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U.S. Nuclear Regulatory Commission
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Your ref: Project Number 740
Our ref: DCP/NRC1772

September 8, 2006

Subject: AP1000 COL Response to Requests for Additional Information (TR #32)

In support of Combined License application pre-application activities, Westinghouse is submitting responses to NRC requests for additional information (RAIs) on AP1000 Standard Combined License Technical Report 32, APP-GW-GLN-002, Zinc Addition. 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.

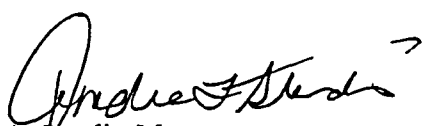
Responses are provided for requests 1 through 6 (TR32-1 through TR32-6) transmitted in an NRC letter from Steven D. Bloom to Andrea Sterdis, dated August 1, 2006, Subject: Westinghouse AP1000 Combined License (COL) Pre-application Technical Report 32 – Request for Additional Information (TAC No. MD1432).

Pursuant to 10 CFR 50.30(b), the responses to requests for additional information on Technical Report 32 numbered RAI-TR32-001, RAI-TR32-002, RAI-TR32-003, RAI-TR32-004, RAI-TR32-005, and RAI-TR32-006 are submitted as Enclosure 1 under the attached Oath of Affirmation.

It is expected that when the RAIs on Technical Report 32 are complete, the technical report will be revised as indicated in the responses and submitted to the NRC. The RAI responses will be included in the document.

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,



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

/Attachment

1. "Oath of Affirmation," dated September 8, 2006

/Enclosure

1. Responses to Requests for Additional Information on Technical Report No. 32
RAI-TR32-001, RAI-TR32-002, RAI-TR32-003, RAI-TR32-004, RAI-TR32-005, and RAI-TR32-006

cc:	S. Bloom	-	U.S. NRC	1E	1A
	S. Coffin	-	U.S. NRC	1E	1A
	G. Curtis	-	TVA	1E	1A
	P. Grendys	-	Westinghouse	1E	1A
	P. Hastings	-	Duke Power	1E	1A
	C. Ionescu	-	Progress Energy	1E	1A
	D. Lindgren	-	Westinghouse	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

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

W. E. Cummins, being duly sworn, states that he is Vice President, Regulatory Affairs & Standardization, 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.

W. E. Cummins
Vice President
Regulatory Affairs & Standardization

Subscribed and sworn to
before me this day
of September 2006.

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Debra McCarthy, Notary Public
Monroeville Boro, Allegheny County
My Commission Expires Aug. 31, 2009
Member, Pennsylvania Association of Notaries

Notary Public

ENCLOSURE 1

Responses to Requests for Additional Information on Technical Report No. 32

RAI-TR32-001, RAI-TR32-002, RAI-TR32-003, RAI-TR32-004, RAI-TR32-005, and RAI-TR32-006

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information

RAI Number: RAI-TR32-001

Question:

The document states that zinc addition to the reactor control system (RCS) water inhibits general corrosion and primary water stress corrosion cracking (PWSCC) in primary system materials and components. The document also states that zinc exists as a divalent cation in the corrosion film that protects the metal from corrosion. The staff requests that Westinghouse provide information as to how the presence of zinc in the oxide layer mitigates corrosion and PWSCC.

Westinghouse Response:

The benefits of zinc injection occur as a result of incorporation of zinc into oxide corrosion films. Once incorporated into the crystal lattice of the oxide, zinc inhibits normal dissolutive corrosion processes and the resultant release, activation, and re-deposition of the activated corrosion products of nickel and cobalt.

For AP1000, the principal purposes of providing zinc addition as an optional operating mode are to reduce plant radiation levels and to reduce the potential for crud induced power shift (CIPS).

Mitigation of PWSCC is not the principal factor in the adoption of zinc for AP1000. As discussed in appropriate sections of the Design Control Document (DCD), material selection and design of the primary system components provides substantial margin to avoid PWSCC without taking credit for zinc addition; specifically, Alloy 690 is used in preference to Alloy 600. It is anticipated that zinc addition will further decrease the likelihood of PWSCC, and this is being evaluated on an industry-wide basis, but not specifically claimed for AP1000.

Therefore, Technical Report 32 will be revised to eliminate the mention of PWSCC, as shown below.

Technical Report 32 Revision:

2.0 Evaluation

RCS exclusive of nuclear fuel:

The addition of zinc to the reactor coolant system of a pressurized water reactor (PWR) is performed as a means to mitigate the effects of general corrosion of primary system materials and components. Zinc addition has been demonstrated to be effective in reducing radiation fields in a number of United States and European plants.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information

Design Control Document (DCD) Revision:

None additional to TR32 previously provided (APP-GW-GLN-002 Rev. 0.)

PRA Revision:

None

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information

RAI Number: RAI-TR32-002

Question:

Provide information regarding the interaction of zinc ions and neutron radiation. Specifically, what is the effect of neutron radiation on the stability of zinc ions and with respect to the reduction in zinc ion concentration due to exposure to neutron radiation? Identify the reactor vessel internal (RVI) component locations where there can be a reduction in zinc ion concentrations due to exposure to neutron radiation and describe any relevant consequences of such a reduction.

Westinghouse Response:

The makeup flowrate of zinc acetate solution is adjustable over a relatively wide range, and the precise makeup flow used can be adjusted based upon the results of RCS samples. Continuous makeup is required because of the removal of zinc in the CVS ion exchangers, but the makeup will compensate for any removal factors.

For AP1000, the principal purposes of providing zinc addition as an optional operating mode are to reduce plant radiation levels and to avoid operating in the range where crud induced power shift (CIPS) would be predicted. Localized reduction in zinc ion concentration postulated due to the effects of neutron radiation would not compromise the efficacy of zinc addition in achieving these overall purposes.

Specifically, material selections for the AP1000 reactor vessel internals are discussed in Section 4.5 of the AP1000 Design Control Document, and provide adequate margin to PWSCC. As noted in the response to RAI-TR32-001 mitigation of PWSCC is not the principal purpose of zinc addition for AP1000. Therefore, there will be no relevant consequences of any localized reduction in zinc in the reactor vessel internals.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information

RAI Number: RAI-TR32-003

Question:

Provide information as to how the availability of zinc in various locations of the RVI components can be assessed and identify the variables that can be measured to assess the zinc availability at various locations in RVI components.

Westinghouse Response:

As noted in the response to RAI-TR32-003, the availability of zinc at the location of all RVI components is not critical to the success of zinc addition for AP1000.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information

RAI Number: RAI-TR32-004

Question:

Provide information (if available) regarding the effect of zinc on PWSCC crack growth rates in PWR RVI components.

Westinghouse Response:

As noted in the response to RAI-TR32-001 mitigation of PWSCC is not the purpose of zinc addition for AP1000, and Technical Report 32 will be revised to eliminate the mention of PWSCC.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information

RAI Number: RAI-TR32-005

Question:

Provide information related to the effect of inadvertent loss of zinc addition for certain durations on PWSCC of the PWR RVI components. Provide information related to the time frame for which loss of zinc addition capability will not affect PWSCC crack growth rates.

Westinghouse Response:

As noted in the response to RAI-TR32-001 mitigation of PWSCC is not the purpose of zinc addition for AP1000, and Technical Report 32 will be revised to eliminate the mention of PWSCC.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information

RAI Number: RAI-TR32-006

Question:

In Nuclear Fuel Section on page 3 of the submittal, Westinghouse states that zinc addition to the RCS water can result in the formation of a thin dark deposit on the surface of the fuel rods. The staff requests that Westinghouse provide information regarding the effect of thermal cycles on the stability (spalling) of these thin dark deposits on the surface of the fuel rods.

Westinghouse Response:

Thin, dark, uniformly distributed deposits have been observed on fuel assemblies during refueling outages in cycles with zinc injection. The higher than normal carbon content in crud removed from Diablo Canyon support the hypothesis that the dark deposits consist of radiolytically reduced carbon derived from the acetate ion from the zinc acetate added to the reactor coolant. These deposits appear on fuel assembly nozzles and grids in addition to the fuel cladding. The deposits are not firmly attached and can be easily removed by brushing. However, the general uniformity of this deposition pattern has not suggested that any appreciable spalling or release from the surfaces has occurred during the shutdown and cooldown going into the outage. Clad oxide measurement following zinc addition show no increase in clad corrosion resulting from zinc addition or the thin, dark deposits. There is also no plant data that suggests that the deposits negatively impact heat transfer.

Design Control Document (DCD) Revision:

None

PRA Revision:

None