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Revision 1

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Structural Analysis Report for STP Units 3 & 4 Spent Fuel Storage Rack Baseline Design

Westinghouse

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Structural Analysis Report for STP Units 3 & 4 Spent Fuel Storage Rack Baseline Design

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1 INTRODUCTION

This report documents the structural analyses of the baseline spent fuel storage rack design for the South Texas Project Units 3 & 4 (STP 3&4). Revision 1 includes supplemental information added as a result of the U.S. Nuclear Regulatory Commission (NRC) Requests for Additional Information (RAIs). The racks are designed to store spent fuel assemblies in the spent fuel pool. The spent fuel pool is designed to hold 31 stainless steel storage racks, which are made up of uniformly sized storage cells. The racks are constructed in varying arrays of cells to maximize the number of storage cells available in the spent fuel pool. The total capacity of the spent fuel pool is 3,410 fuel assemblies. The basis for the analyses is the design requirements specified by the COLA in Part 2, Tier 2, Section 9.1, Revision 4 [1] and Tier 2, Appendix 3A, Revision 4 of the DCD [2]. As Revision 1of this WCAP is a complete re-write, change bars have not been used.

2 TECHNICAL BACKGROUND

This report demonstrates the structural adequacy of the proposed STP 3&4 spent fuel storage racks under postulated loading conditions. Analyses and evaluations follow the NRC Standard Review Plan 3.8.4, Revision 2 [5]. The analysis uses a finite element modeling code used in previous fuel rack licensing efforts. This report provides a discussion of the method of analyses, modeling assumptions, key evaluations, and results obtained to establish that the spent fuel rack meets all structural integrity requirements.

3 DESIGN

The layout of the spent fuel storage racks in the spent fuel pool is shown in Figure 3-1 and summarized in Table 3-1. The pool is populated with 31 spent fuel racks with a total capacity of 3,410 fuel assemblies. The storage racks are composed of individual storage cells made of [ ][a.c] thick austenitic stainless steel sheet. For this analysis, the cells have a center-to-center cell pitch of [ ][a.c] and an inside dimension of [ ][a.c]. The storage cells are 190 inches tall and are welded to a base support assembly as well as one another to form an integral structure.

The base support assembly consists of a 1.5 inch thick stainless steel baseplate supported by leveling block assemblies. The stainless steel leveling block assemblies allow the height of the support feet to be adjusted to level the rack during installation. The top of the baseplate is located 8.1 inches above the spent fuel pool floor. The spent fuel racks are free standing racks and are not anchored to the floor or walls of the spent fuel pool. Each spent fuel rack is attached to the neighboring spent fuel rack with tie-bars at the top of the racks. Each side of a rack has a tie-bar; therefore, an internally located rack will have four tie-bar assemblies. The tie-bars are included in the seismic analysis, but the detailed design and qualification will be completed as part of the final design. During seismic events, the racks may slide along the floor of the spent fuel pool.

The neutron absorbing material, Boral®[1], is attached along the length of the cell walls through the use of thin gauge stainless steel wrapper plates. The wrapper plates are formed to create a small cavity and then welded to the cell walls. The Boral® plates are then inserted into the cavity formed between the wrapper plates and the cell walls. The Boral® plates are [ ][a.c] thick and completely cover the active fuel region of the fuel. The top of the Boral® plates are located [ ][a.c] below the top of the cells. Geometric details of the racks are shown in Figures 3-2 through 3-4. An overview of the construction and materials used in the STP 3&4 spent fuel storage rack is presented in Table 3-2 through Table 3-3. The fuel assembly details are summarized in Table 3-4.

Table 3-1: Spent Fuel Rack Summary

a,c

[1] Boral® is a registered trademark of Ceradyne Inc. in the United States or other countries. All other brand, product, service and feature names or trademarks are the property of their respective owners.

a,c

Note: Dimensions in brackets are in meters.

Figure 3-1: Spent Fuel Pool Layout

a,c

Figure 3-2: STP Spent Fuel Storage Rack Arrangement, 11 x 11 Fuel Storage Rack Isometric

a,c

Figure 3-3: Rack Geometry

[ ]a,c

Figure 3-4: Rack Geometry

Table 3-2: STP Spent Fuel Storage Rack Storage Cell Description

a,c

Table 3-3: STP 3&4 Spent Fuel Storage Rack Module

a,c

Table 3-4: STP Spent Fuel Storage Rack Fuel Data

a,c

4 SEISMIC ANALYSIS METHODOLOGY

4.1 TIME HISTORY INPUT

The safe shutdown earthquake (SSE) time histories are provided in the Westinghouse calculation note for the generation of artificial seismic time histories [6]. The spent fuel layout drawing in Figure 4-1 details the coordinate system for the seismic inputs from [6]. The x-axis is oriented along plane north, the y-axis is oriented along plane west, and the z-axis is oriented in the vertical direction according to the right-hand rule. The response spectra used for creating the artificial time history are taken from node 100 in the DCD Tier 2, Appendix 3A, Revision 4 [2]. This node corresponds to the reactor building at elevation 77.10 feet (23.5 meters). The base of the spent fuel pool is at 64.96 feet (19.8 meters), and the top of the racks is at 81.36 feet (24.8 meters). Therefore, the developed time history accounts for the wall amplification very near the top of the spent fuel racks.

The acceleration versus time data for the x, y, and z directions are shown in Figure 4-2 through Figure 4-4. Baseline corrected displacement time histories are developed using these accelerations. The displacement versus time data for the x, y, and z directions are shown in Figure 4-5.

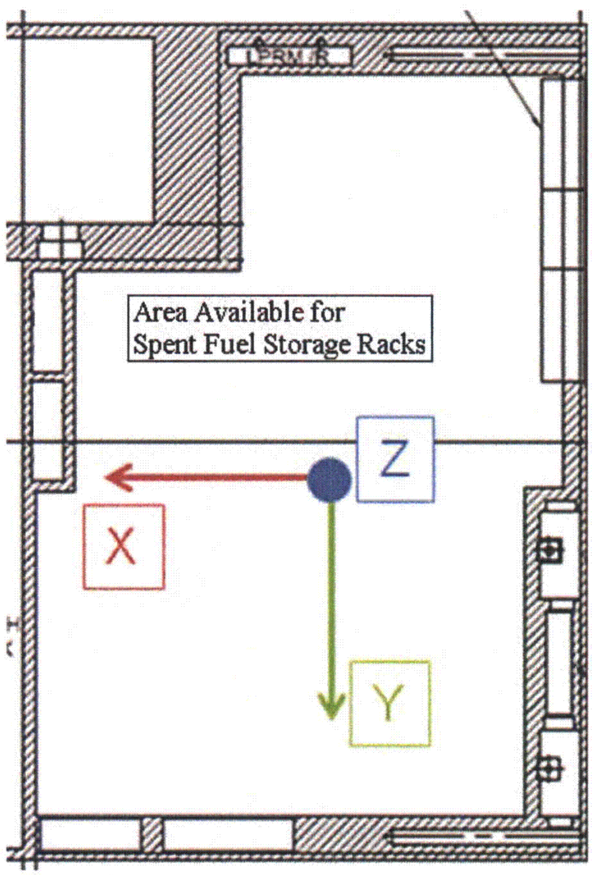

Figure 4-1: Seismic Input Coordinate Directions

a,c

Figure 4-2: Artificial Acceleration Time History - Horizontal (X)

a,c

Figure 4-3: Artificial Acceleration Time History - Horizontal (Y)

a,c

Figure 4-4: Artificial Acceleration Time History – Vertical (Z)

a,c

Figure 4-5: Baseline Corrected Artificial Displacement Time History

4.2 MODELING METHODOLOGY

Once a set of input excitations is obtained, a dynamic representation is developed. Reliable assessment of the stress field and kinematic behavior of the rack modules calls for a conservative dynamic model incorporating all key attributes of the actual structure. This means that the dynamic model must have the ability to execute concurrent sliding, rocking, bending, twisting, and other motion forms compatible with the freestanding installation of the modules. Additionally, the model must possess the capability to affect momentum transfers that occur due to rattling of fuel assemblies inside storage cells and the capability to simulate lift-off and subsequent impact of support pedestals with the rack bearing pad or pool liner. The contribution of the water mass in the interstitial spaces around the rack modules and within the storage cells must be modeled in an accurate manner. The Coulomb friction coefficient at the pedestal-to-bearing pad and pool liner interfaces may lie in a rather wide range, depending on the design of those interfaces; and the model must be able to reflect their effect. In short, there are a large number of parameters with potential influence on the rack motion. A comprehensive structural evaluation must be able to incorporate all of these effects in a finite number of analyses without sacrificing conservatism.

The three-dimensional model of a typical spent fuel storage rack handles the array of variables as follows.

- Interface Coefficient of Friction

  Coefficient of friction values are assigned at each interface, which reflect the realities of wetted stainless steel-to-stainless steel contact. The bounding cases of 0.2 and 0.8 coefficients of friction are analyzed. The limiting values are based on experimental data in the MIT spent fuel rack test report [10].

- Impact Phenomena

  Compression-only spring elements, with gap capability, are used to provide for opening and closing of the fuel assembly-to-cell wall interface. Nonlinear contact elements are used to simulate impact at the pool liner-to-pedestal interface and at the vertical fuel assembly-to-baseplate interface.

- Fluid Coupling

  The nonlinear time history SSE analysis includes the effects due to fluid-structure interaction. Fluid-structure interaction is modeled for the fuel assembly-to-cell wall interface, the rack-to-rack interface, and the rack-to-pool wall interface. The general approach used is to represent the fluid-structure interaction using a mass matrix. The procedure to determine the appropriate hydrodynamic mass matrix is to perform a fluid-structure interaction analysis using the ANSYS®[1] finite element software. The calculated hydrodynamic mass matrix is directly input to the rack structural model using ANSYS® MATRIX27 elements.

[1] ANSYS, ANSYS Workbench, Ansoft, AUTODYN, CFX, FLUENT, and any and all ANSYS, Inc. brand, product service and feature names, logos and slogans are registered trademarks of ANSYS, Inc. or its subsidiaries in the United States or other countries. All other brand, product, service and feature names or trademarks are the property of their respective owners.

To calculate the hydrodynamic mass matrix of the water between two structures using the ANSYS® fluid elements, two cases are considered. The first case is with the inner structure vibrating and the outer structure fixed. The second case is with the inner structure fixed, and the outer structure vibrating. The only mass in both cases is the fluid between the structures. From the work of Fritz [9], the fluid reaction forces on the inner and outer structures are shown in Equation 4-1.

$$\begin{aligned} F_{f1} &= -M_H \cdot A_1 + (M_1 + M_H)A_2 \\ F_{f2} &= (M_1 + M_H)A_1 - (M_1 + M_2 + M_H)A_2 \end{aligned} \qquad \textbf{Equation 4-1}$$

Where F_{f1} and F_{f2} are the hydrodynamic coupling forces, A_1 and A_2 are the body accelerations, M_1, M_2, and M_H refer to the hydrodynamic mass matrix terms. The terms M_1 and M_2 are the on-diagonal terms of the hydrodynamic mass matrix. The M_H term is the off-diagonal term of the hydrodynamic mass matrix.

The effective mass for each case represents the diagonal term of the hydrodynamic mass matrix. Because the work of Fritz states that the sum of all four terms must equal the actual water mass [9], the off diagonal terms, which are equal, were calculated from the results of both cases.

4.2.1 Specific Modeling Details for a Single Rack

The "building block" for the whole pool model (WPM) seismic analysis is a three-dimensional multi-degree of freedom model for each single spent fuel rack. Each rack is modeled as an ANSYS® superelement. The superelement is developed from a fully detailed shell, solid and beam model of the rack structure as shown in Figure 4-6, using the ANSYS® substructuring method. The WPM is built up of 31 individual rack superelements.

The fuel assemblies for the racks are modeled as a beam element model located at the center of the rack. In order to reduce the model degrees of freedom and achieve a reasonable computer run time, only selected racks include this beam element representation. The simplified racks include the weight of the fuel assemblies as an increase grid density. Rack results focus on the detailed models, which include nonlinear gap elements and hydrodynamic coupling between the fuel and rack cell walls. The fuel-to-rack connectivity is shown in Figure 4-7 and Figure 4-8.

Figure 4-9 shows a top down view of the WPM, which includes all 31 rack superelements. Each rack also includes:

- Rack-to-rack hydrodynamic mass effects
- Rack-to-wall hydrodynamic mass effects
- Nonlinear contact between each rack pedestal mount and the spent fuel pool floor. Analysis runs considered a contact coefficient of friction of 0.2 and 0.8.
- Buoyancy effects.

4.2.2 Simulation and Solution Methodology

The sequence of model development and analysis steps that are undertaken for each simulation are summarized in the following:

a. Prepare three-dimensional dynamic models of the assemblage of all rack modules in the pool. Include all fluid coupling interactions and mechanical couplings appropriate for performing an accurate non-linear simulation.

b. Perform non-linear dynamic analyses for the assemblage of racks in the pool. Archive results for post-processing displacement and load outputs from the dynamic model.

c. Perform stress analysis of high stress areas for rack dynamic runs. Demonstrate compliance with American Society for Mechanical Engineers (ASME) Code Section III, Subsection NF [8], as amended by the requirements of paragraphs c.2, 3, and 4 of Regulatory Guide (RG) 1.124 [12], limits on stress and displacement. The high stress areas are associated with the pedestal-to-baseplate connection. In addition, some local evaluations are performed for the bounding case to ensure that the fuel remains protected under all impact loads.

4.2.3 Simulation Description

The WPM is loaded by applying the time varying SSE pool floor displacements from the calculation note for the generation of the artificial time histories [6] to the boundary elements of the WPM. All three directions of motion are applied simultaneously. A 1g vertical acceleration is included to model the effect of gravity. Two separate runs are made to determine the bounding results for the pedestal-to-floor coefficient of friction. A minimum coefficient of friction of 0.2 and maximum coefficient of friction of 0.8 is considered. For the limiting time points of highest fuel impact load and rack-to-floor impact load, submodels of the single rack model are analyzed to determine stresses. These stresses are then compared to the allowables of the ASME Code [8], as amended by the requirements of paragraphs c.2, 3, and 4 of RG 1.124 [12].

4.2.4 Conservatisms Inherent in Methodology

The following item is a built-in conservatism:

- All fuel assemblies are assumed to move as a unit, thus maximizing impact force and rack response.

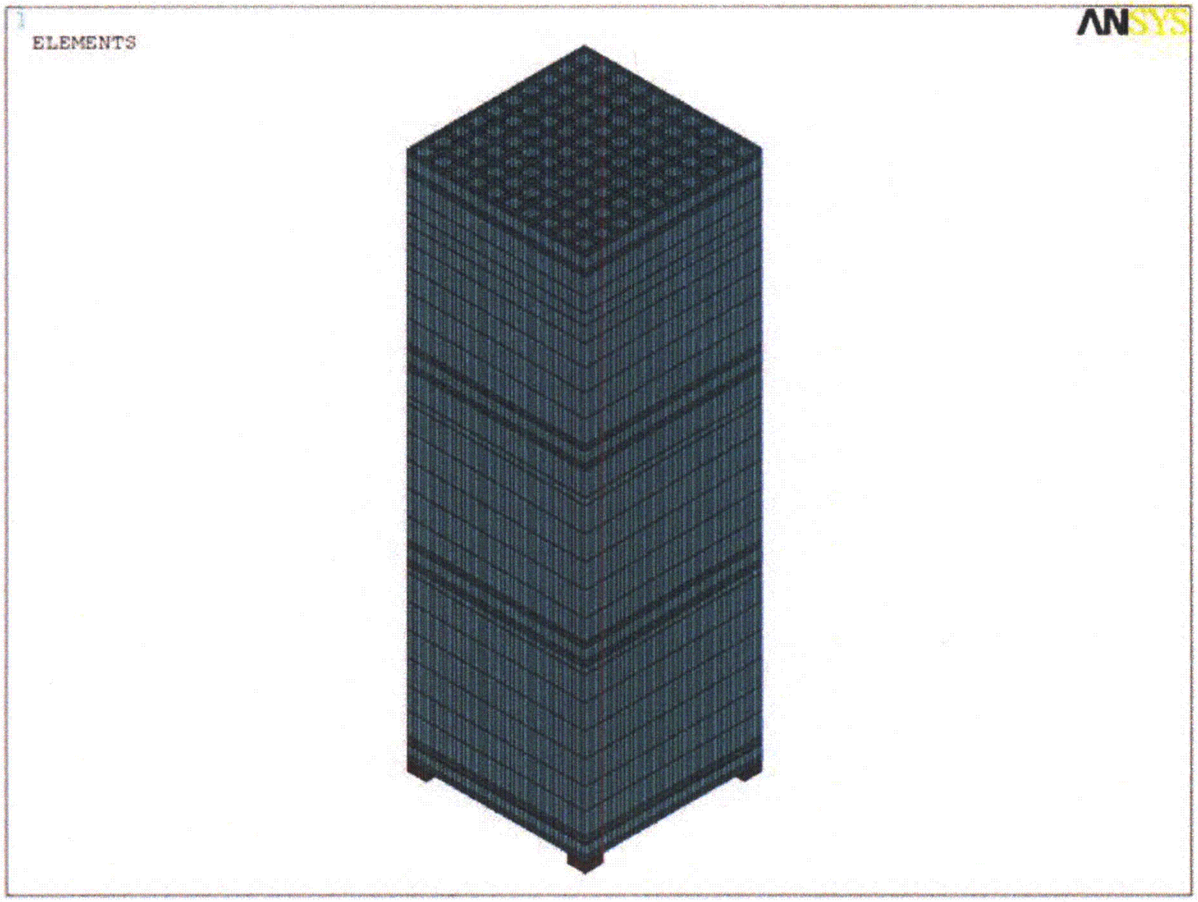

Figure 4-6: ANSYS® Fuel Rack Detailed Model

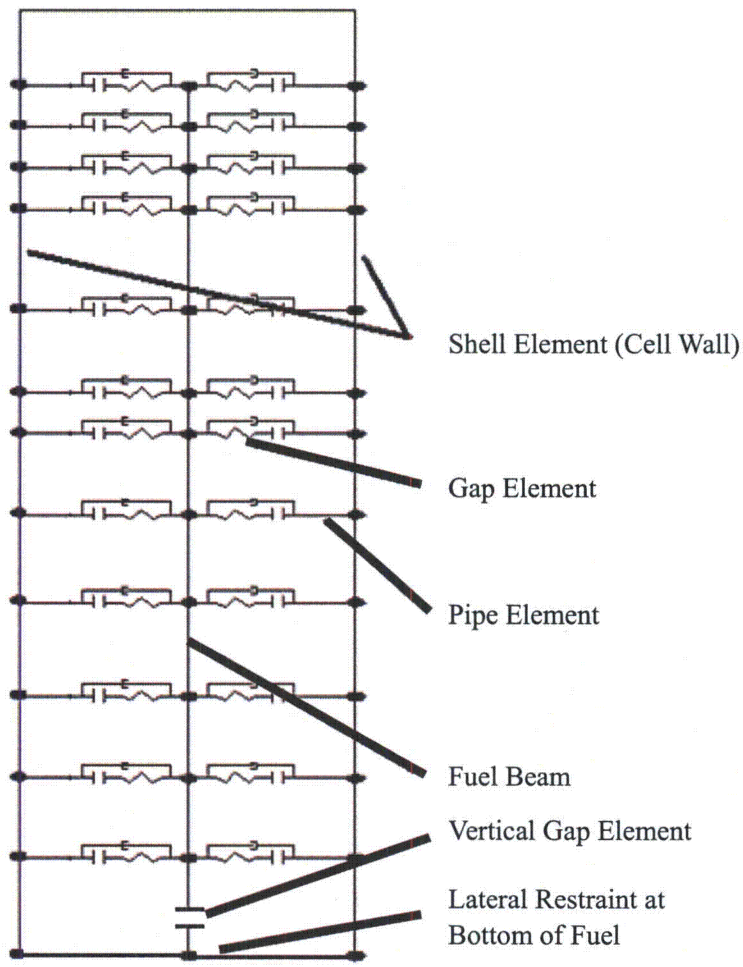

Figure 4-7: Fuel to Cell Connection

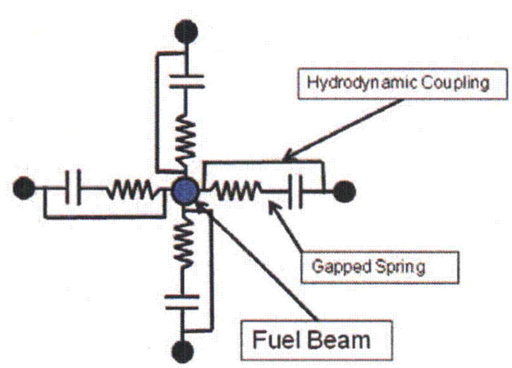

Figure 4-8: Schematic Diagram of Finite Element Model

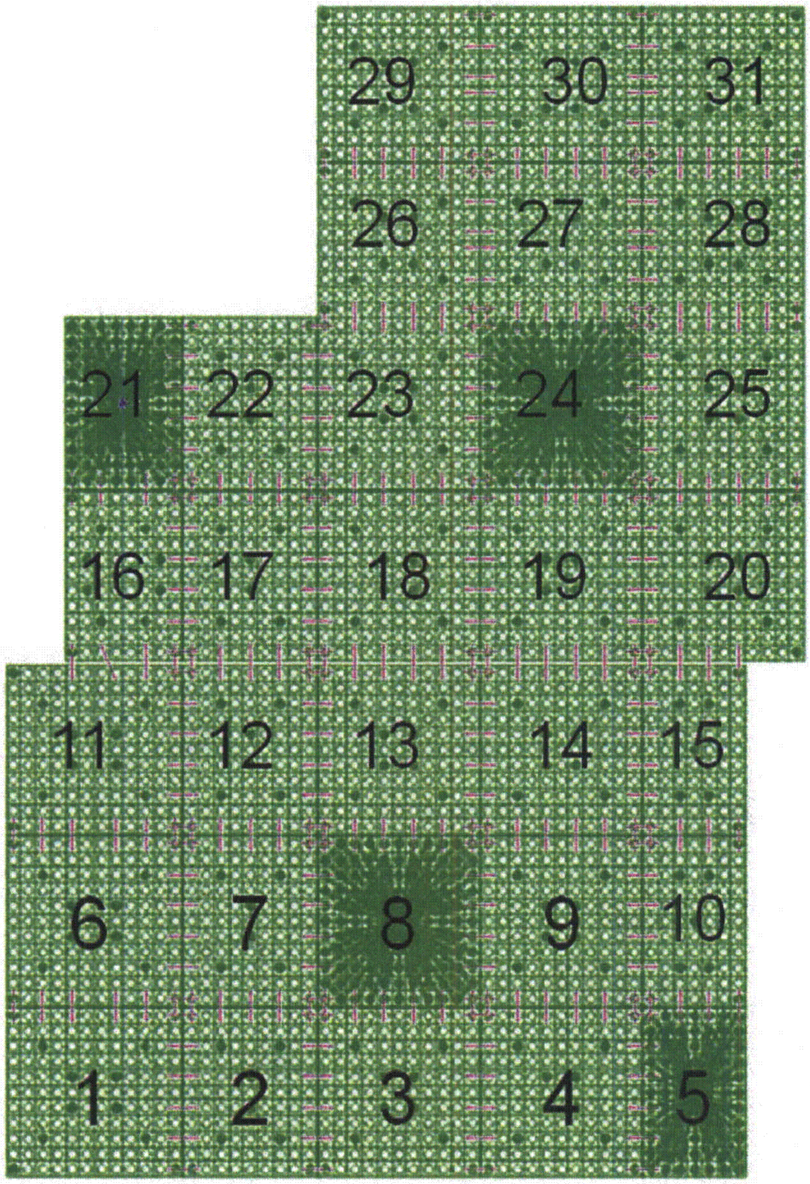

Figure 4-9: ANSYS® Whole Pool Model with Rack Numbering Convention

4.3 KINEMATIC AND STRESS ACCEPTANCE CRITERIA

4.3.1 Introduction

The STP 3&4 spent fuel storage rack is designed as seismic Category I. The U.S. NRC Standard Review Plan 3.8.4 [5] states that the ASME Code Section III, subsection NF [8], as amended by the requirements of paragraphs c.2, 3, and 4 of RG 1.124 [12], as applicable for Class 3 Components, is an appropriate vehicle for design. In the following sections, the ASME limits are set.

4.3.2 Kinematic Criteria

The spent fuel storage rack should not exhibit rotations to cause the rack to overturn (i.e., ensure that the rack does not slide off the bearing pads or exhibit a rotation sufficient to bring the center of mass over the corner pedestal). This requirement is fulfilled by the fact that the spent fuel storage racks are tied together at the top of each rack to the adjacent racks.

4.3.3 Stress Limit Criteria

For thoroughness, the Standard Review Plan [5] load combinations were used. Stress limits must not be exceeded under the required load combinations.

The fuel storage racks were evaluated for the load conditions specified in Table 4-1. It is noted that, as stated in Section 8.4, the stuck fuel assembly load combination does not need to be considered for STP 3 & 4.

Table 4-1: Loading Combinations for STP 3&4 Spent Fuel Storage Rack

Loading Combination	Service Level
D + L D + L + T_o D + L + T_o +E	Level A
D + L + T_a + E D + L + T_o +P_f	Level B (Note 1)
D + L + T_a +E'	Level D
D + L + F_d	Functional capacity according to SRP 3.8.4 [5]

Notes:

1. There is no operating basis earthquake (OBE) for the STP 3&4 plants.

Abbreviations are those used in [6]:

D	=	Dead weight induced loads (including fuel assembly weight)
L	=	Live load (not applicable to fuel racks because there are no moving objects in the rack load path)
E	=	OBE
E'	=	SSE
T_o	=	Differential temperature induced loads based on the most critical transient or steady state condition under normal operation or shutdown conditions
T_a	=	Differential temperature induced loads based on the postulated abnormal design conditions
P_f	=	Upward force on the rack caused by postulated stuck fuel assembly
F_d	=	Force due to dropped fuel assembly

4.3.4 Stress Limits for Various Conditions Per ASME Code

Stress limits for Normal Conditions are derived from the ASME Code, Section III, Subsection NF [8], as amended by the requirements of paragraphs c.2, 3, and 4 of RG 1.124 [12]. Parameters and terminology are in accordance with the ASME Code. Racks are freestanding; thus, there is minimal or no restraint against free thermal expansion at the base of the rack. However, thermal loads are calculated for the storage rack cell walls based on a postulated temperature differential between one cell and the surrounding cells. The stresses from these thermal loads are included in the stress evaluations.

Material properties for analysis and stress evaluation are provided in Table 4-2 and Table 4-3.

Table 4-2: SA-240 Type 304L, English Units

Temperature (°F)	70	140(1)	200
Yield Strength, S_y (ksi)	25	23.0	21.3
Ultimate Strength, S_u (ksi)	70	68.0	66.2
Design Stress, S_m (ksi)	16.7	16.7	16.7
Modulus ($x10^6$ psi)	28.3	27.9	27.5

Note:

(1) Material properties at 140°F (60°C) are conservatively interpolated.

Table 4-3: SA-564, Grade 630, English Units			
Temperature (°F)	70	140[1]	200
Yield Strength, S_y (ksi)	115	110.3	106.3
Ultimate Strength, S_u (ksi)	140	140.0	140
Modulus (x10^6 psi)	28.3	27.9	27.5

Note:

(1) Material properties at 140°F (60°C) are conservatively interpolated.

4.4 ASSUMPTIONS

The following assumptions are used in the analysis.

- The spent fuel pool acts in a rigid fashion and that the acceleration does not vary along the elevation of the pool walls.
- The structural effects of the neutron absorbing material and wrapper are considered insignificant and only their mass effects are included in the rack model.

5 INPUT DATA

5.1 RACK AND FUEL DATA

Section 3 contains information regarding the STP 3&4 spent fuel storage rack module data that was used in the analysis. The fuel assembly beam model was developed in the STP spent fuel storage fuel assembly finite element model analysis [7].

5.2 STRUCTURAL DAMPING

A damping coefficient of 4% damping at [ ]^{a,c} is applied using beta damping. The alpha term for Rayleigh damping was not included in the damping calculation. The storage rack and fuel assembly first resonant frequencies are [ ]^{a,c}. This is consistent with RG 1.61 [11], which specifies 4% damping for welded steel connections. Damping due to fluid affects is not included.

5.3 MATERIAL DATA

The necessary material data is shown in Table 4-2 and Table 4-3. This information is taken from ASME Code Section II, Part D [8].

6 COMPUTER CODES

Computer codes used in this analysis are presented in Table6-1.

Table 6-1: Computer Codes Used for Analysis

Code	Version	Description
ANSYS® [13]	11.0	General purpose commercial finite element analysis code.
LS-DYNA®[1]	971	LS-DYNA is an industry accepted explicit dynamic finite element analysis computer code. LS-DYNA has the capability to solve the finite element model generated using ANSYS in this calculation. The verification problems performed by Westinghouse when the code is configured support the use of ANSYS for this purpose.

[1] LS-DYNA and LS-PREPOST are registered trademarks of Livermore Software Technology Corporation.

7 ANALYSES

7.1 ACCEPTANCE CRITERIA

The stress ratios and interaction ratios must be less than 1.0. In addition, welds and base metal stresses must remain below the allowable stress limits corresponding to the material and load conditions, as discussed in greater detail in Section 8.

8 RESULTS OF ANALYSES

The results for the fuel storage rack seismic analysis are taken from the rack seismic analysis report [3].

8.1 SEISMIC IMPACT LOADS

The impact loads are evaluated at the fuel-to-rack interface and the rack-to-pool interface. Rack-to-rack impact is not expected to occur because the tops of the rack are connected together. The maximum sliding of the spent fuel storage rack structure is 7.67 inches. The equipment around the spent fuel storage racks will be designed and located in the spent fuel pool with enough clearance to prevent impact of the rack structure with the pool wall or the equipment located in the pool.

8.1.1 Fuel-to-Rack Impact

The maximum fuel impact load is 4,689 lbs. This load is based on the conservative assumption that the fuel assemblies move in phase.

8.1.2 Rack-to-Floor Impact

The maximum vertical load and the maximum shear load at the storage rack pedestal mount do not occur at the same time during the transient time history analysis. The maximum vertical load on the pool floor is 256,856 lbs. The shear load is 52,514 lbs at the time of maximum vertical load. The maximum shear load on the pool floor is 68,648 lbs. The vertical load is 139,939 lbs at the time of maximum shear load.

8.2 RACK STRUCTURAL EVALUATION

8.2.1 Cell Wall Stresses

8.2.1.1 Service Level A Stresses

A. Material — ASME SA240, Type 304L

B. Physical Properties — See Table 4-2

C. Allowable Stress — S = 15.7 ksi at 140°F [8, NF-3261, NF-3251.1 and Appendix-I, Table I-7.2]

D. Stress Limits — $\sigma_1 \leq 1.0(S)(SLF)$ [8, NF-3261 and NF-3251.1]

$\sigma_1 + \sigma_2 \leq 1.5(S)(SLF)$

σ_1 = membrane stress

σ_2 = bending stress

SLF =stress limit factor [8, Table NF-3552(b)-1]

Level A = 1.0

However, for the purposes of this analysis, the following will be used for the cell wall stress for the D + L load combination. This is a membrane stress only.

$$\sigma_l = (A)(Density)(Length) / (Area) = (0.283\ Lb/in^3)(190\ in) = 0.05\ ksi$$

The operating thermal membrane stress calculated is 7.33 ksi. The D + L + T_o is, therefore, 7.33 ksi plus 0.05 ksi, 7.38 ksi. This is less than the allowable stress of 15.7 ksi. Note there is no significant bending in the hot cell. The critical buckling of the 18.9 ksi is greater than the membrane stress of 7.38 ksi (50.9 MPa).

8.2.1.2 Service Level D Stresses

The faulted SSE plus deadweight loads are evaluated per Appendix F, F-1332 in the ASME Code [8], as amended by the requirements of paragraphs c.2, 3, and 4 of RG 1.124 [12]. The membrane stress limits are defined as:

Greater of $1.2(S_y) = 1.2(23.0\ ksi) = 27.6\ ksi$

or $1.5(S_m) = 1.5(16.7\ ksi) = 25.05\ ksi$

Not to Exceed $0.7(S_u) = 0.7(68\ ksi) = 47.6\ ksi$

The values of S_m, S_y, and S_u are taken at 140°F. The membrane plus bending stress limit is defined as:

1.5(membrane stress limit) = 1.5 = 41.4 ksi

The cell wall stress results are summarized in Table 8-1. The cell wall maximum membrane plus bending stress is calculated during the fuel impact analysis. The maximum membrane plus bending stress is the D + L + E' stress, 67.1 ksi (427.5 MPa), plus the thermal faulted stress (T_a), 7.33 ksi (50.5 MPa), which equals 74.43 ksi (513.2 MPa). This membrane plus bending stress is greater than the allowable limit of 41.4 ksi (285.5 MPa). Exceeding the allowable limit is acceptable based on the following reasoning. The region of high stress is local to the point of impact. It is expected that this region will locally deform and that loads will redistribute to the surrounding cell walls. The maximum membrane plus bending stress remote from the impact region is 17.2 ksi (118.6 MPa). Therefore, the overall structural integrity of the grid structure will be maintained.

Table 8-1: Summary of Cell Wall Stresses

Loading	Stress Type	Code Level	Summed Actual Stress (ksi)	Allowable Stress (ksi)	Stress Ratio (≤ 1.0)
$D + L + T_o$	Membrane	A	7.4	15.70	0.47
	Membrane + Bending.	A	7.4	23.55	0.31
$D + L + T_a + E'$	Membrane	D	27.2	27.6	0.99
	Membrane + Bending	D	74.4(1)	41.4	1.80(1)

Note:

(1) The cell wall membrane plus bending stress exceeds the allowable limit local to the fuel impact location. This high stress is expected to cause local high distortion, but it is expected that the grid structure structural integrity will be maintained.

8.2.2 Level Screw Stress

The leveling screw will be evaluated as a Class 3, linear type component support. The leveling screw is a 3.5-8 UN-2A thread. The Level D allowable stresses are the Level A allowable stress multiplied by the appropriate factor from Appendix F-1334 in the ASME Code [8], as amended by the requirements of paragraphs c.2, 3, and 4 of RG 1.124 [12]. The Level A allowable stresses are calculated from Subsection NF, Article NF-3360 and NF-3320 in the ASME Code [8], as amended by the requirements of paragraphs c.2, 3, and 4 of RG 1.124 [12]. Because the slenderness ratio is small, the screw will fail by compressive yielding; critical buckling is not a concern.

$F_a = S_y \{0.47 - [(KL / r) / 444]\}$ compression [8, NF-3322.1(c)(2)(a)], as amended by the requirements of paragraphs c.2, 3, and 4 of RG 1.124 [12]

$F_b = 0.75(S_y)$ bending [8, NF-3322.1(d)(3)], as amended by the requirements of paragraphs c.2, 3, and 4 of RG 1.124 [12]

$F_v = 0.4(S_y)$ shear [8, NF-3322.1(b)(1)], as amended by the requirements of paragraphs c.2, 3, and 4 of RG 1.124 [12]

The values for F_a, F_b, and F_v are calculated using the 140°F value of S_y, 110.3 ksi from Table 4-3. The Level A allowables are:

$$F_a = 110.3 \text{ ksi } \{0.47 - [(8.00) / 444]\} = 49.85 \text{ ksi}$$

$$F_b = 0.75(110.3 \text{ ksi}) = 82.73 \text{ ksi}$$

$F_v = 0.4(110.3 \text{ ksi}) = 44.12 \text{ ksi}$

The scale factor for calculating the Level D allowable limits is from the ASME Code [8, Appendix F-1334], as amended by the requirements of paragraphs c.2, 3, and 4 of RG 1.124 [12], as the smaller of:

2.0

$1.167(S_u)/S_y = 1.167(140.0 \text{ ksi})/(110.3 \text{ ksi}) = 1.481$

S_u and S_y are taken at 140°F from Table 4-3. The Level D allowables are:

$F_a = 1.481(49.85 \text{ ksi}) = 73.8 \text{ ksi}$ (buckling is not a concern)

F_b = lesser of

$1.481(82.73 \text{ ksi}) = 122.5 \text{ ksi}$

$0.7(S_u) = 0.7(140 \text{ ksi}) = 98.0 \text{ ksi}$

F_v = lesser of

$1.481(44.12 \text{ ksi}) = 65.3 \text{ ksi}$

$0.42(S_u) = 0.42(140 \text{ ksi}) = 58.8 \text{ ksi}$

8.2.2.1 Allowable Interaction Ratio Limits

The combined axial and bending stress interaction ratio limit is based on the ASME Code [8, NF-3322.1(e)], as amended by the requirements of paragraphs c.2, 3, and 4 of RG 1.124 [12]. As shown in Table 8-2, $f_a/F_a \leq 0.15$. Equation 22 in the ASME Code [8, NF-3322.1(e)(1)], therefore, applies for combined compression and bending interaction ratios (IR) for Service Level A.

$IR = (f_a / F_a) + (f_b / F_b)$ Equation 22

As shown in Table 8-3, $f_a/F_a > 0.15$; therefore, Equations 20 and 21 in the ASME Code [8, NF-3322.1(e)(1)], as amended by the requirements of paragraphs c.2, 3, and 4 of RG 1.124 [12], must both be satisfied for Service Level D. Equations 20 and 21 are:

$F_a/F_a + [C_m(f_b)] / [(1 - f_a/F'_e)F_b] \leq 1.0$ Equation 20

$F_a/(0.6S_y) + f_b/F_b \leq 1.0$ Equation 21

C_m is 1.0 [8, NF-3322.1(e)(1)(c)(2)] and F'_e is:

$F'_e = 12\pi^2 E / [23(KL/r)^2] = 2{,}235 \text{ ksi}$ [8, NF-3322.1(e)], as amended by the requirements of paragraphs c.2, 3, and 4 of RG 1.124 [12]

E is the modulus at temperature, 27.8×10^6 psi at 140°F.

8.2.2.2 Leveling Screw Stress Calculation

The leveling screw stresses are calculated based on the maximum mount loads from the seismic time history analysis. Thermal loads are not considered significant for the calculation of load on the level screws. The maximum D + L load is taken from the initial load step of the seismic time history. The maximum D + L load for a level screw is 8,294 lbs.

For Service Level D loading, the maximum D + L + E' stress condition occurs for the maximum vertical load. The maximum vertical load occurs at 3.894 seconds for rack 8, with a coefficient of friction equal to 0.2. The maximum vertical load is 256,856 lbs with a shear load of 52,514 lbs. The maximum loads occur for a single leveling screw impacting the pool floor.

The level screw stresses are calculated as:

$$F_a = P_{axial} / A_{axial} \quad fb = (P_{shear}*L) / S \quad F_v = P_{shear} / A_{shear}$$

Table 8-2: Level A Service Limits Leveling Screw Stress Summary

Calculated Stress (ksi)		Allowable Stress (ksi)		Stress Ratio (f/F)	Interaction Ratio		Interaction Ratio Allowable
f_a	0.94	F_a	49.85	0.02	$f_a/F_a + f_b/F_b$ (for $f_a/F_a<0.15$)	0.02	1.0
f_b	0	F_b	82.73	0			
f_v	0	F_v	44.12	0	f_v/F_v	0	1.0

Table 8-3: Level D Service Limits Leveling Screw Stress Summary

Calculated Stress (ksi)		Allowable Stress (ksi)		Stress Ratio (f/F)	Interaction Ratio		Interaction Ratio Allowable
f_a	29.17	F_a	73.80	0.39	$f_a/F_a + C_m f_b/[(1 - f_a/F'_e)F_b]$	0.89	1.0
f_b	47.72	F_b	98.00	0.49	$f_a/(0.60S_y) + f_b/F_b$	0.93	1.0
f_v	7.95	F_v	58.80	0.14	f_v/F_v	0.14	1.0

8.2.3 Weld Stresses

Weld locations in the STP 3&4 spent fuel storage rack that are subjected to significant seismic loading are at the cell-to-cell connections, the cell-to-baseplate connection, and at the cell-to-coverplate connections. Bounding values of resultant loads are used to qualify the connections.

a. Cell-to-Cell Welds

Cell-to-cell connections are made by a series of connecting welds along the cell height. Stresses in the storage cell-to-cell welds develop due to fuel assembly impacts with the cell wall, distortion of the rack, and rack impact with the floor. The D + L loading stresses in the cell-to-cell welds are negligible. $S_{u\ weld}$ is assumed to be 68 ksi (same as the base metal). Therefore, the allowable weld stresses are calculated as:

Level A [8, NF-3324.5, Table 3324.5(a)-1], as amended by the requirements of paragraphs c.2, 3, and 4 of RG 1.124 [12]

$F_v = 0.3(S_{uw}) = 0.3(68\text{ ksi}) = 20.4$ ksi weld metal

$F_v = 0.4(S_y) = 0.4(23\text{ ksi}) = 9.2$ ksi base metal ← governs

The Level D allowable weld stress is calculated per the ASME Code [8, Appendix F-1332.4], as amended by the requirements of paragraphs c.2, 3, and 4 of RG 1.124 [12]. The allowable weld stresses are calculated as:

Level D

$F_v = 0.42(S_u) = 0.42(68.0\text{ ksi}) = 28.6$ ksi [8, Appendix F-1332.4]

The cell-to-cell weld stresses are summarized in Table 8-4.

Table 8-4: Summary of Cell-to-Cell Weld Stresses

Combination Equation	Code Level	Summed Actual Stress (ksi)	Allowable Stress (ksi)	Interaction Ratio (≤ 1.0)
$D + L + T_o$	A	4.45	9.2	0.48
$D + L + T_a + E'$	D	19.89	28.6	0.70

b. Cell-to-Baseplate Welds

The allowable stresses for the cell-to-baseplate weld are the same as the allowable for the cell-to-cell welds. Table 8-5 summarizes the results, showing interaction ratios less than 1.

Table 8-5: Summary of Cell-to-Baseplate Weld Stresses

Combination Equation	Code Level	Summed Actual Stress (ksi)	Allowable Stress (ksi)	Interaction Ratio (≤ 1.0)
$D + L + T_o$	A	1.71	9.2	0.19
$D + L + T_a + E'$	D	12.44	28.6	0.43

c. Cell-to-Coverplate Welds

The cell-to-coverplate weld stresses are reported in Table 8-6, and show interaction ratios less than 1.

Table 8-6: Summary of Cell-to-Coverplate Weld Stresses

Combination Equation	Code Level	Summed Actual Stress (ksi)	Allowable Stress (ksi)	Interaction Ratio (≤ 1.0)
$D + L + T_o$	A	4.45	9.2	0.48
$D + L + T_a + E'$	D	11.60	28.6	0.41

8.2.4 Baseplate Stress

The Level A and Level D allowables are the same as those calculated for the cell wall, see Section 8.2.1. The Level A baseplate stresses are negligible. The controlling stresses are in the cell wall. The Level D membrane and membrane plus bending stresses are evaluated for the maximum rack-to-pool floor impact evaluation. The maximum baseplate membrane stress is 5.4 ksi and is less than the allowable limit of 27.6 ksi. The maximum membrane plus bending stress is 20.9 ksi and is less than the allowable limit of 41.4 ksi.

8.2.5 Support Plate Stress

The Level A and Level D allowables are the same as those calculated for the cell wall, see Section 8.2.1. The Level A support plate stresses are negligible. The Level D membrane and membrane plus bending stresses are evaluated for the maximum rack-to-pool floor impact evaluation. The maximum support plate membrane stress is 15.3 ksi and is less than the allowable limit of 27.6 ksi. The maximum membrane plus bending stress is 42.9 ksi and is greater than the allowable limit of 41.4 ksi. This is acceptable because the stress is concentrated in this location and does not represent an average cross section value. Therefore, it is expected that this local peak stress would redistribute.

8.3 DROPPED FUEL ASSEMBLY EVALUATION

The assumed fuel assembly is a representative fuel assembly plus the handling tool, containing a total maximum dry weight of 572 kg (1263 lbs). It was postulated to be dropped from a height of 1.8 m (5.9 ft) above the top of the rack as described in the COLA Part 2, Tier 2, Section 9.1, Revision 4 [1]. The fuel drop analysis was performed on a representative 11x11 fuel rack intended to bound both the 10x10 new fuel rack and the various sizes of the spent fuel racks. As such, the analysis considered a fuel assembly dropped through the air and loading a dry fuel rack, which is very conservative compared to dropping a fuel assembly in the water and hitting a submerged spent fuel rack. Details of the analysis are provided in [ ]^{a,c}.

8.3.1 Drop Orientations

Three drop orientations were considered.

- The drop of a fuel assembly onto the top of a rack with the assembly in a vertical position
- The drop of a fuel assembly onto the top of a rack with the assembly in an inclined position
- The drop of a fuel assembly through an empty rack cell to the bottom of the rack

These orientations are shown in Figure 8-1, Figure 8-2, and Figure 8-3, respectively. Note that the figures are intended to illustrate the orientations of the dropped fuel assembly only. The rack shown is an 8x12 rack and is not the actual rack evaluated for this report.

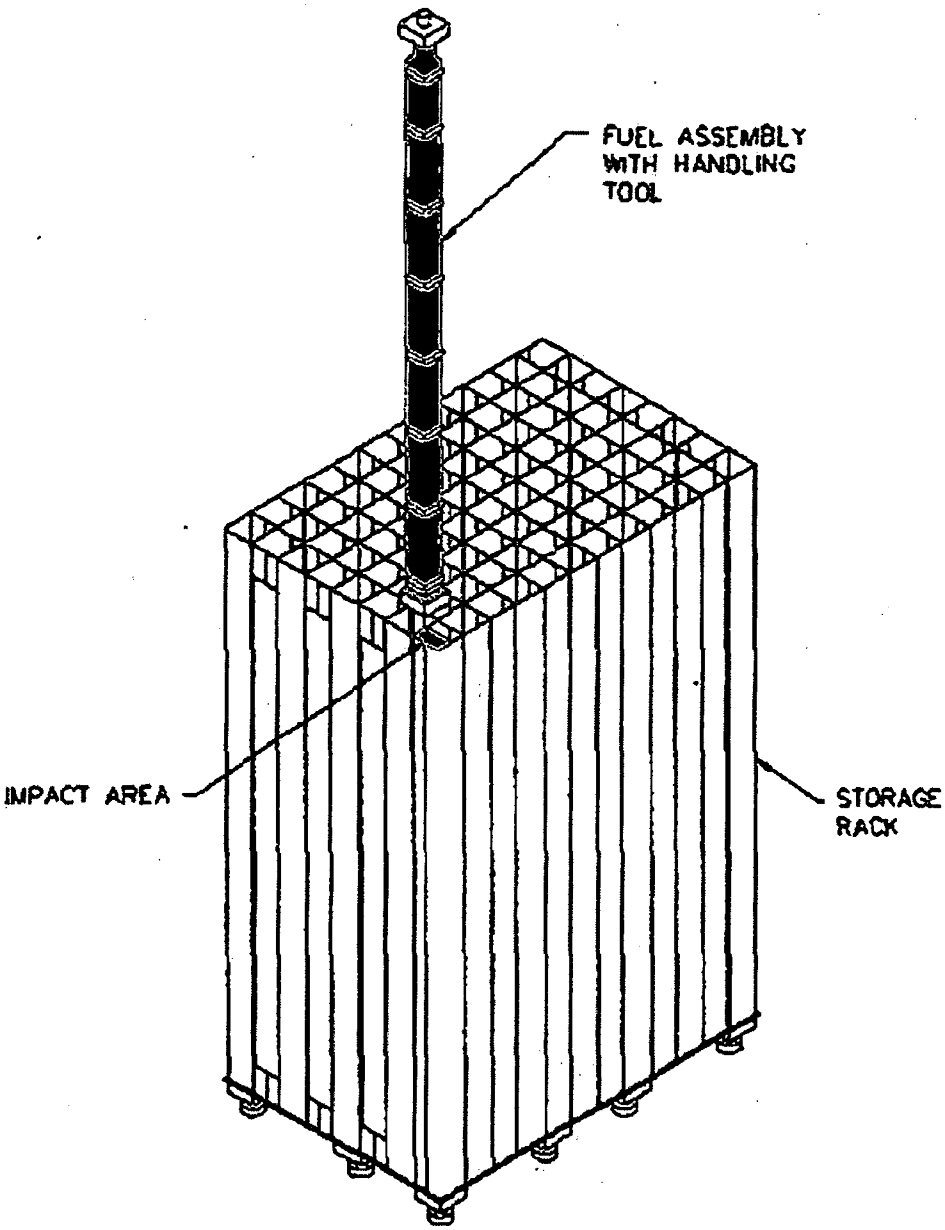

Figure 8-1: Fuel Assembly Drop on Top of Rack

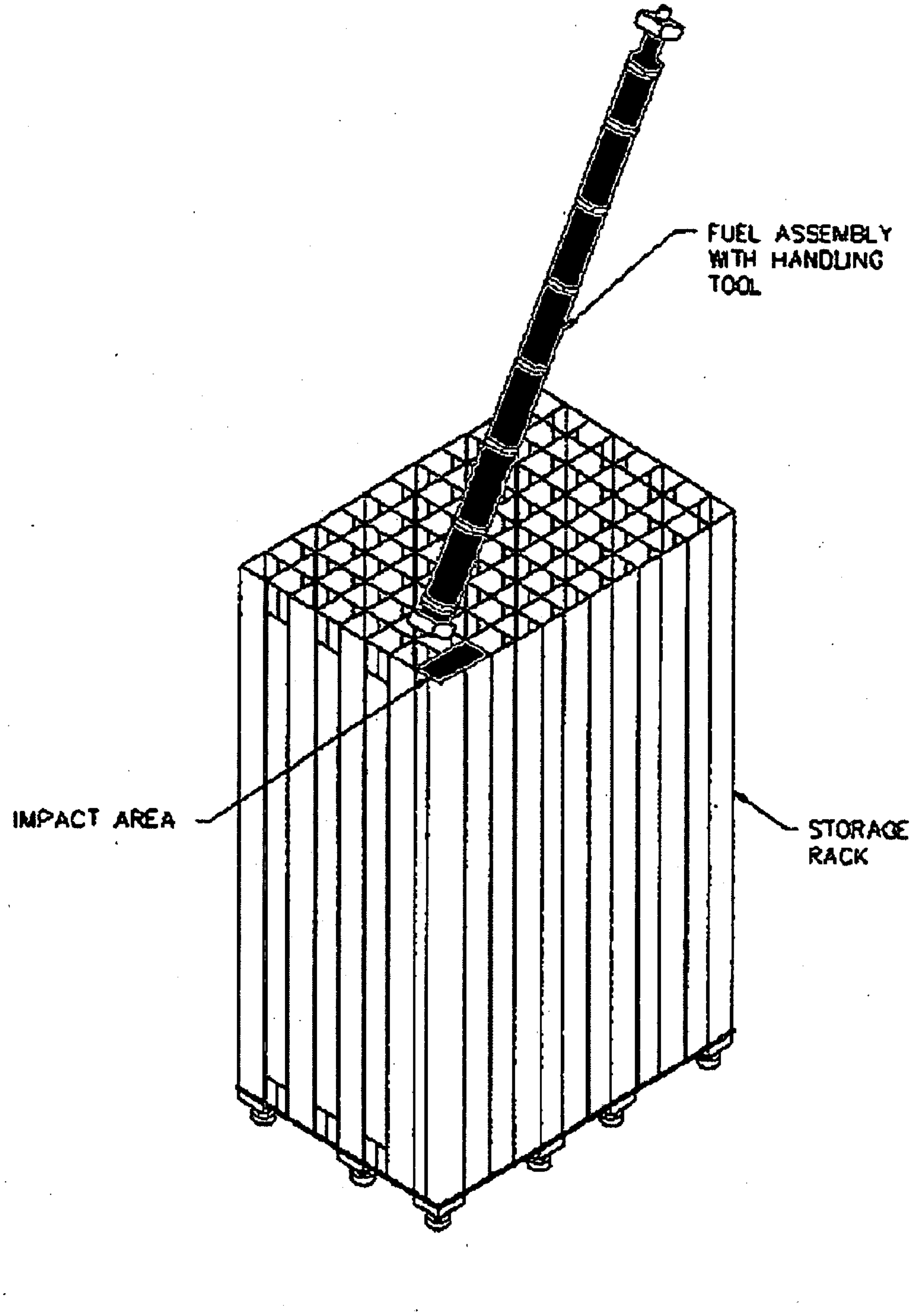

Figure 8-2: Fuel Assembly Drop on Top of Rack, Inclined Orientation

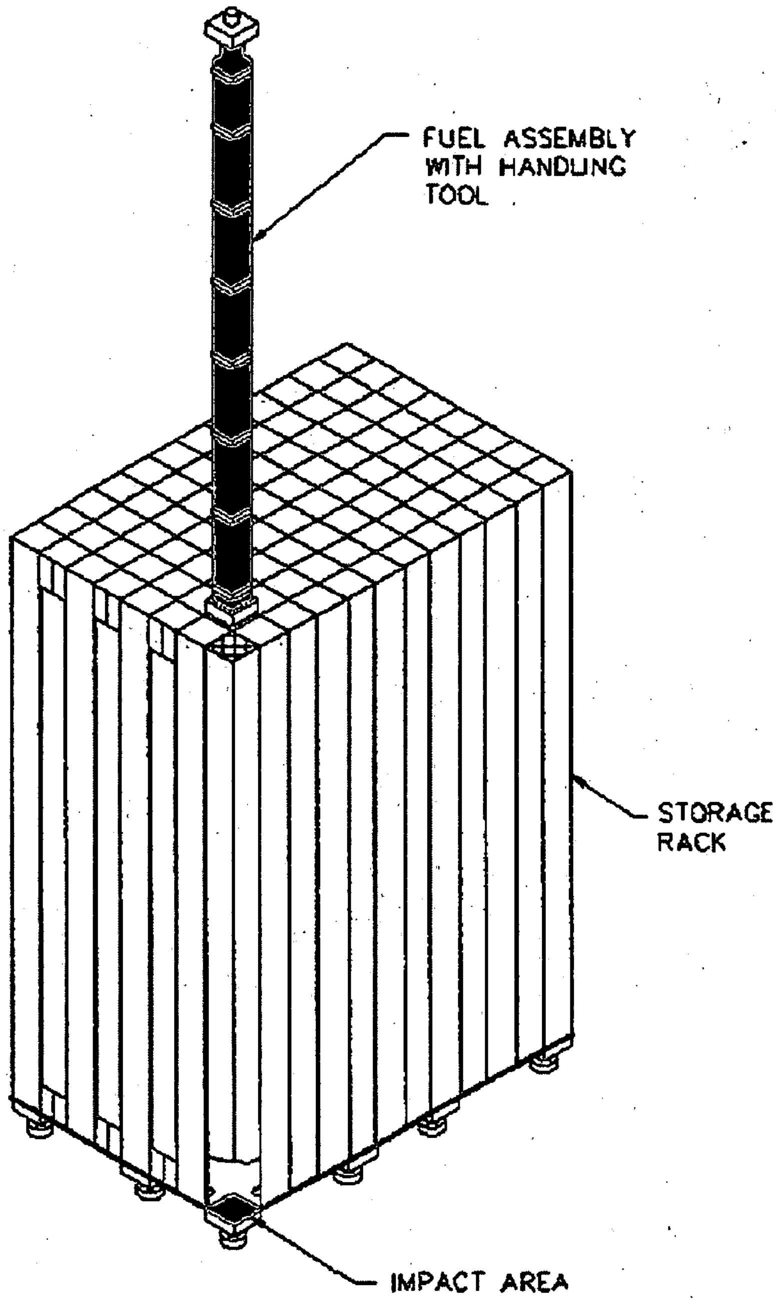

Figure 8-3: Fuel Assembly Drop Through to Bottom of Rack

8.3.2 Drop Locations

The fuel assembly was dropped at seven different locations to find the location with maximum effect. The locations are depicted in Figure 8-4.

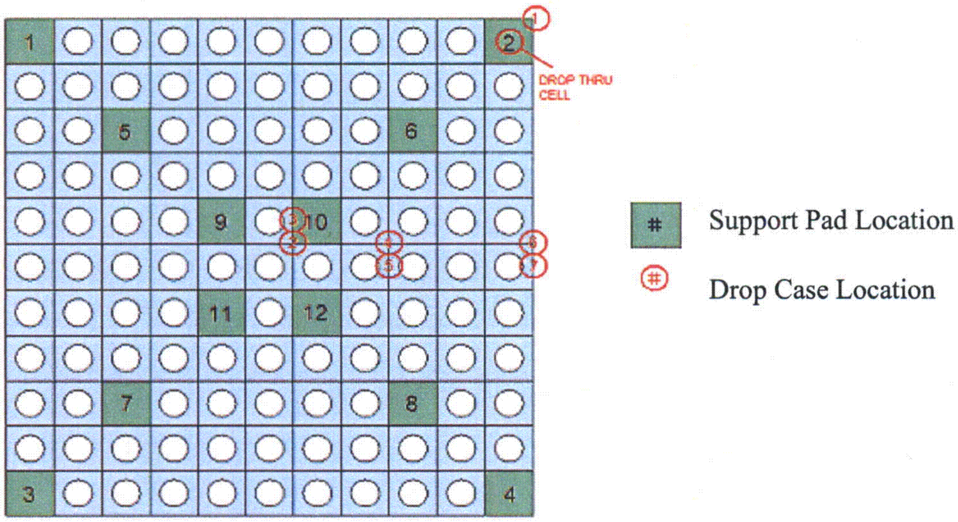

Figure 8-4: Support Pad and Fuel Assembly Drop Locations

8.3.3 Dropped Fuel Assembly Analysis Results

It must be shown that the fuel racks will retain functional capability after being loaded by a dropped fuel assembly. Explicit dynamic drop analyses of fuel assemblies impacting the fuel rack was performed using the dynamic simulation code LS-DYNA® in the STP fuel drop evaluation [4] to ensure that the integrity of the rack is maintained and to determine the forces transferred to the vault floor. A fuel assembly dropped in the vertical position was judged to be the most limiting condition.

For the various fuel assembly drops onto the top of the fuel rack cell, the maximum plastic deformation is a depth of 6.05 inches. The distance from the top of the fuel rack cell to the top of the neutron absorber is [ ]$^{a.c}$, so the active fuel region of the cell remains undamaged.

For a fuel assembly that drops through a cell and hits the baseplate, the maximum force imparted to the spent fuel pool floor from the rack support feet is 95,490 pounds.

8.4 STUCK FUEL ASSEMBLY EVALUATION

The COLA Part 2, Tier 2, Section 9.1, Revision 4 [1] states that for spent fuel racks, the loads experienced under a stuck fuel assembly condition are typically less than those calculated for the seismic conditions and a separate load combination is not required.

9 RESULTS AND CONCLUSIONS

From the spent fuel rack analysis performed on the loading combinations listed in Table 4-1, the following conclusions are made regarding the design and layout of the STP 3&4 spent fuel storage racks.

- The stresses in the spent fuel rack meet ASME NF stress requirements.
- The racks are able to withstand the dropped fuel assembly impact without losing functional capability or damaging the neutron absorbing material.

It is, therefore, considered demonstrated that the design of the STP 3&4 spent fuel storage racks meet the requirements for structural integrity for the postulated Level A and Level D conditions defined. Table 9-1 summarizes the significant results.

Table 9-1: Summary of Spent Fuel Rack Stresses

Component	Load Case	Stress Type	Interaction Ratio
Cell Wall	$D + L + T_o$	Membrane	0.47
		Membrane + Bending	0.31
	$D + L + T_a + E'$	Membrane	0.99
		Membrane + Bending	1.80(1)
Leveling Screw	$D + L + T_o$	Combined Axial & Bending Interaction Ratio	0.02
	$D + L + T_a + E'$	Combined Axial & Bending Interaction Ratio	0.93
Baseplate	$D + L + T_a + E'$	Membrane	0.20
		Membrane + Bending	0.50
Support Pad	$D + L + T_a + E'$	Membrane	0.55
	$D + L + T_a + E'$	Membrane + Bending	1.04(2)
Cell-to-Cell Weld Stress	$D + L + T_o$	Shear	0.48
	$D + L + T_a + E'$	Shear	0.70
Cell-to-Baseplate Weld Stress	$D + L + T_o$	Shear	0.19
	$D + L + T_a + E'$	Shear	0.43
Cell-to-Coverplate Weld Stress	$D + L + T_o$	Shear	0.48
	$D + L + T_a + E'$	Shear	0.41

Notes:

1. The cell wall membrane plus bending stress exceeds the allowable limit only locally where the fuel assembly impacts the cell wall. The high stress is expected to cause local distortion, but structural integrity of cell will cause local distortion.
2. The support pad membrane plus bending stress exceeds the allowable limit only in a very local region. The high stress concentration does not represent an average stress across the plate and is acceptable.

10 REFERENCES

1. Combined Operating and Licensing Application Part 2, Tier 2, Section 9.1 "Fuel Storage and Handling," Revision 4.

2. Design Control Document, Part 2, Tier 2, Appendix 3A, "Seismic Soil Structure Interaction Analysis," U.S. ABWR Design Control Document, GE Nuclear Energy, Revision 4, March 1997.

3. [ ]a.c (Proprietary)

4. [ ]a.c (Proprietary)

5. U.S. Nuclear Regulatory Commission, Standard Review Plan, NUREG-0800, Section 3.8.4, Rev. 2, "Other Seismic Category I Structures," March 2007,

6. [ ]a.c (Proprietary)

7. [ ]a.c (Proprietary)

8. ASME Boiler and Pressure Vessel Code, 1989 Edition.

9. Fritz, R. J., "The Effect of Liquids on the Dynamic Motions of Immersed Solids," ASME Journal of Engineering for Industry, February1972.

10. Rabinowicz, E., "Friction Coefficients of Water Lubricated Stainless Steels for a Spent Fuel Rack Facility," MIT, a Report for Boston Edison Company, 1976.

11. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.61, Rev. 1, "Damping Values for Seismic Design of Nuclear Power Plants," March 2007.

12. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.124, Rev. 2, "Service Limits and Loading Combinations for Class 1 Linear-Type Component Supports," February 2007.

13. Westinghouse Letter, LTR-SST-09-35, Rev. 0, "ANSYS 11.0 for XP64 Release Letter," July 6, 2009.

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CAW-10-3048

December 6, 2010

APPLICATION FOR WITHHOLDING PROPRIETARY INFORMATION FROM PUBLIC DISCLOSURE

Subject: WCAP-17311-P, Revision 1, "Structural Analysis Report for STP Units 3 & 4 New Fuel Storage Rack Baseline Design"

The proprietary information for which withholding is being requested in the above-referenced report is further identified in Affidavit CAW-10-3048 signed by the owner of the proprietary information, Westinghouse Electric Company LLC. The affidavit, which accompanies this letter, sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of 10 CFR Section 2.390 of the Commission's regulations.

Accordingly, this letter authorizes the utilization of the accompanying affidavit by South Texas Project Nuclear Operating Company.

Correspondence with respect to the proprietary aspects of the application for withholding or the accompanying affidavit should reference CAW-10-3048 and should be addressed to J. A. Gresham, Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company LLC, Suite 428, 1000 Westinghouse Drive, Cranberry Township, Pennsylvania 16066.

Very truly yours,

B. F. Maurer, Manager
ABWR Licensing

Enclosures

cc: T. Tai (NRC TWFN 6 D38M)

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF BUTLER:

Before me, the undersigned authority, personally appeared B. F. Maurer, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC (Westinghouse), and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

BF Maurer

B. F. Maurer, Manager
ABWR Licensing

Sworn to and subscribed before me
this 6th day of December 2010

Cynthia Olesky
Notary Public

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Cynthia Olesky, Notary Public
Manor Boro, Westmoreland County
My Commission Expires July 16, 2014
Member, Pennsylvania Association of Notaries

(1) I am Manager, ABWR Licensing, in Nuclear Services, Westinghouse Electric Company LLC (Westinghouse), and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rule making proceedings, and am authorized to apply for its withholding on behalf of Westinghouse.

(2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.390 of the Commission's regulations and in conjunction with the Westinghouse Application for Withholding Proprietary Information from Public Disclosure accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by Westinghouse in designating information as a trade secret, privileged or as confidential commercial or financial information.

(4) Pursuant to the provisions of paragraph (b)(4) of Section 2.390 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Westinghouse system which include the following:

(a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

(b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.390, it is to be received in confidence by the Commission.

(iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

(v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in WCAP-17311-P, Revision 1, "Structural Analysis Report for STP Units 3 & 4 New Fuel Storage Rack Baseline Design," (Proprietary) dated December 2010 for submittal to the Commission, being transmitted by South Texas Project Nuclear Operating Company (STPNOC) letter and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted by Westinghouse is that associated with the NRC review of South Texas Project Units 3&4 COL Application.

This information is part of that which will enable Westinghouse to:

(a) Assist the customer in obtaining NRC review of the South Texas Project Units 3 and 4 COL Application.

Further this information has substantial commercial value as follows:

(a) Westinghouse plans to sell the use of this information to its customers for purposes of plant specific new fuel storage rack structural analysis for ABWR plant designs for licensing basis applications.

(b) Its use by a competitor would improve their competitive position in the design and licensing of a similar product for ABWR new fuel storage rack structural analyses.

(c) The information requested to be withheld reveals the distinguishing aspects of a methodology which was developed by Westinghouse.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar technical evaluations and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended.

Further the deponent sayeth not.

Proprietary Information Notice

Transmitted herewith are proprietary and/or non-proprietary versions of documents furnished to the NRC in connection with requests for generic and/or plant-specific review and approval.

In order to conform to the requirements of 10 CFR 2.390 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal pursuant to 10 CFR 2.390(b)(1).

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CAW-10-3049

December 6, 2010

APPLICATION FOR WITHHOLDING PROPRIETARY INFORMATION FROM PUBLIC DISCLOSURE

Subject: WCAP-17331-P, Revision 1, "Structural Analysis Report for STP Units 3 & 4 Spent Fuel Storage Rack Baseline Design"

The proprietary information for which withholding is being requested in the above-referenced report is further identified in Affidavit CAW-10-3049 signed by the owner of the proprietary information, Westinghouse Electric Company LLC. The affidavit, which accompanies this letter, sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of 10 CFR Section 2.390 of the Commission's regulations.

Accordingly, this letter authorizes the utilization of the accompanying affidavit by South Texas Project Nuclear Operating Company.

Correspondence with respect to the proprietary aspects of the application for withholding or the accompanying affidavit should reference CAW-10-3049 and should be addressed to J. A. Gresham, Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company LLC, Suite 428, 1000 Westinghouse Drive, Cranberry Township, Pennsylvania 16066.

Very truly yours,

BFMaurer

B. F. Maurer, Manager
ABWR Licensing

Enclosures

cc: T. Tai (NRC TWFN 6 D38M)

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF BUTLER:

Before me, the undersigned authority, personally appeared B. F. Maurer, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC (Westinghouse), and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

B F Maurer

B. F. Maurer, Manager
ABWR Licensing

Sworn to and subscribed before me
this 6th day of December 2010

Cynthia Olesky
Notary Public

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Cynthia Olesky, Notary Public
Manor Boro, Westmoreland County
My Commission Expires July 16, 2014
Member, Pennsylvania Association of Notaries

(1) I am Manager, ABWR Licensing, in Nuclear Services, Westinghouse Electric Company LLC (Westinghouse), and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rule making proceedings, and am authorized to apply for its withholding on behalf of Westinghouse.

(2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.390 of the Commission's regulations and in conjunction with the Westinghouse Application for Withholding Proprietary Information from Public Disclosure accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by Westinghouse in designating information as a trade secret, privileged or as confidential commercial or financial information.

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Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

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(f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Westinghouse system which include the following:

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(b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

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(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.390, it is to be received in confidence by the Commission.

(iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

(v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in WCAP-17331-P, Revision 1, "Structural Analysis Report for STP Units 3 & 4 Spent Fuel Storage Rack Baseline Design," (Proprietary) dated December 2010 for submittal to the Commission, being transmitted by South Texas Project Nuclear Operating Company (STPNOC) letter and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted by Westinghouse is that associated with the NRC review of South Texas Project Units 3&4 COL Application.

This information is part of that which will enable Westinghouse to:

(a) Assist the customer in obtaining NRC review of the South Texas Project Units 3 and 4 COL Application.

Further this information has substantial commercial value as follows:

(a) Westinghouse plans to sell the use of this information to its customers for purposes of plant specific spent fuel storage rack structural analysis for ABWR plant designs for licensing basis applications.

(b) Its use by a competitor would improve their competitive position in the design and licensing of a similar product for ABWR spent fuel storage rack structural analyses.

(c) The information requested to be withheld reveals the distinguishing aspects of a methodology which was developed by Westinghouse.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar technical evaluations and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended.

Further the deponent sayeth not.

Proprietary Information Notice

Transmitted herewith are proprietary and/or non-proprietary versions of documents furnished to the NRC in connection with requests for generic and/or plant-specific review and approval.

In order to conform to the requirements of 10 CFR 2.390 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal pursuant to 10 CFR 2.390(b)(1).

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