Document Date: December 12, 2011

REPLY TO NUCLEAR REGULATORY COMMISSION INSPECTION REPORT NO. 99901409/2011-201 AND NOTICE OF VIOLATION AND NOTICE OF NONCONFORMANCE

OBAYASHI

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your ref : Docket No. 99901409
our ref : OBY_NRC_000001

December 3, 2011

Subject: **Reply to NUCLEAR REGULATORY COMMISSION INSPECTION REPORT NO. 99901409/2011-201 AND NOTICE OF VIOLATION AND NOTICE OF NONCONFORMANCE**

Obayashi Corporation reply with regards to the above-mentioned subject is enclosed in "Attachment-1". As mentioned in the attachment, corrective actions are summarized as follows:

Phase-1: Obayashi AP1000 design works shall be performed under Westinghouse Quality Management System in an interim period. This corrective action is currently being implemented and shall continue to take effect until an acceptable Obayashi Quality Management System is in place.

Phase-2: Obayashi shall supplement its Quality Management System to additionally meet U.S. applicable regulatory requirements aside from the existing ISO9001 requirements.

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We believe that these corrective actions will prevent further violation and nonconformance under these areas. Should you have any question, please e-mail me at shimizu.akira@obayashi.co.jp.

Very truly yours,

Akira Shimizu
General Manager
Nuclear Facilities Division
Obayashi Corporation

cc: Kerri Kavanagh, *NRO/DCIP/CQVA*
Robert Prato, *NRO/DCIP/CQVA*
Bret Tegeler, *NRO/DE/SEB1*
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Russell Lion, *Westinghouse Electric Company*
Kevin Moore, *Westinghouse Electric Company*
Yasutaka Sakamoto, *Obayashi Corporation*
Yuji Itabashi, *Obayashi Corporation*

Enclosure: Attachment -1 *(11 pages)*
Attachment -2 *(11 pages)*

Response to NRC Inspection Report No. 999014096/2011-201

1. Violation 99901409/2011-201-01 (Severity Level IV Violation)

	Description
NRC Statement	Title 10 of the *Code of Federal Regulations* (10 CFR), Section 21.21, "Notification of Failure To Comply or Existence of a Defect and Its Evaluation," paragraph 21.21(a), requires, in part, that each individual, corporation, partnership, or other entity subject to 10 CFR Part 21 shall adopt appropriate procedures to evaluate deviations and failures to comply associated with substantial safety hazards as soon as practicable. 10CFR Section 21.51, "Maintenance and Inspection of Records," requires, in part, that each individual, corporation, partnership, dedicating entity, or other entity subject to 10 CFR Part 21 shall prepare and maintain records necessary to accomplish the purpose of 10 CFR Part 21, specifically (1) retain evaluations of all deviations and failures to comply for a minimum of five years after the date of the evaluation; (2) retain any notifications sent to purchasers and affected licensees for a minimum of five years after the date of the notification; and (3) retain a record of the purchasers of basic components for 10 years after delivery of the basic component or service associated with a basic component. Contrary to the above, as of September 16, 2011, Obayashi had not adopted an appropriate procedure for evaluating deviations and failures to comply. Specifically, Obayashi procedure, AP1000-P-001, AP1000 Project Working Procedures, "Reporting of Defects/Non-Compliance and Adverse to Safety in Accordance to 10 CFR Part 21 for AP1000 Contracts," Revision 0, dated August 31, 2011, was established approximately six years after the placement of a safety-related purchase order that imposed 10 CFR Part 21 requirements on Obayashi. Additionally, Obayashi failed to evaluate at least four nonconformances/corrective actions for reportability under 10 CFR Part 21 and failed to establish the record-keeping requirements of Section 21.51 of 10 CFR Part 21.
Obayashi Response	(1) Reason for the violation Since 10 CFR Part 21 training had been done following WEC AP1000 Purchase Order, we were under the impression that we were already complying with 10 CFR Part 21. However, Obayashi insufficiently understood 10 CFR Part 21 requirements. In addition, WEC previously audited Obayashi several times; however, the audit reports of 2004 & 2007 did not report a finding that Obayashi should have its own documented 10 CFR Part 21 procedure until the 2010 audit. (2) Corrective steps that have been taken and the results achieved a) WEC issued a Stop Work Order to Obayashi for the AP1000 design work, on September 26, 2011. b) Obayashi initiated a nonconformance report in relation to the violation cited in this NRC inspection report by following Obayashi QAP. c) Obayashi 10 CFR Part 21 Procedure, AP1000-P-001, will be used for evaluation of the previous 51 nonconformance. (3) Corrective steps that will be taken to avoid further violations a) Obayashi had evaluated that the previous 51 nonconformance as not being

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	reportable against 10 CFR Part 21; but Obayashi will re-evaluate the said 51 nonconformance with WEC support. b) Previous 51 nonconformance/corrective action records will be stored in Obayashi data management system meeting the requirements of NQA-1 17S-1. c) For the long-term plan, Obayashi QAP will be revised to ensure 10 CFR Part 21 requirements are fully addressed. (4) Date when full compliance will be achieved. a) Full compliance will be achieved by January 31, 2012 except for the long-term plan stated above. b) For the long-term plan, Obayashi is expecting to achieve it by the end of March 2013.

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2. Nonconformance 99901409/2011-201-02

	Description
NRC Statement (A)	Criterion II, "Quality Assurance Program," of Appendix B, "Quality Assurance Program Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," states, in part, that a quality assurance program which complies with the requirements of this appendix shall be established consistent with the schedule for accomplishing the activities. This program shall be documented by written policies, procedures, or instructions and shall be carried out in accordance with those policies, procedures, or instructions. Westinghouse Electric Company (WEC) purchase order (PO) 4500176463, Change Notice 2, required that Obayashi design services shall be performed in accordance to Appendix B to 10 CFR Part 50, Regulatory Guide 1.28, "Quality Assurance Program Requirements (Design and Construction)", Revision 3, August 1985; and American Society of Mechanical Engineers (ASME) NQA-1-1994, "Quality Assurance Requirements for Nuclear Facility Applications." Contrary to the above, as of September 16, 2011, Obayashi failed to establish a quality assurance program consistent with the applicable provisions of Appendix B to 10 CFR Part 50 and the industry quality standards specified in PO 4500176463 for AP1000 safety-related engineering services.
Obayashi Response	(1) Reason for the Nonconformance Obayashi QAP (P-35) was developed and established based on ISO9001 requirements. Prior to the start of AP1000 design work, a gap analysis between Obayashi QAP and 10 CFR Part 50 Appendix B was performed which inadvertently judged the two to be similar and have the same requirements. Moreover, Obayashi made an effort to translate ASME NQA-1 1994 into Japanese; however, a gap analysis between ASME NQA-1 1994 against the Obayashi QAP was not performed. Primary reason of the nonconformance is due to Obayashi insufficient understanding of 10 CFR Part 50 Appendix B, Reg. Guide 1.28 Rev. 3 and ASME NQA-1 1994. (2) Corrective steps that have been taken and the results achieved a) WEC issued a Stop Work Order to Obayashi for the AP1000 design work, on September 26, 2011. b) Obayashi initiated a nonconformance report in relation to the nonconformance cited in this NRC inspection report by following Obayashi QAP. c) Obayashi is in the process of completing a complete gap analysis to fully understand the requirements of 10 CFR Part 50 Appendix B, ASME NQA-1 and Regulatory Guide 1.28 and differences with its existing quality program. (3)Corrective steps that will be taken to avoid further Nonconformances a) Obayashi will revise, improve and implement a QAP meeting the requirements of 10 CFR Part 50 Appendix B, ASME NQA-1 and Regulatory Guide 1.28 aside from the existing ISO9001.

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	(4) Date when full compliance will be achieved a) Full compliance will be achieved by January 31, 2012 except for the long-term plan stated above. b) For the long-term plan, Obayashi is expecting to implement a fully compliant QMS program in accordance with 10CFR50 App B, 10CFR21, NQA-1, and RG .1.28 by the end of March 2013.

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3. Nonconformance 99901409/2011-201-03

	Description
NRC Statement (B)	Criterion III, "Design Control," of Appendix B states, in part, that measures shall be established to assure that applicable regulatory requirements and the design basis for those structures, systems, and components to which Appendix B applies are correctly translated into specifications, drawings, procedures, and instructions. Measures shall be established for the identification and control of design interfaces and for coordination among participating design organizations. These measures shall include the establishment of procedures among participating design organizations for the review, approval, release, distribution, and revision of documents involving design interfaces. In addition, design changes shall be subject to design control measures commensurate with those applied to the original design and be approved by the organization that performed the original design. Contrary to the above, as of September 16, 2011, Obayashi failed to: 1) assure that applicable design basis are correctly translated into calculations; 2) establish procedures for the identification and control of design control interfaces and for coordination among participating design organizations; and 3) subject design changes to the commensurate design control measures applied to the original design. Specifically, Obayashi failed to: (1) correctly implement the provisions of the American Concrete Institute (ACI) 349, "Code Requirements for Nuclear Safety-Related Concrete Structures & Commentary;" (2) implement measures to identify and implement organizational interfaces between Obayashi and Westinghouse Electric Company for design control, design changes and technical direction; and (3) ensure that design changes were reviewed and verified with the same rigor as the original design.
Obayashi Response	(1)Reason for the Nonconformance a) Please see Attachment-2 that describes Obayashi response to the technical issues identified in the NRC Inspection Report Section 3 Design Control. b) Obayashi QAP (P-35) was developed and established based on ISO9001 requirements. Prior to the start of AP1000 design work, a gap analysis between Obayashi QAP and 10 CFR Part 50 Appendix B was performed which inadvertently judged the two to be similar and have the same requirements. Moreover, Obayashi made an effort to translate ASME NQA-1 1994 in Japanese; however, a gap analysis between ASME NQA-1 1994 against Obayashi QAP was not performed. Primary reason of the nonconformance is due to Obayashi insufficient understanding of 10 CFR Part 50 Appendix B, Reg. Guide 1.28 Rev. 3 and ASME NQA-1 1994. For issues identified as items (2) and (3) above, Obayashi failed to recognize the difference of requirements on "Design Control" between ISO9001 and with that of 10 CFR Part 50 Appendix B. (2)Corrective steps that have been taken and the results achieved a) WEC issued a Stop Work Order to Obayashi for the AP1000 design work, on September 26, 2011. b) Obayashi initiated a nonconformance report in relation to the nonconformance

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	cited in this NRC inspection report by following Obayashi QAP. c) The design methodology is re-affirmed with WEC. Moreover, the applicability of ACI 349 provisions relating to similar design methodology has been verified and confirmed acceptable. d) Obayashi is in the process of completing a complete gap analysis to fully understand the requirements of 10 CFR Part 50 Appendix B, ASME NQA-1 and Regulatory Guide 1.28 and differences with its existing quality program. (3)Corrective steps that will be taken to avoid further Nonconformances a) Obayashi will revise, improve and implement its own QAP meeting the requirements of 10 CFR Part 50 Appendix B, ASME NQA-1 and Regulatory Guide 1.28 aside from the existing ISO9001. (4)Date when full compliance will be achieved. a) Full compliance will be achieved by January 31, 2012 except for the long-term plan stated above. b) For the long-term plan, Obayashi is expecting to achieve it by the end of March 2013.

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4. Nonconformance 99901409/2011-201-04

	Description
NRC Statement (C)	Criterion XV, "Nonconforming Materials, Parts, or Components," of Appendix B to 10 CFR Part 50 states, in part, that measures shall be established to control materials, parts, or components which do not conform to requirements in order to prevent their inadvertent use. These measures shall include, as appropriate, procedures for identification, documentation, segregation, disposition, and notification to affected organizations. Criterion XVI, "Corrective Action," of Appendix B to 10 CFR Part 50 states that "Measures shall be established to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances are promptly identified and corrected. In the case of significant conditions adverse to quality, the measures shall assure that the cause of the condition is determined and corrective action taken to preclude repetition. The identification of the significant condition adverse to quality, the cause of the condition, and the corrective action taken shall be documented and reported to appropriate levels of management." Contrary to the above, as of September 16, 2011, Obayashi failed to establish measures to adequately address nonconformances and corrective actions. Specifically, Obayashi failed to establish measures for: (1) the segregation of nonconforming calculations and drawings; (2) performing prompt corrective actions; (3) differentiating between conditions adverse to quality and significant conditions adverse to quality; (4) providing a link between the Obayashi nonconformance control and corrective action procedure and the Obayashi Part 21 procedure; and (5) implementing corrective actions on two WEC supplier corrective action reports (SCARs).
Obayashi Response	(1)Reason for the Nonconformance Obayashi QAP (P-35) was developed and established based on ISO9001 requirements. Prior to the start of AP1000 design work, a gap analysis between Obayashi QAP and 10 CFR Part 50 Appendix B was performed which inadvertently judged the two to be similar and have the same requirements. Moreover, Obayashi made an effort to translate ASME NQA-1 1994 into Japanese; however, a gap analysis between ASME NQA-1 1994 against Obayashi QAP was not performed. Primary reason of the nonconformance is due to Obayashi insufficient understanding of 10 CFR Part 50 Appendix B, Reg. Guide 1.28 Rev. 3 and ASME NQA-1 1994. For issues identified as items (1) thru (5) above, Obayashi failed to recognize the differences with these requirements on "Nonconforming Materials, Parts, or Components" and "Corrective Action" between ISO9001 and with that of 10 CFR Part 50 Appendix B. (2)Corrective steps that have been taken and the results achieved a) WEC issued a Stop Work Order to Obayashi for the AP1000 design work, on September 26, 2011. b) Obayashi initiated a nonconformance report in relation to the nonconformance cited in this NRC inspection report by following Obayashi QAP.

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	c) Obayashi is in the process of completing a complete gap analysis to fully understand the requirements of 10 CFR Part 50 Appendix B, ASME NQA-1 and Regulatory Guide 1.28 and differences with its existing quality program.. (3)Corrective steps that will be taken to avoid further Nonconformances a) Obayashi will generate a nonconformance report in relation to the two (2) WEC SCARs by using Obayashi QAP. b) Obayashi will revise, improve, and implement its own QAP meeting the requirements of 10 CFR Part 50 Appendix B, ASME NQA-1 and Regulatory Guide 1.28 aside from the existing ISO9001. In addition, Obayashi QAP will address the requirements with regards to issues identified as items (3) and (4) above. (4)Date when full compliance will be achieved a) Full compliance will be achieved by January 31, 2012 except for the long-term plan stated above. b) For the long-term plan, Obayashi is expecting to achieve it by the end of March 2013.

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5. Nonconformance 99901409/2011-201-05

	Description
NRC Statement (D)	Criterion XVII, "Quality Assurance Records," of Appendix B to 10 CFR Part 50 states, in part, that records shall include the results of reviews, inspections, tests, audits, monitoring of work performance, and materials analyses. The records shall also include closely-related data such as qualifications of personnel, procedures, and equipment. Consistent with applicable regulatory requirements, requirements shall be established concerning record retention, such as duration, location, and assigned responsibility. Contrary to the above, as of September 16, 2011, Obayashi failed to establish requirements for the retention of records. Specifically, Obayashi failed to: (1) provide instructions for the maintenance of records for the qualification of personnel; and (2) document the record-keeping process used by Obayashi.
Obayashi Response	(1)Reason for the Nonconformance Obayashi QAP (P-35) was developed and established based on ISO9001 requirements. Prior to the start of AP1000 design work, a gap analysis between Obayashi QAP and 10 CFR Part 50 Appendix B was performed which inadvertently judged the two to be similar and have the same requirements. Moreover, Obayashi made an effort to translate ASME NQA-1 1994 into Japanese; however, a gap analysis between ASME NQA-1 1994 against Obayashi QAP was not performed. Primary reason of the nonconformance is due to Obayashi insufficient understanding of 10 CFR Part 50 Appendix B, Reg. Guide 1.28 Rev. 3 and ASME NQA-1 1994. For issues identified as item (1) and (2) above, Obayashi failed to recognize the difference of requirements on "Quality Assurance Records" between ISO9001 and with that of 10 CFR Part 50 Appendix B. (2)Corrective steps that have been taken and the results achieved a) WEC issued a Stop Work Order to Obayashi for the AP1000 design work, on September 26, 2011. b) Obayashi initiated a nonconformance report in relation to the nonconformance cited in this NRC inspection report by following Obayashi QAP. c) Obayashi is in the process of completing a complete gap analysis to fully understand the requirements of 10 CFR Part 50 Appendix B, ASME NQA-1 and Regulatory Guide 1.28 and differences with its existing quality program. (3)Corrective steps that will be taken to avoid further Nonconformances a) Continuous trainings on updated revisions of WEC QMS; PQP; and Policies & Procedures will be held among Obayashi personnel for awareness, familiarity, and implementation. b) Obayashi will revise, improve and implement its own QAP meeting the requirements of 10 CFR Part 50 Appendix B aside from the existing ISO9001. (4) Date when full compliance will be achieved a) Full compliance will be achieved by January 31, 2012 except for the long-term plan stated above.

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	b) For the long-term plan, Obayashi is expecting to achieve it by the end of March 2013.

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6. Nonconformance 99901409/2011-201-06

	Description
NRC Statement (E)	Criterion II of Appendix B to 10 CFR Part 50 states, in part, that the quality assurance program shall provide for indoctrination and training of personnel performing activities affecting quality as necessary to assure that suitable proficiency is achieved and maintained. Criterion XVIII, "Audits," of Appendix B to 10 CFR Part 50 states that "audits shall be performed in accordance with the written procedures or check lists by appropriately trained personnel not having direct responsibilities in the areas being audited." Contrary to the above, as of September 16, 2011, Obayashi failed to adequately qualify lead auditors for internal audits of Obayashi quality-related activities consistent with the requirements of Appendix B to 10 CFR Part 50 and the provisions of ASME NQA-1-1994, as required in the Westinghouse purchase orders.
Obayashi Response	(1) Reason for the Nonconformance Obayashi failed to recognize the difference of requirements between ISO9001 and with that of 10 CFR Part 50 Appendix B as well as ASME NQA-1 1994 in terms of qualifying lead auditor. (2) Corrective steps that have been taken and the results achieved a) Obayashi initiated a nonconformance report in relation to the nonconformance cited in this NRC inspection report by following Obayashi QAP. b) Obayashi is in the process of completing a complete gap analysis to fully understand the requirements of 10 CFR Part 50 Appendix B, ASME NQA-1 and Regulatory Guide 1.28 and differences with its existing quality program. (3) Corrective steps that will be taken to avoid further Nonconformances a) Obayashi will revise, improve and implement its own QAP meeting the requirements of 10 CFR Part 50 Appendix B as well as ASME NQA-1 aside from the existing ISO9001. b) Obayashi will have a trained and qualified auditor/s meeting the requirements of 10 CFR Part 50 Appendix B and ASME NQA-1. (4) Date when full compliance will be achieved Obayashi is expecting to achieve it by the end of March 2013.

Response to NRC Inspection Report Section 3, Design Control

3. Design Control

a. Inspection Scope

The NRC inspection team reviewed the Obayashi QMS and implementing procedures that govern Obayashi's design control activities to verify compliance with the requirements of Criterion III, "Design Control," of Appendix B to 10 CFR Part 50. In addition, the inspection team reviewed a number of WEC POs for Obayashi engineering services and the resulting calculations and discussed the associated activities with Obayashi management and technical staff.

Specifically, the NRC inspection team reviewed the following POs, calculations, and related supporting documentation for this inspection area:

- Quality Management System (QMS) – Quality Manual, 14th Edition, September 1, 2003
- QMS – Quality Manual, Revision 3, April 1, 2010
- Implementing Procedure T-35, "Procedure for Work Activities of Nuclear Facilities Division," Revision 14, September 1, 2003
- Implementing Procedure P-35, "Procedure for Work Activities of Nuclear Facilities Division," Revision 6, April 7, 2010.

  PO 4500176463, "Purchase of Engineering services from Obayashi Corporation," (Initial PO between WEC and Obayashi Corporation, Nuclear Division) September 16, 2005
- PO 4500176463, Change Notice 1: "Purchase of Engineering services from Obayashi Corporation," (added Line Item 4) March 30, 2006
- PO 4500176463, Change Notice 2: "Purchase of Engineering services from Obayashi Corporation," (added Line Item 4) May 31, 2006
- PO 4500176463, Change Notice 3: "Purchase of Engineering services from Obayashi Corporation," (added Line Item 5) October 27, 2006
- PO 4500176463, Change Notice 4: "Purchase of Engineering services from Obayashi Corporation," (added Line Item 6) November 22, 2006
- PO 4500176463, Change Notice 5: "Purchase of Engineering services from Obayashi Corporation," (added Line Items 7-10) December 20, 2006
- PO 4500176463, Change Notice 6: "Purchase of Engineering services from

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Obayashi Corporation," (added Line Item 11 & 12) May 16, 2007

- PO 4500234432, "Purchase of Engineering services from Obayashi Corporation," June 21, 2007
- PO 4500213322, "Purchase of Engineering services from Obayashi Corporation," January 31, 2007
- Calculation Report APP-1000-S2C-030,"Response Spectrum Analysis of AP1000 Auxiliary and Shield Building," Revision 3, issued June 2011.
- Calculation Report APP-1208-CCC-001,"Auxilliary Building Slab Joint Rebar to Connect with Shield Building Wall," Revision 0, issued November 2009.
- Calculation Report APP-1200-S2C-002, "ASB Thermal and Earth Pressure Analyses," Revision 3, issued July 2011
- Calculation Report APP-1230-SSC-002, "Auxiliary Building Steel Framing Design EL. 100', Areas 3&4," Revision 2, issued July 2008.
- Calculation Report APP-CA20-S3C-002,"CA20 Connection Design Calculation-Module Wall-to-Basemat," Revision 4, issued February 2011
- Calculation Report APP-1200-CCC-102,"Auxiliary Building Wall 7.3 Reinforcement Design," Revision 5, issued December 2007
- Calculation Report APP-1200-CCC-106,"Auxiliary Building Wall I Reinforcement Design," Revision 6, issued December 2009
- Calculation Report APP-1010-CCC-005, "Basemat Design, Below Auxiliary Building," Revision 2, issued March 2011
- Calculation Report APP-1260-SSC-002,"Auxilliary Building Steel Framing Design EL. 160'-6" Areas 3&4," Revision 1, issued August 2010
- Drawing APP-1200-C3-911, "Auxiliary Building Key Concrete Reinforcement Wall I Elevation between Column Lines 5 and 11," Revision 1, April, 2010.
- Drawing APP-1260-C3-346,"Auxilliary Building Key Concrete Reinforcement Roof El 160'-6" Areas 3&4," Revision 1, March, 2011.

b. Observations and Findings

b.1 Policies and Procedures

Note: 1. Black fonts are excerpt from NRC Inspection Report.
2. Blue fonts are Obayashi response.

Response to NRC Inspection Report Section 3, Design Control

The NRC inspection team reviewed Obayashi QMS, Section 7.0, "Realization of Structure," which contains design control guidance and activities, as well as the applicable portions of P-35, Obayashi's Nuclear Department implementing procedure for safety-related activities applicable to the AP1000 design.

The NRC inspection team reviewed P-35, Section 5, "Drawing Up Quality Plan Documents," and verified that this procedure provides guidance for developing "quality plans" that organizes customer requirements; applicable laws, regulations, and construction restrictions; schedules; fundamental policy; and a check sheet for confirmation of the content of the contract. P-35 also references management and control procedures to include controls of external standards and analytical programs and provides guidance for implementing "Quality Planning Document."

The NRC inspection team reviewed P-35, Section 6.1, "Guide for Documentation," that provides the guidance for implementing reviews to confirm that the requirements of the customer are being addressed, and to confirm the role sharing and method for mutual arrangement and communication of information for implementing work activities or identifying problems. P-35, Section 6.1 provides for the verification of design by confirming design inputs, appropriate information for construction, the criteria of applicable standards, and a description of distinctive features of the product (such as permissible loads and requirements for handling and maintenance) that are indispensable for the product's safe and appropriate use. The NRC inspection team verified that guidance was provided to confirm the appropriateness of the design by the procedure in the "Quality Plan Document" through confirmation of a model, simulation, or comparative evaluation; confirmation of performance during construction activities; comparative evaluation with similar certified designs or records of construction activities; or licensing requirements such as verification of building construction, and approval of the construction work plan.

b.2 Design Analyses

The NRC inspection team performed a technical review of multiple calculation reports and design drawings pertaining to reinforced concrete and steel design of the AP1000 nuclear island. Specifically, the NRC inspection team focused its efforts on reviewing the calculations and drawings relating to wall, roof, and floor sections that were either defined as critical sections in the AP1000 DCD or were representative of the application of structural codes American Concrete Institute (ACI) 349, "Code Requirements for Nuclear Safety-Related Concrete Structures and Commentary," and American Institute for Steel Construction (AISC) N690, "Specification for Safety-Related Steel Structures for Nuclear Facilities."

b.2.1 Response Spectrum Analysis of AP1000 Auxiliary and Shield Building

The NRC inspection team reviewed Obayashi calculation report APP-1000-S2C-030, "Response Spectrum Analysis of AP1000 Auxiliary and Shield Building," Revision 3, and noted references to various revisions of this calculation. WEC calculation report APP-1000-S2C-030 provides updated seismic analysis results from the AP1000

Response to NRC Inspection Report Section 3, Design Control

NI-05 standard design model. Results from this model are used in combination with the results of other calculations, performed by Obayashi, such as dead, live, thermal, and soil pressure loads. The NRC inspection team determined that APP-1000-S2C-030, Revision 3, dated June 6, 2011, was the most-recent revision at the time of this inspection and that calculated seismic demands had increased in certain portions of the model.

The NRC inspection team asked Obayashi to describe the process used to reconcile any Obayashi calculation that references calculation report APP-1000-S2C-030 to the latest revision of this calculation and to ensure the use of the latest revision in future calculations. After extensive discussions with Obayashi, the inspection team determined that Obayashi did not have a procedure to ensure that new AP1000 design information would be accounted for in past, present, and future Obayashi calculations. The absence of documented measures to ensure the control of changes to design information is a design change control issue and is further discussed in Section 3.b.4, "Design Change Control," of this report.

Response:

Westinghouse calculation APP-1000-S2C-030, "Response Spectrum Analysis of AP1000 Auxiliary and Shield Building," Revision 3, June 2011, is a document prepared by the engineers at its headquarters in Pittsburgh/Cranberry, PA.

(Note: Westinghouse Lead Engineer for seismic analysis authored all the three revisions).

Even though Obayashi did not have a 'procedure' to ensure that new WEC revisions are accounted for in their calculations, the Obayashi PO with Westinghouse required Obayashi to use latest design information from Westinghouse for the performance of all calculations. Thus Obayashi did not rely on previous Obayashi calculations for design input, but instead uses the latest design information from Westinghouse document management control per Westinghouse procedure NSNP 3.2.6.

b.2.2 Auxiliary Building Slab Joint Rebar to Connect with the Shield Building Wall

The NRC inspection team reviewed Obayashi calculation report APP-1208-CCC-001, "Auxiliary Building Slab Joint Rebar to Connect with Shield Building Wall," which describes the design of the Auxiliary Building composite steel floor slabs connections to the AP1000 shield building wall. Based on review of this calculation, the NRC inspection team indentified that there were some floor slab locations with demands in excess of design capacity. Obayashi justified the exceedances on the basis that the average values of required reinforcement were less than allowed by code.

Calculation report APP-1208-CCC-001 did not describe the methodology for calculating the average values of reinforcement. Therefore, the NRC inspection team asked Obayashi to provide the necessary justification. In response, Obayashi

provided finite element plots showing locations were the exceedances occur. The inspection team reviewed the finite element plots and verified that the areas of exceedances were both small and localized. The NRC inspection team found the technical basis for addressing the exceedances to be acceptable.

Response:

As stated above in the NRC review, the NRC inspection team found the technical basis for addressing the exceedances to be acceptable.

b.2.3 Auxiliary Building Thermal and Earth Pressure Analysis

The NRC inspection team reviewed Obayashi calculation report APP-1200-S2C-002, "Auxiliary Building Thermal and Earth Pressure Analysis," which contains the calculations for the design member forces on walls and floors below grade due to combined thermal and seismic demands. The NRC inspection team noted that the calculation report references APP-1000-S2C-030, Revision 3, and therefore is based on the most-recent seismic analysis results (refer to Section 3.b.2.1, above). The calculation also references thermal inputs (from WEC calculations) for accident and normal load cases. The NRC inspection team noted that the calculation method used to develop dynamic soil pressure was consistent with the provisions of American Society of Civil Engineers (ASCE) 4-98, "Seismic Analysis of Safety-Related Nuclear Structures and Commentary," and AP1000 DCD Section 3.8.4.1.1, "Seismic Category I Structures."

Response:

The NRC inspection team reviewed Obayashi calculation report APP-1200-S2C-002, "Auxiliary Building Thermal and Earth Pressure Analysis". As stated above in their review, the team concluded that the calculation is in conformance with the code requirements and the DCD commitments.

b.2.4 Auxiliary Building Steel Framing Design EL.100"-0" Areas 3&4

The NRC inspection team reviewed Obayashi calculation report APP-1230-SSC-002, "Auxiliary Building Steel Framing Design EL.100"-0" Areas 3&4," which contains design requirements for the composite steel floor slabs at the 100-ft elevation. The NRC inspection team noted that seismic demands were based on an earlier revision of APP-1000-S2C-030 and, therefore, may need to be updated (Refer to 3.b.2.1, above). The NRC inspection team reviewed the report and determined that the approach applied for calculating the composite steel floor slabs was consistent with the provisions of ACI-349 and AISC N690. Although the NRC inspection team did not identified any technical issues specific to this calculation report, Obayashi needs to reconcile the seismic demands with the most-recent revision to APP-1000-S2C-030. This is a design change control issue, and is discussed further in Section 3.b.4 of this report.

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Response:

Obayashi calculation APP-1230-SSC-002 (Auxiliary Building Floor Design EL.100"-0" Areas 3&4") contains the design of a composite floor (steel beams supporting metal deck, with shear connectors, with 9" thick concrete at the top):

The NRC team review concluded that the design approach for the composite floor was consistent with the provisions of ACI-349 and AISC N690. However, the NRC identified the need to reconcile the design to meet the seismic loads based on the latest revision of APP-1000-S2C-030.

The AP1000 DCD and the design certification are based on the design of 'Critical Sections'. The design approach for the critical sections was reviewed by the NRC. The design reconciliation, for the latest loads, of other similar structures is being performed as part of the design finalization.

The design reconciliation of APP-1230-SSC-002 (Auxiliary Building Floor Design EL.100"-0" Areas 3&4"), for the latest loads, will be performed as part of this design finalization process.

b.2.5 CA-20 Connection Design Calculation: Module Wall-to-Basemat

The NRC inspection team reviewed Obayashi calculation report APP-CA20-S3C-002, "CA-20 Connection Design Calculation: Module Wall-to-Basemat," which contains the design requirements for the connection of the CA-20 module (a containment internal structural module) to the AP1000 nuclear island basemat. The NRC inspection team determined that the calculation references an older version of the response spectrum analysis (see 3.b.2.1, above). This is a design change control issue, and is discussed further in Section 3.b.4 of this report.

The NRC inspection team reviewed Section 5.1.2.1 of APP-CA20-S3C-002 and determined that the center of the dowel reinforcement is 10-inches from the skin reinforcement (i.e. steel face plates). In accordance with Section 12.14.2.3 of ACI-349, the lap splice distance between reinforcements is to be limited to 6-inches. In response to NRC inspection team inquiries relating to the lap splice distances, Obayashi determined that WEC had revised the calculation and modified the design of the connection. Obayashi learned of the changes implemented by WEC during this inspection as part of its research to respond to inquiries from the NRC inspection team. This is a design interface issue, and is discussed further in Section 3.b.3, "Design Interfaces," of this report.

The NRC inspection team reviewed Section 4.5.4.4 of APP-CA20-S3C-002, and determined that accident thermal loads were excluded from the calculation, which is inconsistent with the provisions of ACI-349 that require the combination of accident thermal and seismic loads. The NRC inspection team is aware of a WEC AP1000

design commitment to combine seismic and thermal demands, as applicable, but Obayashi had not yet been informed of this commitment and the need to revise this calculation. This is a design interface issue, and is discussed further in Section 3.b.3 of this report.

Response:

Obayashi is contracted to support WEC on as needed basis. Work packages are assigned to Obayashi based on various considerations; such as, the availability of resources at WEC Headquarters and at Obayashi Tokyo office, and the urgency for the completion of the tasks.

This calculation, APP-CA20-S3C-002, covers the design of the connection between the CA20 structural module and the basemat. Obayashi had prepared APP-CA20-S3C-002, "CA-20 Connection Design Calculation: Module Wall-to-Basemat," Rev 0 to Rev 3. These calculations used the dowel reinforcement for splicing.

The standard plant design was changed, per DCP APP-GW-GEE-2090, from dowel bars to embedded plates with mechanical connection. Therefore, for expeditious design finalization, WEC decided not to get Obayashi involved. WEC got APP-CA20-S3C-002, Rev 4 to Rev 6, prepared by engineers at the WEC headquarters office (Cranberry, PA).

b.2.6 Auxiliary Building Wall 7.3 Reinforcement Design

The NRC inspection team reviewed Obayashi calculation report APP-1200-CCC-102, "Auxiliary Building Wall 7.3 Reinforcement Design," which provided the design of an AP1000 nuclear island shear wall. The NRC inspection team noted that Section 5.1.2.2 of the report stated that the in-plane shear stress demands exceed ACI-349 Section 11.10.3 provisions pertaining to shear walls. Obayashi dealt with the exceedance by designing the wall as a corbel. Provisions for the design of corbels are described in Section 11.9 of ACI-349. In designing this share wall as a corbel, Obayashi averaged the in-plane shear stresses over the entire 60-foot wall height, thus reducing the calculated maximum shear stress applied to the wall to a lower average value.

The NRC inspection team reviewed the Obayashi justification and found the justification unacceptable. The NRC inspection team determined that the complex state of in-plane shear stresses due to penetrations and intercepting walls and floors (as demonstrated by detailed calculation results) cannot be averaged over the 60-foot wall height as was the case when Obayashi represented the shear wall as a simple corbel element. Obayashi's failure to correctly implement the provisions of ACI-349 consistent with the requirements of Criterion III of Appendix B to 10 CFR Part 50 has been identified as an example of Nonconformance 99901409/2011201-03.

The NRC inspection team evaluated this misapplication of ACI-349 and determined

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that it was not of high safety significance due to the high degree of redundancy. In addition, the NRC inspection team verified that cracking of the particular shear wall will not lead to a reduction in lateral resistance of the auxiliary building or shield building.

Response:

The NRC inspection team noted that the in-plane shear stress demands exceed ACI-349 Section 11.10.3 provisions pertaining to shear walls. Obayashi dealt with the exceedances by designing the wall as a corbel.

Provisions for the design of corbels are described in Section 11.9 of ACI-349. In designing this shear wall as a corbel, Obayashi averaged the in-plane shear stresses over the entire 60-foot wall height, thus reducing the calculated maximum shear stress applied to the wall to a lower average value. The NRC inspection team evaluated this as a misapplication of ACI-349.

The wall 7.3 ties the shield building to the exterior wall I and the in-plane shear forces are transferring vertical forces from the much higher shield building out to wall I and the basemat. This is similar to the behavior of a corbel. It can also be considered as a low rise shear wall for which the section to be considered would be the full height of the wall.

Nevertheless, the exceedances occur in elements close to the shield building above elevation 135' 3" at the top of the wall as shown by Figures A.3-3c and A.6-2 of the calculation. The reduced stiffness of this wall relative to the shield building due to cracking of the wall will redistribute the forces with a small increase in the vertical force in the shield building wall and a corresponding reduction of the in-plane shear in Wall 7.3.

The NRC inspection team also determined, as stated in the Inspection report, that it was not of high safety significance due to the high degree of redundancy. Additionally, the NRC inspection team has also noted that cracking of the particular shear wall will not lead to a reduction in lateral resistance of the auxiliary building or the shield building.

b.2.7 Auxiliary Building Wall 1 Reinforcement Design

The NRC inspection team reviewed Obayashi calculation report APP-1200-CCC-106, "Auxiliary Building Wall 1 Reinforcement Design," which provides the design of an exterior shear wall for the AP1000 nuclear island. The NRC inspection team determined that the report did not reference the most-recent AP1000 response spectrum model which indicated a 30 to 40 percent increase in seismic moment and an 80-percent increase in axial load for this particular wall (refer 3.b.1, above). In addition, the NRC inspection team determined that Section 4.5.3 of APP-1200-CCC-106 did not include ACI-349 load combinations for thermal and seismic demands. As discussed Section 3.b.2.5 of this report, Obayashi had not yet

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been informed of the WEC AP1000 design commitment to combine seismic and thermal demands, as applicable, and the need to revise this calculation. This is a design interface issue, and is discussed further in Section 3.b.3 of this report.

Response:

Obayashi is contracted to support WEC on as needed basis. Work packages are assigned to Obayashi based on various considerations, such as, the availability of resources at WEC Headquarters and at Obayashi Tokyo office, and the urgency for completion of the tasks.

Obayashi has been informed that WEC has performed a calculation to address the issues identified in the NRC Inspection Report for Wall 1 as follows.

Auxiliary Building Wall 1 is a 'Critical Section'. The purpose of WEC calculation was to perform a structural assessment of the AP1000 nuclear island critical sections for the load combination of safe shutdown earthquake and normal thermal load demand.

That assessment provided assurance that the design of the critical sections, including Wall 1, is acceptable for the direct combination of SSE and normal thermal demand in accordance with the load combinations specified in Section 9.2.1 of ACI 349. It has been demonstrated the critical sections continue to perform their intended nuclear safety function, and there is no change required in the reinforcement provided.

b.2.8 Basemat Design, Below Auxiliary Building

The NRC inspection team reviewed Obayashi calculation report APP-1010-CCC-005, "Basemat Design, Below Auxiliary Building," dated March 2011. This calculation report described the design of the reinforced concrete basemat below the auxiliary building. The NRC inspection team reviewed this calculation report and determined that it references APP-1200-S2C-002, Revision 1 (September 2005). The NRC inspection team determined that APP-1200-S2C-002 was revised (to Revision 2) in October 2007, but was not referenced in the most-recent revision to APP-1010-CCC-005. Accordingly, APP-1010-CCC-005 does not reflect the most-recent information available at the time of issuance. This failure to update the calculation report is a design change control issue, and is discussed further in Section 3.b.4 of this report.

Response:

APP-1010-CCC-005 documents the design of the 6' thick basemat below the auxiliary building. The NRC correctly identified that APP-1010-CCC-005, Rev 2, of the calculation references Rev 1 of APP-1200-S2C-002 when Rev 2 had already been issued.

Note: 1. Black fonts are excerpt from NRC Inspection Report.
2. Blue fonts are Obayashi response.

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A draft Rev 3 of basemat calculation APP-1010-CCC-005 has been prepared. It used the latest revision of APP-1200-S2C-002. Since the member forces at the interface of the exterior walls and basemat are not significantly different, the basemat design is adequate.

b.2.9 Auxiliary Building Steel Framing Design

The NRC inspection team reviewed Obayashi calculation report APP-1260-SSC-002, "Auxiliary Building Steel Framing Design." This calculation report described the design for the composite steel framing used in the auxiliary building at the 160-foot elevation. The NRC inspection team performed a review of the calculation report and found the approach consistent with ACI-349 and AISC/N690 code provisions.

Response:

The NRC inspection team found the design approach consistent with ACI-349 and AISC/N690 code provisions. No response required.

b.2.10 Review of ANSYS model

The NRC inspection team reviewed Obayashi's implementation of the ANSYS finite element (FE) analysis code. The ANSYS code is a general purpose FE code used by both WEC and Obayashi to perform detailed structural calculations for design basis demands. The NRC inspection team reviewed the general implementation process and the process for receiving code errors and notices from ANSYS and implementing corrections. The NRC inspection team also reviewed the implementation of the ANSYS code as it applied to the WEC AP1000 NI-05 model, including the boundary conditions and material properties at selected locations, and verified that they were consistent with the AP1000 seismic analysis model. In addition, the inspection team verified that the total model mass is consistent with the WEC AP1000 NI-05 model.

Response:

As stated above, the NRC team reviewed and was satisfied with the WEC ANSYS model

b.2.11 Auxiliary Building Structural Drawings

The NRC inspection team reviewed Obayashi structural drawings APP-1200-C3-911, Revision 1, "Auxiliary Building Key Concrete Reinforcement Wall 1 Elevation Between Column Lines 5 & 11" and APP-1260-C3-346, Revision 2, "Auxiliary Building Areas 3&4 Key Concrete Reinforcement Floor El. 160'-6" Plan" to verify that drawing details were consistent with the supporting design calculations. The

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inspection team determined that Obayashi is only responsible for concrete layout reinforcement drawings and that WEC had subsequently modified the remainder of the Obayashi drawings. The NRC inspection team determined that Obayashi did not have a formal process in place to track drawing revisions that describe and detail the AP1000 design. This is a design change control issue, and is discussed further in Section 3.b.4 of this report.

Response:

The concrete rebar drawings for construction are prepared by Westinghouse INITEC (Westinghouse office in Spain).

To facilitate the INITEC review of the design calculations prepared by Obayashi, C3 drawings are provided by Obayashi to INITEC. These C3 drawings (such as APP-1200-C3-911, APP-1260-C3-346, etc) are just the input information for review of the calculations and for preparation of final rebar drawings to be produced by INITEC. If INITEC finds any inconsistency or discrepancy, it is reported to Obayashi and WEC.

It is not the responsibility of Obayashi to keep track of the drawing revisions; the drawing revisions are tracked by Westinghouse. The latest revision number of the documents is available in the Westinghouse document management system.