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U.S. Nuclear Regulatory Commission
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Your ref: Project Number 740
Our ref: DCP/NRC2015

October 4, 2007

Subject: AP1000 COL Response to Requests for Additional Information (TR 121)

In support of Combined License application pre-application activities, Westinghouse is submitting responses to the NRC requests for additional information (RAIs) on AP1000 Standard Combined License Technical Report 85, APP-GW-GLN-121, Spent Fuel Pool Level and Dose. These RAI responses are submitted as part of the NuStart Bellefonte COL Project (NRC Project Number 740). The information included in the responses is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification.

Responses are provided for RAI-TR121-CHPB-01 through -04, as transmitted in an email from Dave Jaffe to Sam Adams dated September 14, 2007. These responses complete all requests received to date for Technical Report 121.

Pursuant to 10 CFR 50.30(b), the responses to the requests for additional information on Technical Report 121, are submitted as Enclosure 1 under the attached Oath of Affirmation.

Questions or requests for additional information related to the content and preparation of these responses 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,

Andrea Sterdis

A. Sterdis, Manager
Licensing and Customer Interface
Regulatory Affairs and Standardization

D063
D079
NRO

/Attachment

1. "Oath of Affirmation," dated October 4, 2007

/Enclosure

1. Responses to Requests for Additional Information on Technical Report No. 121

cc:	D. Jaffe	-	U.S. NRC	1E	1A
	E. McKenna	-	U.S. NRC	1E	1A
	G. Curtis	-	TVA	1E	1A
	P. Hastings	-	Duke Power	1E	1A
	C. Ionescu	-	Progress Energy	1E	1A
	A. Monroe	-	SCANA	1E	1A
	M. Moran	-	Florida Power & Light	1E	1A
	C. Pierce	-	Southern Company	1E	1A
	E. Schmiech	-	Westinghouse	1E	1A
	G. Zinke	-	NuStart/Entergy	1E	1A
	A. Pfister	-	Westinghouse	1E	1A

ATTACHMENT 1

"Oath of Affirmation"

ATTACHMENT 1

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

In the Matter of:)

NuStart Bellefonte COL Project)

NRC Project Number 740)

APPLICATION FOR REVIEW OF
"AP1000 GENERAL COMBINED LICENSE INFORMATION"
FOR COL APPLICATION PRE-APPLICATION REVIEW

B. W. Bevilacqua, being duly sworn, states that he is Vice President, New Plants Engineering, for Westinghouse Electric Company; that he is authorized on the part of said company to sign and file with the Nuclear Regulatory Commission this document; that all statements made and matters set forth therein are true and correct to the best of his knowledge, information and belief.

Bruce W. Bevilacqua.

B. W. Bevilacqua
Vice President
New Plants Engineering

Subscribed and sworn to
before me this 4th day
of October 2007.

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Patricia S. Aston, Notary Public
Murrysville Boro, Westmoreland County
My Commission Expires July 11, 2011
Member, Pennsylvania Association of Notaries

Patricia S. Aston
Notary Public

ENCLOSURE 1

Responses to Requests for Additional Information on Technical Report No. 121

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR121-CHPB-01
Revision: 0

Question:

Attachment 5, Figure 3 shows the gamma ray dose rates at various heights over the SFP water surface from a spent fuel assembly which is covered by 114.77 inches of water over the top of active fuel. For this proposed DCD change, the distance between the top of the active fuel and a person standing on the Bridge Deck will be decreased by 18 inches (6 inches less water shielding (by changing the water over active fuel from 10 feet to 9 ½ feet) and 12 inches less air shielding (by raising the level of the SFP water by 12 inches)).

a. It is not clear from the dose rate curves shown in attachment 5, figure 3 whether these dose rates include not only the dose contribution from the fuel assembly, but also the dose contribution from the radionuclides (corrosion and fission products) contained in the SFP water itself. Verify that these dose curves include dose contributions from both sources. If they do not, provide similar dose curves which include the dose contribution from both sources.

b. State what effects, if any, these proposed changes will have on the radiation zone designations of the areas surrounding the SFP.

Westinghouse Response:

The top of the active fuel remained unchanged. The SFP water level was increased by 12 inches. There was an inconsistency in Revision 15 of the DCD. There was not 10 feet of water above the top of the active fuel. There was only 8.5 feet of water above the top of the active fuel at the previous SFP level. Therefore, the DCD change does not decrease the shielding of personnel on the Bridge Deck. The shielding is increased by adding 12 inches of water shielding.

The dose rate curves included in Technical Report 121 are based on the radiation sources associated with a fuel assembly and do not include that from the radionuclides distributed in the spent fuel pit water. The curves that are included in the report are intended to present the capability of the water cover shielding in meeting the design constraint of a maximum of 2.5 millirem/hr in occupied areas. As noted in DCD Section 9.1.3.1.4, a similar design constraint (i.e. less than 2.5 millirem/hr) is imposed on the spent fuel pool purification system design. Note that the combined doses are well below the limit of 20 millirem/hour at the surface of the water during spent fuel transfer specified in the DCD (Section 9.1.4.3.7).

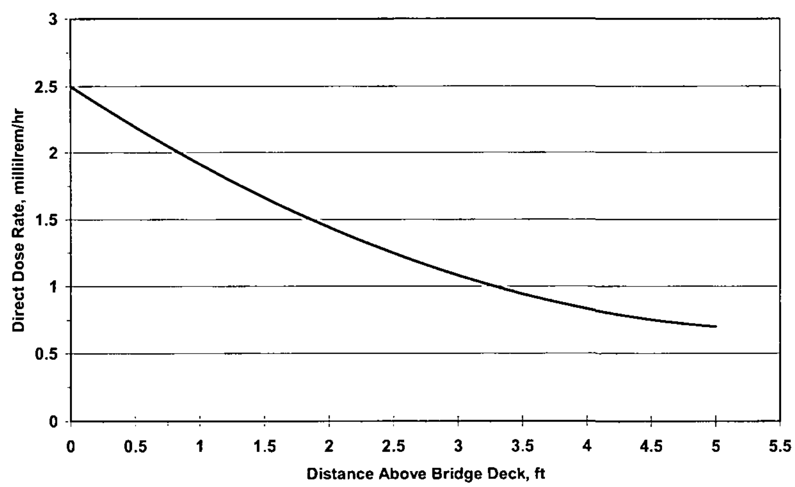
It should also be noted that the **expected** dose rates in the occupied areas (e.g. trolley, bridge deck, edge of operating deck) from both sources are less than 2.5 millirem/hr. This expectation is based on,

I. the conservative assumptions used in the calculation of dose rate above a fuel assembly; i.e. the assembly source strengths considered in the analysis envelope all of the assemblies in the core and are approximately twice that associated with normal discharge fuel assemblies, and

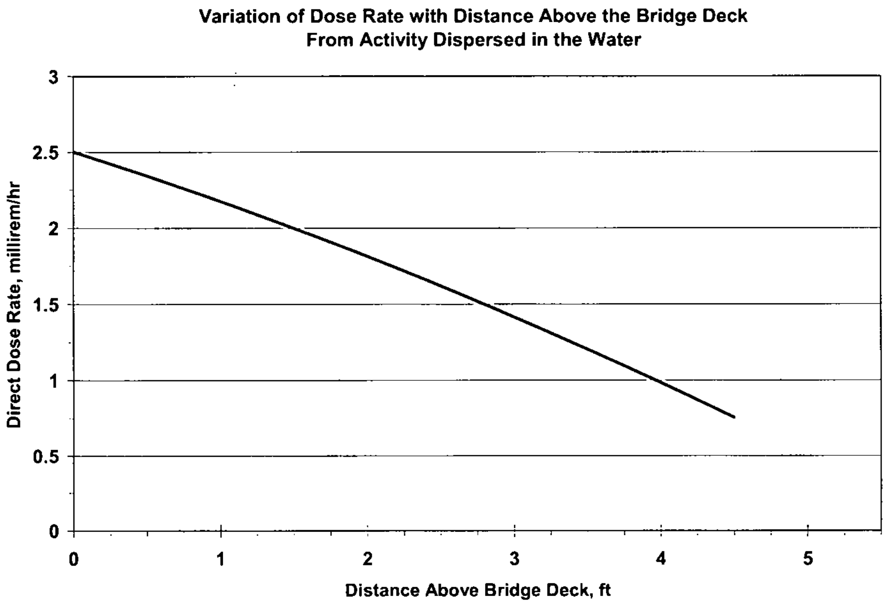
II. the value of 2.5 milllirem/hr is based on a concentration in the refueling cavity and spent fuel pit of 0.005 microcuries/gram for the dominant gamma-emitting isotopes. This concentration is the basis for the "cleanup/purification" end point value recommended by Westinghouse and EPRI during refueling shutdowns. This activity level is not generally approached in the spent fuel pit water when appropriate crud solubilization procedures are followed during plant cooldown and depressurization.

Further, even if the worst-case scenario is assumed (i.e. using the SFHT to move an assembly with the highest source strength coupled with water that has a concentration of 0.005 microcuries/gram), the TEDE dose rate to the worker is determined to be less than 2.5 millirem/hr. As shown in the following figure, the dose rate above the bridge deck due to the fuel assembly decreases with distance.

Variation of Dose Rate with Distance Above the Bridge Deck From A Fuel Assembly



In addition, the dose rate from the spent fuel pit water decreases with distance as illustrated in the figure below:



Since the worker will receive dose in a non-uniform radiation field, RIM 2003-04[1] states that it encourages the use of " ... the effective dose equivalent in place of the DDE in all situations that do not involve direct monitoring of external exposures using personnel dosimeter" such as "assessing the effects of as low as reasonably achievable (ALARA) measures ..." and "all other situations in which the doses are calculated rather than measured by personnel dosimetry. Thus, NRC has concluded[2] that calculating TEDE using EDE and the weighting factors from ANS/HPS 13.41-1997 "... is technically sound and acceptable for the purposes of demonstrating compliance with the TEDE based requirements of 10CFR20". RIM 2004-01[3] further provides a NRC approved method for estimating EDE_{ex} based on a two dosimeter method where the dosimeters are worn on the front and back of the trunk of the body. Considering that the trunk of the body is at least a meter above the bridge deck, the projected TEDE dose rate can be determined from the above figures; i.e.

D_{fuel} = 1.0 millirem/hr
D_{water} = 1.4 millilrem/hr

for a total TEDE dose rate of 2.4 millirem/hr. Determining the dose rate using the compartment factors from ANS/HPS 13.41-1997[4] results in an even lower dose rate. The projected dose rate at the trolley deck, which is approximately 3 feet higher than the bridge deck, tends to be more uniform with distance above the deck, and is projected to be approximately 1 millirem/hr.

b.) The radiation zone designations do not change.

References:

1. NRC Regulatory Issue Summary 2003-04 – Use of the Effective Dose Equivalent in Place of the Deep Dose Equivalent in Dose Assessments, February 13, 2003.

2. Safety Evaluation by the Office of Nuclear Reactor Regulation Related to the Approval to Use Weighting Factors for External Radiation Exposures for the Exelon/Amergen Fleet of Nuclear Power Plants, Docket Nos. STN 50-456 and STN 50-457; STN 50-454 and STIV 50-455; 50-461, 50-237,50-249, and 72-37; STN 50-373 and STIV 50-374; 50-352 and 353;50-219 and 72-15; 50-171, 50-277, 50-278, AIVD 72-1027; 50-254 and 265; and 50-289.

3. NRC Regulatory Issue Summary 2004-01 – Method For Estimating Effective Dose Equivalent From External Radiation Sources Using Two Dosimeters, February 17, 2004.

4. HPS N13.41-1997, An American National Standard – Criteria for Performing Multiple Dosimetry, Approved 1996.

Design Control Document (DCD) Revision:
None

PRA Revision:
None

Technical Report (TR) Revision:
None

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR121-CHPB-02
Revision: 0
Question:

Describe what effects raising the water level in the SFP by 12 inches will have on the fuel pool ventilation system used to direct air over the surface of the spent fuel pool to remove SFP evaporation products.

Westinghouse Response:

The water level increase does not change the spent fuel pool water surface area and does not impact the spent fuel pool water temperature. The air supply to the space is not blown directly across the spent fuel pool. The exhaust system terminals are located over 20 feet above the fuel pool surface. The average air velocity at the spent fuel pool water surface could increase very slightly with the pool level change. Any impact on the evaporation rate will be minimal. The HVAC heat/moisture removal calculations have been performed with a 15% margin to account for minor changes such as this spent fuel pool level change. Dose calculations show a margin in excess of 15% before this change, so there should be no personnel exposure problems.

Design Control Document (DCD) Revision:
None

PRA Revision:
None

Technical Report (TR) Revision:
None

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR121-CHPB-03
Revision: 0

Question:

What additional engineering features and/or access controls will be used to ensure that occupational doses remain ALARA during fuel handling?

Westinghouse Response:
Expected dose rates in the occupied areas from the fuel assemblies and radionuclides are less than 2.5 millirem/hr. RAI-TR121-CHPB-01 defines the expected dose rates. No additional engineering features of access controls are required.

References:
RAI-TR121-CHPB-01

Design Control Document (DCD) Revision:
None

PRA Revision:
None

Technical Report (TR) Revision:
None

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR121-CHPB-04
Revision: 0

Question:

In Section 9.1.3.1.4 (Spent Fuel Pool Purification) of the Tier 2 DCD (referenced on page 7 of your submittal), it states that "The spent fuel cooling system is designed to limit exposure rates *to personnel on the Spent Fuel Pool Fuel Handling Machine* to less than 2.5 millirem per hour." The original version of this section limited dose rates to 2.5 millirem per hour *at the surface of the spent fuel pool*. If the activity level in the spent fuel pool water remains unchanged as a result of this proposed modification, provide your reasoning for changing the expected dose rate at the surface of the spent fuel pool from 2.5 millirem per hour (when no fuel assemblies are being moved).

Westinghouse Response:

The revised wording in Tier 2 of the DCD reflects the wording in section 9.1.2 of NUREG-0800. Section 9.1.2 of NUREG-0800 states that water levels in the spent fuel pool should provide adequate radiological shielding for personnel. The calculated radiation dose rates based on the previous spent fuel pool water level of 133.25 feet exceeded 2.5 millirem per hour exposure to personnel on the spent fuel pool fuel handling machine. The previous revision of the DCD was incorrect in saying that the dose rates at the surface of the spent fuel pool were less than 2.5 millirem. Increasing the water level by 12 inches reduces exposure rates to personnel on the spent fuel pool fuel handling machine to 2.5 millirem or less per hour. These dose rates are based on the expected maximum dose rates when fuel is being moved since this is the limiting case. These are not the dose rates when no fuel assemblies are being moved. The dose rates are less when no fuel is being moved.

Design Control Document (DCD) Revision:
None

PRA Revision:
None

Technical Report (TR) Revision:
None