 R2
RAI-TR44-017 R2

Questions or requests for additional information related to the content and preparation of this response should be directed to Westinghouse. Please send copies of such questions or requests to the prospective applicants for combined licenses referencing the AP1000 Design Certification. A representative for each applicant is included on the cc: list of this letter.

Very truly yours,

Robert Sisk, Manager
Licensing and Customer Interface
Regulatory Affairs and Standardization

/Enclosure

1. Response to Request for Additional Information on Technical Report No. 44



DO63
NRO

| | | | | |
|---|---|---|---|---|
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ENCLOSURE 1

Response to Request for Additional Information on Technical Report No. 44

# AP1000 TECHNICAL REPORT REVIEW

## Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR44-016
Revision: 2

***Question: (Revision 0)***

Explain whether only a full fuel rack is considered in the simulation, or if several scenarios are considered; i. e., different fill ratios, from empty to full. Provide the technical justification if only a full rack is considered.

**Staff Assessment:** Response similar to response for spent fuel racks. See RAI-TR54-025.

**Westinghouse Response: (Revision 0)**

The new fuel rack is assumed to be fully loaded with maximum weight fuel assemblies in all three simulations. This scenario bounds any partially loaded configuration since it (1) maximizes the vertical compression and lateral friction loads on the support pedestals and (2) produces the maximum rack displacements and fuel-to-cell wall impacts. The displacements are larger for a fully loaded rack, as opposed to a partially filled rack, because the dynamic model conservatively assumes that all stored fuel assemblies rattle in unison. Hence, the momentum transferred between the rattling fuel mass and the spent fuel rack is maximum for a fully loaded rack. For a partially filled rack, the decrease in rattling fuel mass outstrips the destabilizing effect of an eccentric fuel loading pattern.

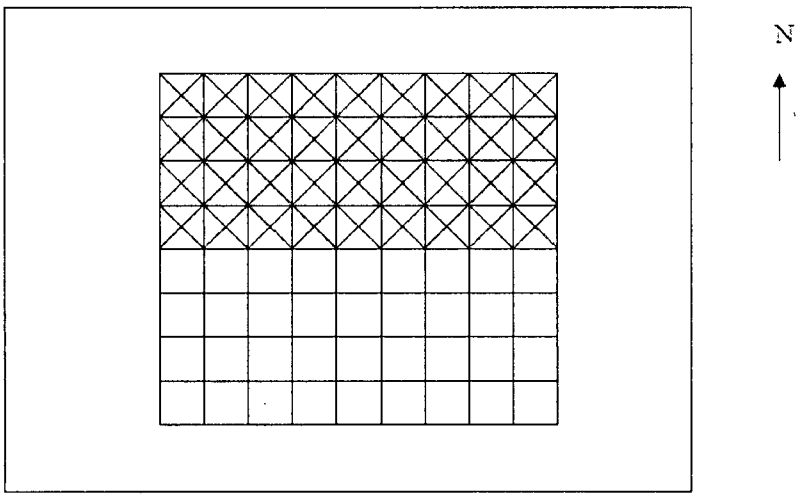
**Westinghouse Supplemental Response following May 21 and 22, 2008 Technical Review: (Revision 1)**

For the similar spent fuel racks RAI-TR54-025, the NRC found that the Westinghouse response "does appear to support the conclusion that generally the fully loaded racks would be expected to maximize impact forces and displacements." The NRC reviewer also concluded that "the use of the maximum weight for the fuel assemblies, the analysis assumption that all stored fuel assemblies rattle in unison, and consideration of the upper and lower bound coefficient of friction at all support legs provide added conservatism to bound the results from the other possible variations." Therefore, Westinghouse considers the above response to RAI-TR44-016 to be resolved for the new fuel rack.

Section 9.1.1.2.1 of the DCD will be revised to eliminate the reference to performing seismic and stress analyses that evaluate partially full and empty fuel assembly loadings of the new fuel rack.

**Additional Response: (Revision 2)**

Following the August 2009 audit with the NRC, Westinghouse has completed an additional run (Run Number 4) to examine the effects of the worst possible partial rack loading scenario (half full, all on one side, as depicted in the following figure). The results of this additional run will be included in Revision 2 of TR-44. Also, DCD Section 9.1.1.2.1, Item A, is modified to indicate that a partially filled loading case was evaluated.




Reference:

1. APP-GW-GLR-026, Revision 0, "New Fuel Storage Rack Structural/Seismic Analysis," (Technical Report Number 44)

# AP1000 TECHNICAL REPORT REVIEW

## Response to Request For Additional Information (RAI)

**Design Control Document (DCD) Revision:**
(Revision 0, 1 changes have been included in DCD R17.)
Additional Response (Revision 2):

The first paragraph under Item A of Section 9.1.1.2.1 of Rev. 17 of the DCD is revised as follows:

The new fuel storage rack array center-to-center spacing of nominally 10.9 inches provides a minimum separation between adjacent fuel assemblies sufficient with neutron absorbing material to maintain a subcritical array. The seismic and stress analyses of the new fuel rack consider the conditions of full and partially filled fuel assembly loadings. The rack is evaluated for the safe shutdown earthquake condition against the seismic Category I requirements. A stress analysis is performed to verify the acceptability of the critical load components and paths under normal and faulted conditions. The rack rests on the pit floor.

**PRA Revision:**

None

**Technical Report (TR) Revision:**

~~None~~

(Revision 1): The results of the ANSYS analysis of cell wall buckling at the base of the rack will be included in the next revision of TR-44. This revision is expected to be available in November, 2009.

Additional Response (Revision 2):

The results of the partial rack loading analysis will be included in the next revision of TR-44. This revision is expected to be available in November, 2009.

# AP1000 TECHNICAL REPORT REVIEW

## Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR44-017
Revision: 2

***Question: (Revision 0)***

What are the gaps and tolerances for each of the gaps between the fuel assembly and cell wall, and between the rack and vault wall? What are the assumed initial locations of the various components (fuel assemblies and rack) and what is the technical basis for this assumption. Were any studies done for different initial conditions (considering tolerances); if not, explain why it was not necessary. Are there requirements in the DCD to ensure that the assumed gaps (considering tolerances) are maintained throughout the operating license period?

**Staff Assessment:** Response similar to response for spent fuel racks. See RAI-TR54-026.

**Westinghouse Response: (Revision 0)**

All gaps between fuel assemblies and cell walls and between the rack and vault walls are set to match the nominal gaps provided on the layout drawing. Table TR44-017.1 summarizes the gap information used in the dynamic analyses.

| | Fuel-to-Cell Wall | Rack-to-Wall |
|---|---|---|
| Nominal Gap (inch) | (8.8"-8.404")/2 = 0.198" | North – 0" (see note 1)<br>East – 28.7"<br>South – 0" (see note 1)<br>West – 28.7" |

Table TR44-017.1 Gap Information used in the Dynamic Analysis of the New Fuel Rack

Note:
1. The new fuel storage rack is braced against the north and south walls of the New Fuel Storage Pit by inserting stainless steel wedges in the interstitial space between the top of the new fuel storage rack and the New Fuel Storage Pit opening (see TR44-009 RAI Response Figure TR44-9.1).

Fuel is assumed centrally located in cell. This is conservative since minimizing gap on one or two walls will generally produce a larger hydrodynamic coupling effect.

Some numerical studies were done on other rack projects; the results generally showed a small influence on results. A larger influence occurs if the gaps are assumed to be displacement dependent, rather than always being held constant at their initial value. The neglect of this effect is conservative.

Once the new fuel rack is installed, the "as-built" gaps are reconciled with the gaps initially used for analysis by evaluation of the numerical results and the predicted motions. The new fuel rack will be positioned in the New Fuel Storage Pit per the gap information provided in Table TR44-017.1. The only way the gaps would change over time would be by the action of a seismic event. Combined License applicants will have a procedure in place to address measurement of the post design-basis seismic event gaps, and to evaluate the acceptability of the configuration showing it is acceptable, or to take appropriate corrective actions. A statement will be added to the Technical Report addressing the design-basis seismic event potential change in gaps between the new fuel rack and New Fuel Storage Pit walls.

**Westinghouse Supplemental Response following May 21 and 22, 2008 Technical Review: (Revision 1)**

Since the Westinghouse submittal of the Revision 0 response to this RAI, the design of the new fuel storage pit was changed to remove the concrete corbels at the top of the pit and the stainless steel wedges that were to be welded in the interstitial space between the top of the new fuel storage rack and the pit opening following installation of the rack. As a result of the changes to the new fuel storage pit, the updated gap information is provided in the table below and was used in the dynamic analyses. Note that a conservative gap size was used for the fuel-to-cell wall gap in the dynamic analysis based on the smallest fuel assembly cross-section of 8.404 inches. The largest fuel assembly cross-section is 8.426 inches which equates to a 0.187 inch fuel-to-cell wall gap.

| | Fuel-to-Cell Wall | Rack-to-Wall |
|---|---|---|
| Nominal Gap (inch) | (8.8"-8.404")/2 = 0.198" | North – 6.88"<br>East – 28.93"<br>South – 6.88"<br>West – 28.93" |

Per the structural/seismic calculation for the new fuel rack, APP-FS01-S3C-001, Revision 1, the maximum displacement at the top of the new fuel rack is 6.35". Therefore, the minimum gap between the new fuel rack and the pit walls (at the top of rack elevation) will be specified on Rev. 1 of Drawing APP-FS01-V2-002 as 6-3/8".

***Additional Response: (Revision 2)***

Following the August 2009 audit, Westinghouse is updating DCD Figure 9.1-1 to include additional details related to the placement of the New Fuel Storage Rack within the New Fuel Pit. Figure 9.1-1 will be updated as shown in the DCD Revision section below to show the general position of the rack within the pit, including a definition of the minimum gaps. The only changes to the figure are that the rack is now shown within the vault and the 4 inch minimum typical gap dimension along with the clarifying note about where the gaps are measured from have been added. The 4 inch minimum gap is conservative based on the maximum rack displacement of 3.2 inches (which occurs at the top of the rack; the maximum displacement at the baseplate elevation is only 0.5 inches) when the 0.2 COF is ignored (justification for ignoring the 0.2 COF case is discussed in the response to RAI-SRP9.1.2-SEB1-02, Revision 1).

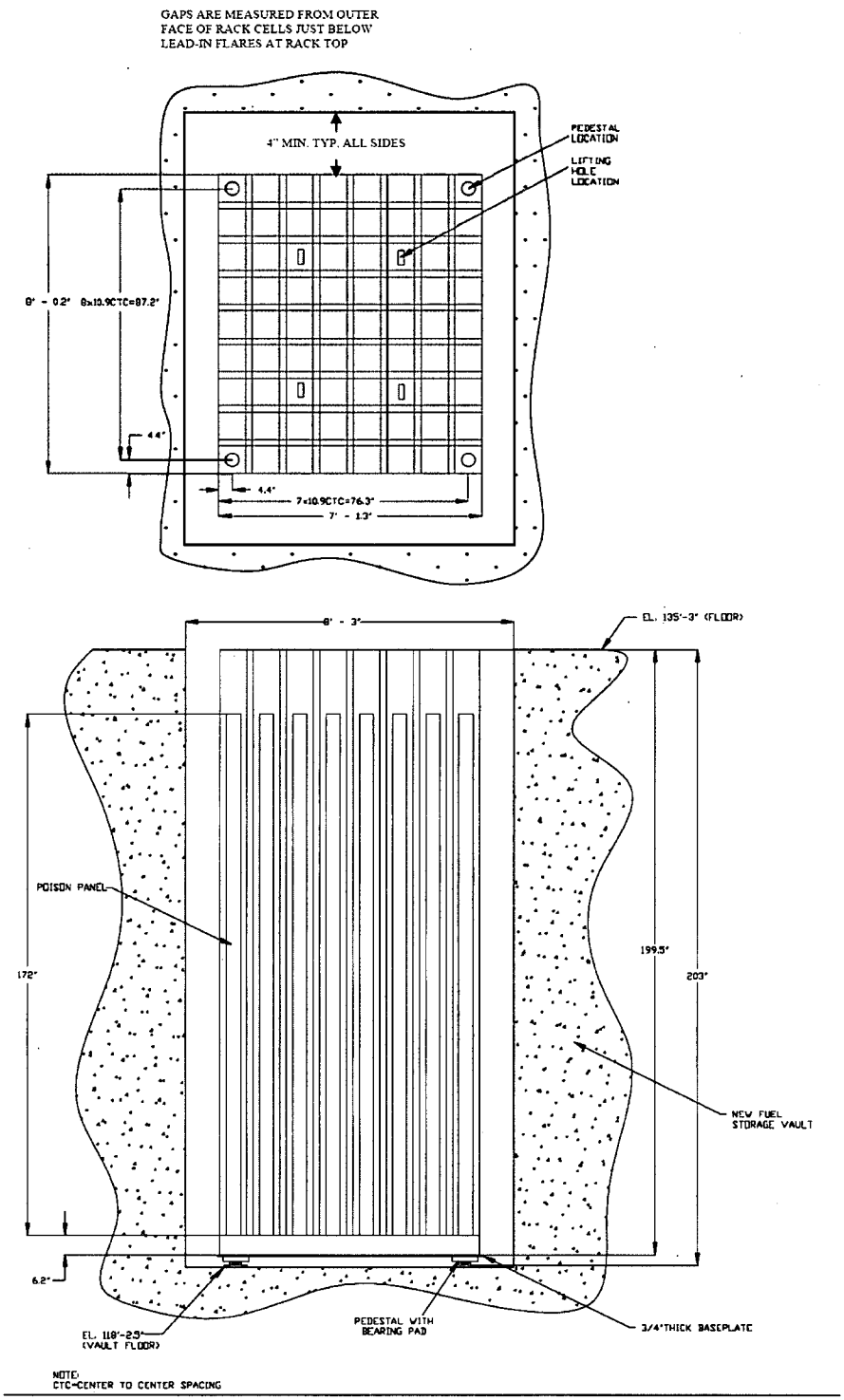
References:

1. APP-GW-GLR-026, Revision 0, "New Fuel Storage Rack Structural/Seismic Analysis," (Technical Report Number 44)
2. APP-FS01-S3C-001, Revision 1, "New Fuel Storage Rack Structural/Seismic Analysis"
3. Westinghouse Drawing APP-FS01-V2-002, Revision 1, "New Fuel Storage Rack Layout"

**Design Control Document (DCD) Revision: (Revision 0, 1)**
~~None~~

(Revision 2)

Replace DCD Figure 9.1-1 with the following figure:


GAPS ARE MEASURED FROM OUTER FACE OF RACK CELLS JUST BELOW LEAD-IN FLARES AT RACK TOP
4" MIN. TYP. ALL SIDES
PEDESTAL LOCATION
LIFTING HOLE LOCATION
8' - 0.2" 8x10.9CTC=87.2"
4.4"
4.4"
7x10.9CTC=76.3"
7' - 1.3"
8' - 3"
EL. 135'-3" (FLOOR)
POISON PANEL
172"
199.5"
203"
NEW FUEL STORAGE VAULT
6.2"
EL. 118'-2.5" (VAULT FLOOR)
PEDESTAL WITH BEARING PAD
3/4"THICK BASEPLATE
NOTE:
CTC-CENTER TO CENTER SPACING

**PRA Revision:**
None

**Technical Report (TR) Revision: (Revision 0, 1) (No changes for Revision 2)**

The following statement will be added to Technical Report 44 addressing the design-basis seismic event potential changes in gaps between the new fuel rack and walls of the new fuel storage pit:

"Per DCD subsection 3.7.5.2, Combined License applicants will prepare site-specific procedures for activities following an earthquake. These procedures will be used to accurately determine both the response spectrum and cumulative absolute velocity of the recorded earthquake ground motion from the seismic instrumentation system. An activity will be to address measurement of the post-seismic event gaps between the new fuel rack and walls of the new fuel storage pit and to take appropriate corrective actions."