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Your ref: Project Number 740
Our ref: DCP/NRC2040

November 12, 2007

Subject: AP1000 COL Responses to Requests for Additional Information (TR 110)

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 110, APP-GW-GLN-110, "Changes to the DCD Chapter 3.11, Environmental Qualification, and Appendix 3D". 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-TR110-ICE1-01 through RAI-TR110-ICE1-06, as finalized in a phone call between Sam Adams and Dave Jaffe on October 17, 2007. These responses complete all requests received to date for Technical Report 110.

Pursuant to 10 CFR 50.30(b), the responses to the requests for additional information on Technical Report 110, 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,

for

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

00288psa.doc

D079
D063
NRO

/Attachment

1. "Oath of Affirmation," dated November 12, 2007

/Enclosure

1. Responses to Requests for Additional Information on Technical Report No. 110

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
	J. Wilkinson	-	Florida Power & Light	1E	1A
	C. Pierce	-	Southern Company	1E	1A
	E. Schmiech	-	Westinghouse	1E	1A
	G. Zinke	-	NuStart/Entergy	1E	1A
	R. Grumbir	-	NuStart	1E	1A
	R. Wessel	-	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

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 12th day
of November 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. 110

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR110-ICE1-01
Revision: 0

Question:

The staff has reviewed the DCD mark up of pages 23, 25, and 26 (Sections 3.11.1.1 and 3.11.5) and proposed the editorial change from "the combined license (COL) applicant" to "the COL holder." The staff finds that it is not clear whether this change is only applicable to Chapter 3.11. Since the words "COL applicant" were used throughout the other parts of the DCD, WEC needs to clarify the roles and responsibilities among the COL agent (i.e., WEC), holders, and applicants used in the DCD. The staff identifies this issue as open item 3.11-1.

Westinghouse Response:

The DCD was changed in Revision 16 from "the combined license (COL) applicant" to "the COL holder" for COL items that would be performed after the COL is issued. This change was applied in Revision 16 of the DCD for items that are considered post COL issuance activities. Environmental Qualification is considered an operational program that will be implemented after the COL is issued.

References:
1. APP-GW-GL-700, Revision 16, "AP1000 Design Control Document."

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-TR110-ICE1-02
Revision: 0

Question:

The staff has reviewed the proposed deletion of reference to IEEE 344-1987, "IEEE Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations" on pages 25-26 of sections 3.11.2.1 and 3.11.6 that deals with the seismic qualification. The proposed request cited that this section addresses only equipment environmental qualification (EQ). In view of IEEE 323, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations" references equipment qualification pertinent to both environmental and seismic qualifications, the staff finds that the request for deletion of IEEE 344 is not clear. In addition, the staff finds that RG 1.100 that provides reference to seismic qualification still remains in the section. On this basis, the staff believes that the proposed seismic references (i.e., IEEE 344) should remain in the sections. In addition, the staff noted that references to GDC 2 and RG 1.209, "Guidelines for Environmental Qualification of Safety-Related Computer-Based Instrumentation and Control (I&C) systems in nuclear Power Plants" that addresses I&C equipment located in a mild environmental are not listed as requirements to 10 CFR 50, Appendix A. The staff identifies this issue as open item 3.11-2.

Westinghouse Response:

Westinghouse concurs that IEEE Std 323 addresses seismic qualification as part of the full qualification program for safety-related equipment. Seismic qualification of safety-related equipment is described in Section 3.10 as stated in Section 3.11 as part of an overall qualification program. Appendix 3D integrates Section 3.10 (seismic) and 3.11 (environmental) into the overall methodology for the AP1000 equipment qualification program. The subsection (3.11.2.1) where IEEE Std 344 was deleted is a subsection specifically addressing environmental qualification of electrical equipment and does not need to include the reference to IEEE Std. 344. Westinghouse will revise the paragraph in APP-GW-GLN-110 (TR110) and DCD Revision 16 to add IEEE Std. 344-1987 as a guideline for the EQ methodology described in Appendix 3D of the DCD.

Westinghouse will revise the paragraph in APP-GW-GLN-110 (TR110) and DCD Revision 16 to add GDC 2 in the subject paragraph.

Regulatory Guide 1.209 was released after the Design Certification for AP1000 was issued. Therefore, this regulatory guide is not applicable to AP1000 design certification.

Reference:
1. APP-GW-GL-700, Revision 16, "AP1000 Design Control Document."

Design Control Document (DCD) Revision:

DCD Revision 16 Chapter 3, Subsection 3.11.2.1, Page 3.11-3, Mark-up

3.11.2.1 Environmental Qualification of Electrical Equipment

The AP1000 approach for environmental qualification of Class 1E equipment is outlined in Appendix 3D. The~~is~~ Appendix 3D methodology is developed based on the guidelines provided in IEEE 323-1974 (Reference 1)~~,~~ and IEEE 344-1987 (Reference 2).

Qualification for equipment in a harsh environment is based on type testing or testing and analysis. Analysis may be used to determine significant aging mechanisms in mild environment applications. Type testing includes thermal and mechanical aging, radiation, and exposure to extremes of environmental, seismic, and vibration effects. Type testing is done with representative samples of the production line equipment according to the sequence indicated in IEEE 323-1974 to the specified service conditions, including margin. The testing takes into account normal and abnormal plant operation and design basis accident and post-design basis accident operations, as required.

When reliable data and proven analytical methods are available, environmental qualification may be based on analysis supported by partial type test data. This method includes justification of the methods, theories, and assumptions used (that is, mathematical or logical proof based on actual test data) that the equipment meets or exceeds its specified performance requirements when subjected to normal, abnormal, and design basis accident environmental conditions.

Regulatory guides providing guidance for meeting the requirements of 10CFR50, Appendix A, General Design Criteria 1, 2, 4, 23, and 50; Appendix B, Criteria III, XI, and XVII to 10CFR50 and 10CFR50.49, include Regulatory Guide 1.89, Regulatory Guide 1.30, Regulatory Guide 1.63, Regulatory Guide 1.73, Regulatory Guide 1.100, and Regulatory Guide 1.131. The maintenance surveillance program follows the guidance of Regulatory Guide 1.33.

Additional information regarding conformance with each of these regulatory guides is given in Section 1.9.

DCD Revision 16 Chapter 3, Subsection 3.11.6, Page 3.11-5, Mark-up

3.11.6 References

1. IEEE 323-1974, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations."

2. IEEE 344-1987, "IEEE Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations."

PRA Revision:
None

Technical Report (TR) Revision:

APP-GW-GLN-110 (TR110) Revision 0, Page 5, Mark-up

Change 3.11-3: Sections 3.11.2.1, ~~3.11.6~~:

An editorial change has been made to this section. ~~This section refers to environmental qualification (IEEE 323-1974). Reference to IEEE 344-1987 (Seismic) is not required and therefore removed from this section and from Section 3.11.6 References.~~ A change in paragraph 1 was made for clarification purposes and General Design Criteria 2 was added to paragraph 4.

APP-GW-GLN-110 (TR110) Revision 0, Page 25, Mark-up

Change 3.11-3:

3.11.2.1 Environmental Qualification of Electrical Equipment

The AP1000 approach for environmental qualification of Class 1E equipment is outlined in Appendix 3D. The~~is~~ Appendix 3D methodology is developed based on the guidelines provided in IEEE 323-1974 (Reference 1)~~,~~ and IEEE 344-1987 (Reference 2).

Qualification for equipment in a harsh environment is based on type testing or testing and analysis. Analysis may be used to determine significant aging mechanisms in mild environment applications. Type testing includes thermal and mechanical aging, radiation, and

exposure to extremes of environmental, seismic, and vibration effects. Type testing is done with representative samples of the production line equipment according to the sequence indicated in IEEE 323-1974 to the specified service conditions, including margin. The testing takes into account normal and abnormal plant operation and design basis accident and post-design basis accident operations, as required.

When reliable data and proven analytical methods are available, environmental qualification may be based on analysis supported by partial type test data. This method includes justification of the methods, theories, and assumptions used (that is, mathematical or logical proof based on actual test data) that the equipment meets or exceeds its specified performance requirements when subjected to normal, abnormal, and design basis accident environmental conditions.

Regulatory guides providing guidance for meeting the requirements of 10CFR50, Appendix A, General Design Criteria 1, 2, 4, 23, and 50; Appendix B, Criteria III, XI, and XVII to 10CFR50 and 10CFR50.49, include Regulatory Guide 1.89, Regulatory Guide 1.30, Regulatory Guide 1.63, Regulatory Guide 1.73, Regulatory Guide 1.100, and Regulatory Guide 1.131. The maintenance surveillance program follows the guidance of Regulatory Guide 1.33.

Additional information regarding conformance with each of these regulatory guides is given in Section 1.9.

APP-GW-GLN-110 (TR110) Revision 0, Page 26, Mark-up

Change 3.11-3:

3.11.6 References

1. IEEE 323-1974, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations."

2. IEEE 344-1987, "IEEE Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations."

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR110-ICE1-03
Revision: 0

Question:

The staff has reviewed the proposed editorial change from "and" to "or" on page 75 of Section 3D. The staff finds that the intent of Attachment C of page 75 is not clear and recommends revising the sentences or provide additional information for clarification. The staff identifies this issue as open item 3.11-3.

Westinghouse Response:

The "and" to "or" change was intended to clarify the statement regarding when radiation aging is not required to be included in AP1000 qualification programs.

Attachment C provides the basis for the conclusion that radiation aging below 10^4 rads (10^3 rads for certain electrical components) is not a significant factor in the ability of equipment to perform during a seismic event. The scope of Attachment C is limited to consideration of the effect of radiation for equipment that does not experience an adverse change in external environment as a result of the high-energy line break. Therefore, radiation aging must be addressed for qualification of equipment required to perform a safety-related function in a high-energy line break environment regardless of the lifetime radiation dose.

Westinghouse will revise the paragraph in APP-GW-GLN-110 (TR110) and DCD Revision 16 to clarify the subject matter.

Reference:
1. APP-GW-GL-700, Revision 16, "AP1000 Design Control Document."

Design Control Document (DCD) Revision:

DCD Revision 16 Appendix 3D, Page 3D-2, Mark-up

Attachment C, "Effects of Gamma Radiation Doses Below 10^4 rads on the Mechanical Properties of Materials," provides the basis that radiation aging below 10^4 rads is not a significant factor in the ability of the equipment to perform properly during a seismic event. For some devices, electrical properties are degraded ~~below~~ above 10^3 rads. Radiation aging for safety-related equipment which is subject to lifetime doses of less than 10^4 rads (10^3 rads for certain electrical components) ~~not required to perform a safety-related function in~~ and not subjected to a high-energy line break environment ~~or subject to lifetime doses of less than 10^4 rads~~ is not required to be addressed in AP1000 ~~test~~ qualification programs.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

PRA Revision: None

Technical Report (TR) Revision:

APP-GW-GLN-110 (TR110) Revision 0, Page 6, Mark-up

Chapter 3 Appendix 3D:

Change 3D-1: Sections 3D, 3D.1, 3D.4.2, 3D.4.4, 3D.5.2.1, 3D.6, Table 3D.4.2, Table 3D.C-1, Attachment D.2:

Editorial clarifications and typographic changes have been made to these sections. These changes are summarized below.

Chapter 3 Appendix 3D Editorial Changes		
Section	**Paragraph**	**Comment**
3D	7	~~Changed "and" to "or"~~Revised paragraph as shown in DCD mark-up on page 75
3D.1	4	Correct title of IEEE 344-1987 as shown in DCD mark-up on page 75
3D.4.2	1	Correct title of IEEE 100 as shown in DCD mark-up on page 78
3D.4.4	1	Changed "subsequence" to "subsequent" as shown in DCD mark-up on page 78
3D.5.2.1	3	Changed "240°F" to "250°F" as shown in DCD mark-up on page 80
3D.6	2	Correct Section Number for Analysis and Experience as shown in DCD mark-up on page 84
Table 3D.4-2	1st Row	Correct typographic error as shown in DCD mark-up on page 86
Table 3D.C-1 (Sheet 2)	5th Row	Added value to table for Aromatic Amide-Imide as shown in DCD mark-up on page 112
Attachment D.2	-	Corrected typographic errors in the Boltzmann's constant and the Arrhenius equations as shown in DCD mark-up on pages 113-114

APP-GW-GLN-110 (TR110) Revision 0, Page 75, Mark-up

Attachment C, "Effects of Gamma Radiation Doses Below 10^4 rads on the Mechanical Properties of Materials," provides the basis that radiation aging below 10^4 rads is not a significant factor in the ability of the equipment to perform properly during a seismic event. For some devices, electrical properties are degraded ~~below~~ above 10^3 rads. Radiation aging for safety-related equipment which is subject to lifetime doses of less than 10^4 rads (10^3 rads for certain electrical components) ~~not required to perform a safety-related function in~~ and not subjected to a high-energy line break environment ~~or subject to lifetime doses of less than 10^4 rads~~ is not required to be addressed in AP1000 ~~test~~ qualification programs.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR110-ICE1-04
Revision: 0

Question:

The staff finds the list in 3D.4.1.2 does not include RG 1.40, RG 1.183, and RG 1.180. The staff identifies this issue as open item 3.11-4.

Westinghouse Response:

Westinghouse will revise the DCD Appendix 3D subsection 3D.4.1.2 and APP-GW-GLN-110 (TR110) to include RG 1.183 and RG 1.180. RG 1.40 which is applicable to continuous duty Class 1E motors inside containment will not be included subsection 3D.4.1.2. The AP1000 plant design does not have continuous duty Class 1E motors installed inside the containment (See Appendix 1A of the DCD).

Reference:
1. APP-GW-GL-700, Revision 16, "AP1000 Design Control Document."

Design Control Document (DCD) Revision:

DCD Revision 16 Appendix 3D, Subsection 3D.4.1.2 (Page 3D-5 through 3D-7) Mark-up

3D.4.1.2 NRC Regulatory Guides

In the area of seismic and environmental qualification of safety-related electrical and mechanical equipment, the NRC has issued the following Regulatory Guides:

Regulatory Guide 1.33, "Quality Assurance Program Requirements (Operation)" – The guide endorses ANS and ANSI standards for quality assurance programs, but is considered here specifically for guidance in determining documentation adequacy. Appendix A of the guide, Item 9, "Procedures for Performing Maintenance," addresses procedural and documentation requirements for maintenance of safety-related equipment, preventive maintenance, repair, and replacement. This guide is a source in the development of qualification in the on-going qualification programs discussed in subsection 3D.6.4.

Regulatory Guide 1.61, "Damping Values for Seismic Design of Nuclear Plants" – The guide prescribes acceptable values of damping used in elastic modal dynamic seismic analysis of seismic Category I structures, systems, and components. The AP1000 equipment qualification program is based on Regulatory Guide 1.61 and on values considered to be acceptable based on past NRC acceptances. The safe shutdown earthquake (SSE) damping values used for the qualification of mechanical and electrical equipment are listed in Table 3.7.1-1 of Chapter 3.

Regulatory Guide 1.63, "Electric Penetration Assemblies in Containment Structures for Nuclear Power Plants" – The guide endorses, with certain qualifications, IEEE 317-1983. External circuit protection of electric penetration assemblies should meet the provisions of Section 5.4 of IEEE 741-1986, "Criteria for Protection of Class 1E Power Systems and Equipment in Nuclear Generating Stations, as these are beyond the of scope IEEE 317. The AP1000 design complies with IEEE 741-1997. The AP1000 equipment qualification program employs the recommendations of Regulatory Guide 1.63, Revision 3, in specifying qualification plans as a means of supplementing the guidance of IEEE 317 and 323.

Regulatory Guide 1.73, "Qualification Tests of Electric Valve Operators Installed Inside the Containment of Nuclear Power Plants" – The guide endorses, with certain qualifications, IEEE 382-1972. The AP1000 equipment qualification program employs recommendations of Regulatory Guide 1.73, but gives preference to the guidance of IEEE 382-1996, where it is necessary to supplement the guidance of IEEE 323 or 344 in specifying qualification plans for electric valve operators.

Regulatory Guide 1.89, "Qualification of Class 1E Equipment for Nuclear Power Plants" – The guide provides guidance for conformance with 10 CFR 50.49, and endorses the procedures of IEEE 323-1974 as an acceptable means for qualifying Class 1E equipment. Implicit in the endorsement of IEEE 323 is the reference to seismic qualification methods of IEEE 344 as a part of the qualification test sequence. (See Regulatory Guide 1.100 later in this discussion.) The AP1000 equipment qualification methodology addresses the recommendations of Regulatory Guide 1.89 by the following:

- The recommendations of IEEE 323-1974 are met by the methods discussed in this appendix
- The radiation source terms used in qualification differ from those of Regulatory Guide 1.89, and are described in Section 3D.5 of this appendix
- The seismic qualification requirements employ the recommendations of IEEE 344-1987 as described in Attachment E of this appendix.

Regulatory Guide 1.92, "Combining Modal Responses and Spatial Components in Seismic Response Analysis" – The guide describes methods and procedures for the following:

- Combining the values of the response of individual modes in a response spectrum modal dynamic analysis to find the representative maximum value of a particular response of interest for each of the three orthogonal seismic spatial components
- Combining the maximum values (or representative maximum values) of the responses for a given element of a system or item of equipment, determined for each of the three orthogonal spatial components

~~Regulatory Guide 1.97, Revision 3, "Instrumentation for Light Water Cooled Nuclear Power Plants to Access Plant and Environs Conditions During and Following and an Accident." The guide describes a method acceptable to provide instrumentation to monitor plant variables and systems during and following an accident in a light water cooled nuclear power plant. The AP1000 program, identified as the~~

~~post-accident monitoring instrumentation system (PAMS), provides the capability to monitor plant variables and systems operating status during and following an accident. PAMS includes those instruments provided to indicate system operating status and furnish information regarding the release of radioactive materials.~~

The AP1000 equipment qualification program employs methods consistent with the recommendations of Regulatory Guide 1.92 when combining individual modal response values or the response of three independent spatial components in seismic analyses.

Regulatory Guide 1.97, Revision 3, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Access Plant and Environs Conditions During and Following and an Accident." The guide describes a method acceptable to provide instrumentation to monitor plant variables and systems during and following an accident in a light-water-cooled nuclear power plant. The AP1000 program, identified as the post-accident monitoring instrumentation system (PAMS), provides the capability to monitor plant variables and systems operating status during and following an accident. PAMS includes those instruments provided to indicate system operating status and furnish information regarding the release of radioactive materials.

Regulatory Guide 1.100, "Seismic Qualification of Electrical Equipment for Nuclear Power Plants" – The guide endorses IEEE 344-1987. Regulatory Guide 1.100 particularly notes that IEEE 344-1987 is applied in the qualification of safety-related mechanical equipment, as well as Class 1E electrical equipment. The AP1000 equipment qualification methodology employs the recommendations of Regulatory Guide 1.100, as described in Attachment E of this appendix.

Regulatory Guide 1.122, "Development of Floor Design Response Spectra for Seismic Design of Floor-Supported Equipment or Components" – The guide describes specific methods for developing floor (and other equipment mounting locations) response spectra. Included are specific criteria for the broadening frequency amplitude peaks and smoothing of the frequency amplitude spectrum to incorporate conservatism in the seismic requirements. This is to compensate for other uncertainties of analysis. The AP1000 equipment qualification program employs methods consistent with the recommendations of Regulatory Guide 1.122.

Regulatory Guide 1.131, "Qualification Tests of Electrical Cables, Field Splices, and Connections for Light-Water Cooled Nuclear Power Plants" – The guide endorses IEEE 383-1974. The AP1000 equipment qualification program employs the recommendations of Regulatory Guide 1.131 in specifying the qualification program plans where this guide supplements the guidance of IEEE 383 and to further demonstrate conformance with the guidance of IEEE 323. As neither IEEE 383 nor Regulatory Guide 1.131 specifically addresses considerations for cable field splices and connections, guidance for their qualification is taken from IEEE 572 and Regulatory Guide 1.156.

Regulatory Guide 1.156, "Environmental Qualification of Connection Assemblies for Nuclear Power Plants" – The guide endorses IEEE 572-1985. The AP1000 equipment qualification program employs the recommendations of Regulatory Guide 1.156 in specifying the qualification program plans where this guide supplements the guidance of IEEE 572 to demonstrate conformance with the guidance of IEEE 323.

Regulatory Guide 1.158, "Qualification of Safety-Related Lead Storage Batteries for Nuclear Power Plants" – The guide endorses IEEE 535-1986. The AP1000 equipment qualification program employs the recommendations of Regulatory Guide 1.158 in specifying the qualification program plans where this guide supplements the guidance of IEEE 535 to demonstrate conformance with the guidance of IEEE 323.

Regulatory Guide 1.180, "Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems." Regulatory Guide 1.180 provides guidance to evaluate Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems. The AP1000 equipment qualification program employs methods consistent with the recommendations of Regulatory Guide 1.180, where applicable.

Regulatory Guide 1.183, "Alternate Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors." The radiation dose rates and integrated doses applicable for AP1000 following a Design Basis Accident are determined based on the criteria of NUREG-1465 and this regulatory guide.

PRA Revision:
None

Technical Report (TR) Revision:

APP-GW-GLN-110 Revision 0, Page 6, Mark-up

~~Also,~~ Regulatory Guide 1.97 has been added to Section 3D.4.1.2, "NRC Regulatory Guides." AP1000 conformance to this Regulatory Guide is define in the DCD Section 1.9, Chapter 1 Appendix 1A and Section 7.5.1. This Regulatory Guide also provides the required qualification criteria for the post accident monitoring instruments.

Regulatory Guide 1.180 has been added to Section 3D.4.1.2, "NRC Regulatory Guides." AP1000 conformance to this Regulatory Guide is define in the DCD Section 1.9, Chapter 1 Appendix 1A and Appendix 3D. The AP1000 equipment qualification program employs methods consistent with the recommendations of Regulatory Guide 1.180, where applicable.

Regulatory Guide 1.183 has been added to Section 3D.4.1.2, "NRC Regulatory Guides." AP1000 conformance to this Regulatory Guide is define in the DCD Section 1.9, Chapter 1 Appendix 1A and Appendix 3D. This Regulatory Guide also provides the guidance for determination of radiation dose rates and integrated doses following a Design Basis Accident.

APP-GW-GLN-110 Revision 0, Page 76 through 78, Mark-up

Change 3D-2:

3D.4.1.2 NRC Regulatory Guides

In the area of seismic and environmental qualification of safety-related electrical and mechanical equipment, the NRC has issued the following Regulatory Guides:

Regulatory Guide 1.33, "Quality Assurance Program Requirements (Operation)" – The guide endorses ANS and ANSI standards for quality assurance programs, but is considered here specifically for guidance in determining documentation adequacy. Appendix A of the guide, Item 9, "Procedures for Performing Maintenance," addresses procedural and documentation requirements for maintenance of safety-related equipment, preventive maintenance, repair, and replacement. This guide is a source in the development of qualification efforts in the on-going qualification programs discussed in subsection 3D.6.4.

Regulatory Guide 1.61, "Damping Values for Seismic Design of Nuclear Plants" – The guide prescribes acceptable values of damping used in elastic modal dynamic seismic analysis of seismic Category I structures, systems, and components. The AP1000 equipment qualification program is based on Regulatory Guide 1.61 and on values considered to be acceptable based on past NRC acceptances. The safe shutdown earthquake (SSE) damping values used for the qualification of mechanical and electrical equipment are listed in Table 3.7.1-1 of Chapter 3.

Regulatory Guide 1.63, "Electric Penetration Assemblies in Containment Structures for Nuclear Power Plants" – The guide endorses, with certain qualifications, IEEE 317-1983. External circuit protection of electric penetration assemblies should meet the provisions of Section 5.4 of IEEE 741-1986, "Criteria for Protection of Class 1E Power Systems and Equipment in Nuclear Generating Stations, as these are beyond the of scope IEEE 317. The AP1000 design complies with IEEE 741-1997. The AP1000 equipment qualification program employs the recommendations of Regulatory Guide 1.63, Revision 3, in specifying qualification plans as a means of supplementing the guidance of IEEE 317 and 323.

Regulatory Guide 1.73, "Qualification Tests of Electric Valve Operators Installed Inside the Containment of Nuclear Power Plants" – The guide endorses, with certain qualifications, IEEE 382-1972. The AP1000 equipment qualification program employs recommendations of Regulatory Guide 1.73, but gives preference to the guidance of IEEE 382-1985, where it is necessary to supplement the guidance of IEEE 323 or 344 in specifying qualification plans for electric valve operators.

Regulatory Guide 1.89, "Qualification of Class 1E Equipment for Nuclear Power Plants" – The guide provides guidance for conformance with 10 CFR 50.49, and endorses the procedures of IEEE 323-1974 as an acceptable means for qualifying Class 1E equipment.

Implicit in the endorsement of IEEE 323 is the reference to seismic qualification methods of IEEE 344 as a part of the qualification test sequence. (See Regulatory Guide 1.100 later in this discussion.) The AP1000 equipment qualification methodology addresses the recommendations of Regulatory Guide 1.89 by the following:

- The recommendations of IEEE 323-1974 are met by the methods discussed in this appendix
- The radiation source terms used in qualification differ from those of Regulatory Guide 1.89, and are described in Section 3D.5 of this appendix
- The seismic qualification requirements employ the recommendations of IEEE 344-1987 as described in Attachment E of this appendix.

Regulatory Guide 1.92, "Combining Modal Responses and Spatial Components in Seismic Response Analysis" – The guide describes methods and procedures for the following:

- Combining the values of the response of individual modes in a response spectrum modal dynamic analysis to find the representative maximum value of a particular response of interest for each of the three orthogonal seismic spatial components
- Combining the maximum values (or representative maximum values) of the responses for a given element of a system or item of equipment, determined for each of the three orthogonal spatial components.

The AP1000 equipment qualification program employs methods consistent with the recommendations of Regulatory Guide 1.92 when combining individual modal response values or the response of three independent spatial components in seismic analyses.

Regulatory Guide 1.97 Revision 3, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following and An Accident." The guide describes a method acceptable to provide instrumentation to monitor plant variables and systems during and following an accident in light-water-cooled nuclear power plant. The AP1000 program identified as the post accident monitoring instrumentation system (PAMS), provides the capability to monitor plant variables and systems operating status during and following an accident. PAMS includes those instruments provided to indicate system operating status and furnish information regarding the release of radioactive materials.

Regulatory Guide 1.100, "Seismic Qualification of Electrical Equipment for Nuclear Power Plants" – The guide endorses IEEE 344-1987. Regulatory Guide 1.100 particularly notes that IEEE 344-1987 is applied in the qualification of safety-related mechanical equipment, as well as Class 1E electrical equipment. The AP1000 equipment qualification methodology employs the recommendations of Regulatory Guide 1.100, as described in Attachment E of this appendix.

Regulatory Guide 1.122, "Development of Floor Design Response Spectra for Seismic Design of Floor-Supported Equipment or Components" – The guide describes specific methods for developing floor (and other equipment mounting locations) response spectra. Included are specific criteria for the broadening frequency amplitude peaks and smoothing of the frequency amplitude spectrum to incorporate conservatism in the seismic requirements. This is to compensate for other uncertainties of analysis. The AP1000 equipment qualification program employs methods consistent with the recommendations of Regulatory Guide 1.122.

Regulatory Guide 1.131, "Qualification Tests of Electrical Cables, Field Splices, and Connections for Light-Water Cooled Nuclear Power Plants" – The guide endorses IEEE 383-1974. The AP1000 equipment qualification program employs the recommendations of Regulatory Guide 1.131 in specifying the qualification program plans where this guide supplements the guidance of IEEE 383 and to further demonstrate conformance with the guidance of IEEE 323. As neither IEEE 383 nor Regulatory Guide 1.131 specifically addresses considerations for cable field splices and connections, guidance for their qualification is taken from IEEE 572 and Regulatory Guide 1.156.

Regulatory Guide 1.156, "Environmental Qualification of Connection Assemblies for Nuclear Power Plants" – The guide endorses IEEE 572-1985. The AP1000 equipment qualification program employs the recommendations of Regulatory Guide 1.156 in specifying the qualification program plans where this guide supplements the guidance of IEEE 572 to demonstrate conformance with the guidance of IEEE 323.

Regulatory Guide 1.158, "Qualification of Safety-Related Lead Storage Batteries for Nuclear Power Plants" – The guide endorses IEEE 535-1986. The AP1000 equipment qualification program employs the recommendations of Regulatory Guide 1.158 in specifying the qualification program plans where this guide supplements the guidance of IEEE 535 to demonstrate conformance with the guidance of IEEE 323.

Regulatory Guide 1.180, "Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems." Regulatory Guide 1.180 provides guidance to evaluate Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems. The AP1000 equipment qualification program employs methods consistent with the recommendations of Regulatory Guide 1.180, where applicable.

Regulatory Guide 1.183, "Alternate Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors." The radiation dose rates and integrated doses applicable for AP1000 following a Design Basis Accident are determined based on the criteria of NUREG-1465 and this regulatory guide.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR110-ICE1-05
Revision: 0

Question:

The staff has reviewed the proposed changes on pages 83–85 and 109–111 on Sections 3D.5.5.1.5, 3D.5.5.2 and Figure 3D.5-9. These changes to the sections and figure have been developed based on a re-evaluation of the main steam isolation valve compartment. The original evaluation of the temperature response to a main steam line break outside containment used a mass and energy release that has been updated (i.e., from 2.8 square ft to 1.0 square ft based on NUREG-0800). This re-evaluation resulted in updating of Figure 3D.5-9. In addition, the EQ envelopes have been removed from Figures 3D.5-8 to show the responses to the different accidents. However, WEC indicated that current Figures 3D.5-8 and 3D.5-9 do not include margins for temperature and pressure (from IEEE Std. 323-1974), which will be incorporated in the EQ program. The staff identifies this issue as open item 3.11-5.

Westinghouse Response:

The EQ envelope was removed from Figure 3D.5-9 and the figure title was changed in Revision 16 of the DCD. The new figures show the transient conditions based on the Main Steam Line Break re-evaluation. As stated in APP-GW-GLN-110, Page 84 for Change 3D-3, Appendix 3D.5.5.2 of the DCD was revised to reflect that the margin required from IEEE Std. 323-1974 is not included in Figure 3D-9. The applicable environmental qualification programs will define the overall transient test profile and include the required margin for the test profile. The equipment qualification test reports will provide a comparison of the actual test profile versus the required test profile. The qualification test reports will be presented at the time of NRC EQ document review.

Reference:
1. APP-GW-GL-700, Revision 16, "AP1000 Design Control Document."

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-TR110-ICE1-06
Revision: 0

Question:

The staff has reviewed the proposed change to Figure 3D.5-8 that has been revised to remove the EQ curve to show only the DBA conditions on pages 105–108. Since the composite and EQ curves will be used to compare with the qualification test report during the EQ inspection, the curves should remain in the figure. The staff identifies this issue as open item 3.11-6.

Westinghouse Response:

The EQ envelope was removed from Figure 3D.5-8 and the figure title was changed in Revision 16 of the DCD. As stated in APP-GW-GLN-110, Page 83 for Change 3D-3, Appendix 3D.5.5.1.5 of the DCD was revised to reflect that the margin required from IEEE Std. 323-1974 is not included in Figure 3D-8. The applicable environmental qualification programs will define the overall transient test profile and include the required margin for the test profile. The equipment qualification test reports will provide a comparison of the actual test profile versus the required test profile. The qualification test reports will be presented at the time of NRC EQ document review.

Reference:
1. APP-GW-GL-700, Revision 16, "AP1000 Design Control Document."

Design Control Document (DCD) Revision:
None

PRA Revision:
None

Technical Report (TR) Revision:
None