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Your ref: Project Number 740
Our ref: DCP/NRC1882

May 11, 2007

Subject: AP1000 COL Standard Technical Report Submittal of APP-GW-GLN-113, Revision 0

In support of Combined License application pre-application activities, Westinghouse is submitting Revision 0 of AP1000 Standard Combined License Technical Report Number 113. This report identifies and justifies standard changes to DCD Section 3.8.2.6 in the AP1000 Design Control Document. Changes to the Design Control Document identified in Technical Report Number 113 are intended to be incorporated into FSARs referencing the AP1000 design certification or incorporated into the design certification using supplemental rulemaking when Part 52 is revised to permit revision of the design certification. This report is submitted as part of the NuStart Bellefonte COL Project (NRC Project Number 740). The information included in this report is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification.

The purpose for submittal of this report was explained in a March 8, 2006 letter from NuStart to the NRC.

Pursuant to 10 CFR 50.30(b), APP-GW-GLN-113, Revision 0, "AP1000 Containment Vessel Shell: Material Specification," Technical Report Number 113, is submitted as Enclosure 1 under the attached Oath of Affirmation.

It is expected that when the NRC review of Technical Report Number 113 is complete, the changes to the AP1000 DCD identified in Technical Report 113 will be considered approved generically for COL applicants referencing the AP1000 Design Certification.

Questions or requests for additional information related to content and preparation of this report 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.

Westinghouse requests the NRC to provide a schedule for review of the technical report within two weeks of its submittal.

DO79

Very truly yours,

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

/Attachment

1. "Oath of Affirmation," dated May 11, 2007

/Enclosure

1. APP-GW-GLN-113, Revision 0, "AP1000 Containment Vessel Shell: Material Specification," Technical Report Number 113

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
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	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 11th day
of May 2007.

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

Debra McCarthy
Notary

ENCLOSURE 1

APP-GW-GLN-113, Revision 0

"AP1000 Containment Vessel Shell: Material Specification"

Technical Report 113

AP1000 DOCUMENT COVER SHEET

TDC: Permanent File: APY

RFS#: RFS ITEM #:

AP1000 DOCUMENT NO.	REVISION NO.		ASSIGNED TO
APP-GW-GLN-113	0	Page 1 of 8	W - A. Sterdis

ALTERNATE DOCUMENT NUMBER: TR 113 WORK BREAKDOWN #:

ORIGINATING ORGANIZATION: Westinghouse Electric Company

TITLE: **AP1000 Containment Vessel Shell: Material Specification**

ATTACHMENTS:	DCP #/REV. INCORPORATED IN THIS DOCUMENT REVISION: APP-GW-GEE-091, Rev 1
CALCULATION/ANALYSIS REFERENCE:	

ELECTRONIC FILENAME	ELECTRONIC FILE FORMAT	ELECTRONIC FILE DESCRIPTION
APP-GW-GLN-113 Rev 0 .doc	Microsoft Word	

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Class 3 Documents being transmitted to the NRC require the following two review signatures in lieu of a Form 36.

LEGAL REVIEW J.C. VALENTINE	SIGNATURE/DATE J.C. Valentine	5/2/2007
PATENT REVIEW Mike Corletti	SIGNATURE/DATE M. Corletti	4/30/07

☐ WESTINGHOUSE PROPRIETARY CLASS 2

ORIGINATOR N. Prasad	SIGNATURE/DATE N. Prasad 4/30/07	
REVIEWERS	SIGNATURE/DATE	
VERIFIER C. Hoffmann	SIGNATURE/DATE C. Hoffmann 5/1/07	VERIFICATION METHOD
AP1000 RESPONSIBLE MANAGER L. Tunon-Sanjur	SIGNATURE* L. Tunon-Sanjur	APPROVAL DATE 5/1/07

* Approval of the responsible manager signifies that document is complete, all required reviews are complete, electronic file is attached and document is released for use.

APP-GW-GLN-113
Revision 0

April 2007

AP1000 Standard Combined License Technical Report

AP1000 Containment Vessel Shell: Material Specification
Revision 0

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TABLE OF CONTENTS

1.0 INTRODUCTION

- The AP1000 Design Certification Document (DCD) has specified the basic Containment Vessel (CV) material as SA738, Grade B, plate. According to DCD subsection 3.8.2.6, the procurement specification for this plate material is required to include supplemental requirements S17 "Vacuum Carbon-Deoxidized Steel" and S20 "Maximum Carbon Equivalent for Weldability".

- Westinghouse Supply Management department has been investigating the availability of SA738 Grade B plate (with S17 supplementary requirement) in the United States; as well as in all the large steel producing countries in the world. It has been determined that the steel producing mills do not use S17 process ("Vacuum Carbon-Deoxidized Steel"); but use supplementary requirement S1 to get similar high quality steel. The steel mills would not be able to meet our demand due to lengthy production schedule associated with S17. The production cost would also be very high.

The purpose of this technical report is to establish a technical justification for replacing Supplementary Requirement S17 by Supplementary Requirement S1, in the DCD.

2.0 BACKGROUND

- SA-738 Grade B plate material was approved for use in construction of metal containment vessels in Code Case N-655 for Section III, Division 1 in February 2002. This plate material was also incorporated into Table 1A of Section II, Part D in the 2002 Addenda to the 2001 Edition of the ASME B&PV Code.

- In the Code Case approval process, the Nuclear Regulatory Commission updated Regulatory Guide 1.84 in Revision 33, for Design, Fabrication, and Materials Code Case Acceptability in August 2005. Code Case N-655 was included in Table 2 for "Conditionally Acceptable Section III Code Cases".

- Limitations indicated by the NRC are in addition to the conditions specified in the Code case. For Code Case N-655, "Use of SA-738, Grade B, for Metal Containment Vessels, Class MC, Section III, Division 1," the conditions imposed by Reg. Guide 1.84, Rev. 33 are as follows:

  For metal containment vessels up to 1.75 inch thick:

  (1) Supplementary Requirement S17, "Vacuum Carbon-Deoxidized Steel," of Material Specification SA-738 must be applied to the material, and

  (2) Supplementary Requirement S20, "Maximum Carbon Equivalent for Weldability," of Material Specification SA-738 must be applied to the material.

RAI 252.009-1 (Reference 2) imposed these same additional conditions on the AP1000 containment material, which is also SA-738 Grade B.

- The announcement of the draft Revision 33 to Reg. Guide 1.84, in the Federal Register, gave the following description of conditions on Code Case N-655.

  For New Code Case N-655:
  "The guide would require for metal containment vessels up to 1.75 inch thick that Supplementary Requirements S17 and S20 of Material Specification SA-738 be applied to the use of SA-738, Grade B. These two conditions are needed to ensure adequate material properties and weldability of the containment vessel material. The ASME Code, Section III, exempts SA-738, Grade B, material up to 1.75 inch of thickness from post-weld stress relief heat treatment. Because the welds in containment vessel material thickness up to 1.75 inch thick will not be stress-relieved, higher residual stresses will be present in the welds. Also, the material will likely be procured in the quenched and tempered condition. Welding will reduce the impact properties of the material in the heat affected zone. Requiring Supplementary Requirement S17 and the use of vacuum degassed steel will ensure adequate material properties because nonmetallic inclusions such as oxides and silicates will be minimized as a result of the vacuum degassing of the steel. Requiring Supplementary Requirement S20 and a carbon equivalent weldability check will ensure that the steel is readily weldable."

- Additional Supplementary Requirements, for use at the option of the purchaser, are identified in SA-20, "Specification for General Requirements for Steel Plates for Pressure Vessels."

  One of the other Supplementary Requirements in SA-20 is as follows:

  S1. Vacuum Treatment

  S1.1 The steel shall be made by a process which includes vacuum degassing while molten. Unless otherwise agreed upon with the purchaser, it is the responsibility of the manufacturer to select suitable process procedures.

3.0 TECHNICAL JUSTIFICATION FOR USING SUPPLEMENTARY REQUIREMENT S-1

- The requirement that the steel making practice include a vacuum degassing process was added to ensure that the hydrogen content of the final product would be minimized, thus minimizing the potential for hydrogen induced cold cracking in weld joints that do not receive a full PWHT. The condition imposed on SA-738 Grade B plate (by the NRC in Reg. Guide 1.84, Rev. 33) cited Supplementary Requirement S17 for VCD because it was listed as one of the supplementary requirements in SA-738 considered to be suitable for use on material made to this specification. It was also noted that it will be essential to have proper welding controls during construction to require the use of low-hydrogen electrodes and fluxes, proper pre-heat and adequate maintenance of pre-heat upon completion of welding to further reduce the potential for cold cracking.

- The use of the VCD process for vacuum degassing of SA-738 plate material was discussed with a metallurgist from a large domestic steel plate producer. He indicated that steel producers in the US typically do not use VCD for plate materials like SA-738. For this reason, he suggested that listing S17 for VCD in SA-738 as being suitable for this type of plate is somewhat of an anomaly and that the more general Supplementary Requirement S1. "Vacuum Treatment" listed in SA-20 is probably more appropriate. Supplementary Requirement S1 requires the steel to be made by a process which includes vacuum degassing while molten by a suitable practice selected by the steel manufacturer or purchaser.

  (Note: According to this expert metallurgist, the use of VCD typically applies to certain grades of Cr-Mo steels where carbon contents are lower and reduced silicon content is beneficial. The VCD process allows oxygen and carbon to react in the molten steel and evolve as carbon monoxide which is drawn off by the vacuum. While under vacuum other gases, such as hydrogen and nitrogen, also tend to be removed from the steel. Reducing the oxygen content by VCD reduces the need for the addition of other deoxidizing additions such as silicon or aluminum. Steels treated by VCD have a specified silicon content of 0.12% maximum that is lower than the normally specified range of silicon content. This process is beneficial in Cr-Mo steels that are susceptible to temper embrittlement during elevated temperature service. Silicon is one of the impurity elements that contributes to the loss of toughness. By reducing the silicon content of the steel the tendency for temper embrittlement is reduced.)

- Information provided by an international producer of SA-738 Grade B steel plate (Bao Steel of China) indicated that SA-738 Grade B plate material would be melted by means of melting in a conventional converter, followed by treatment in a Ladle Refining Furnace (LF), followed by vacuum treatment using a Ruhrstahl-Heraeus (RH) vacuum recirculation process. The steel would not be vacuum carbon-deoxidized (VCD), so the silicon content would be more than 0.12%; the typical content is 0.20-0.30%. The RH vacuum degassing process will provide material with acceptable characteristics in terms of weldability, NDE and mechanical properties compliance even at low temperatures.

- In addition to VCD and the RH process, there are other vacuum degassing processes commonly used by steel producers. The type of process used depends on the type of steel being produced and the equipment and capabilities of each steel producer. The question of using alternate vacuum degassing processes, other than VCD, for SA-738 Grade B plate was also discussed with a nuclear industry expert for the provisional requirements regarding Code

Case N-655 and the use of SA-738 Grade B steel plate. The information received indicated that **"the basis for imposing S17 on SA-738 plate was to ensure clean, high quality steel plate by requiring it to be vacuum degassed, primarily because of the PWHT exemption to 1-3/4". The method of vacuum degassing used is not as important as ensuring that the plate has a low hydrogen content to minimize the potential for cold cracking. Other standard methods in use by steel producers would accomplish the same objective. Use of other vacuum degassing methods instead of VCD would be considered acceptable".**

4.0 CONCLUSION

In summary, it seems appropriate that the condition on Code Case N-655 requiring vacuum degassing of SA-738 Grade B plate material by VCD should be revised to permit alternative vacuum degassing methods. Similarly, the AP1000 DCD condition imposed on the containment plate material should be revised to permit alternative vacuum degassing methods; and that it should be acceptable to the NRC.

It will be appropriate if the 'Supplementary Requirement' to be imposed on SA-738, Grade B, refers the Purchaser to Supplementary Requirement S1 "Vacuum Treatment" and not to S17 "Vacuum Carbon-Deoxided Steel".

5. REGULATORY IMPACT

The changes to the DCD presented in this report do not represent an adverse change to the design functions, including the pressure boundary integrity functions and the access function, or to how design functions are performed or controlled. The analysis and design of the Containment Vessel remains consistent with the description of the AP1000 analysis in 3.8.2 of the AP1000 DCD. The changes to the DCD do not involve revising or replacing a DCD-described evaluation methodology. The changes to the DCD do not involve a test or experiment not described in the DCD. The change will not result in a significant decrease in the level of safety otherwise provided by the design. The Tier 2 DCD changes identified in this report do not require a license amendment per the criteria of VIII. B. 5.b. of Appendix D to 10 CFR Part 52.

The DCD changes do not affect resolution of a severe accident issue and does not require a license amendment based on the criteria of VIII. B. 5.c of Appendix D to 10 CFR Part 52.

The DCD changes will not alter barriers or alarms that control access to protected areas of the plant. The DCD change will not alter requirements for security personnel. Therefore, the DCD change does not have an adverse impact on the security assessment of the AP1000.

6. REFERENCES

1. APP-GW-GL-700, AP1000 Design Control Document, Revision 15.

2. AP 1000 RAI 252.009-1.

7. DCD MARK UP

A markup of the DCD changes, in Table 5.2-3 and in subsection 3.8.2.6, resulting from the technical change described in this report are shown below.

7.1 Proposed Revisions to DCD

(1) Add Code Case N-655 to Table 5.2-3, as follows.

Table 5.2-3

ASME CODE CASES

Code Case Number	Title
N-655	Use of SA-738, Grade B, for Metal Containment Vessels, Class MC, Section 11, Division 1.

(2) Revise the first paragraph of DCD subsection 3.8.2.6 as follows: to delete "S17, Vacuum Carbon-Deoxidized Steel" and replace it by "S1, Vacuum Treatment".

3.8.2.6 Materials, Quality Control, and Special Construction Techniques

Materials for the containment vessel, including the equipment hatches, personnel locks, penetrations, attachments, and appurtenances meet the requirements of NE-2000 of the ASME Code. The basic containment material is SA738, Grade B, plate. The procurement specification for the SA738, grade B, plate includes supplemental requirements ~~S17, Vacuum Carbon-Deoxidized Steel~~ S1, Vacuum Treatment and S20, Maximum Carbon Equivalent for Weldability. This material has been selected to satisfy the lowest service metal temperature requirement of -15°F. This temperature is established by analysis for the portion of the vessel exposed to the environment when the minimum ambient air temperature is -40°F. Impact test requirements are as specified in NE-2000.