July 16, 2010

Rob Sisk
Manager AP1000 Licensing and Customer Interface
Westinghouse Electric Company,
Suite 115
1000 Westinghouse Dr
Cranberry Township, PA 16066

SUBJECT: NRC INSPECTION REPORT NO. 05200006/2010-202 AND (NOTICE OF VIOLATION)

Dear Mr. Sisk:

On May 25 through 28, 2010, U.S. Nuclear Regulatory Commission (NRC) inspectors conducted an inspection of testing being conducted by Purdue University under contract to Westinghouse. The inspection was focused on Westinghouse's oversight and dedication of the testing activities as related to the design of the AP1000 shield building.

This limited scope inspection focused on assessing your compliance with the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 21, "Reporting of Defects and Noncompliance," and selected portions of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities." This NRC inspection report does not constitute NRC endorsement of your quality assurance or 10 CFR Part 21 program(s).

Based on the results of this inspection, the NRC has determined that three Severity Level IV violations of NRC requirements occurred. The violations are cited in the enclosed Notice of Violation (Notice) and the circumstances surrounding them are described in detail in the subject inspection report. The violations are being cited in the Notice because NRC inspectors identified that Westinghouse Electric Company (WEC) failed to verify through its commercial grade dedication process a number of critical characteristics associated with the in-plane shear testing conducted at Purdue University. Specifically, WEC failed to verify critical characteristics associated with the test specimen, the calibration and installation of displacement sensors, the test procedure, and the selection of sensors for measuring the applied force to the test specimen.

You are required to respond to this letter and should follow the instructions specified in the enclosed Notice when preparing your response. The NRC will use your response, in part, to determine whether further enforcement action is necessary to ensure compliance with regulatory requirements.

In accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding," a copy of this letter, its enclosures, and your response will be made available electronically for public inspection in the NRC Public Document Room or through the NRC's Agencywide Documents Access and Management System (ADAMS) at http://www.nrc.gov/reading-

rm/adams.html. To the extent possible, your response should not include any personal privacy, proprietary, or Safeguards Information so that it can be made available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request that such material is withheld from public disclosure, you must specifically identify the portions of your response that you seek to have withheld and provide, in detail, the bases for your claim (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If Safeguards Information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements."

Sincerely,
/RA/

Juan Peralta, Chief
Quality and Vendor Branch 1
Division of Construction Inspection
& Operational Programs
Office of New Reactors

Docket No.: 05200006

Enclosures:
1. Notice of Violation
2. Inspection Report No. 05200006/2010-202

proprietary, or Safeguards Information so that it can be made available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request that such material is withheld from public disclosure, you must specifically identify the portions of your response that you seek to have withheld and provide, in detail, the bases for your claim (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If Safeguards Information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements."

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DATE	7716/2010		7/15/2010					

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NOTICE OF VIOLATION

Westinghouse Electric Company
Suite 153
1000 Westinghouse Drive
Cranberry Twp, PA 16066

Docket No.: 5200006
Inspection Report No.: 2010-202

During a U.S. Nuclear Regulatory Commission (NRC) inspection of testing commissioned by Westinghouse and performed at Purdue University in West Lafayette, Indiana, on May 25 through 28, 2010, violations of NRC requirements were identified. In accordance with NRC Enforcement Policy, the violations are listed below:

A. 10 CFR Part 21.3, defines "Dedication" as … an acceptance process undertaken to provide reasonable assurance that a commercial grade item to be used a basic component will perform its intended safety function and, in this respect, is deemed equivalent to an item designed and manufactured under a 10 CFR Part 50, Appendix B, quality assurance program. This assurance is achieved by identifying the critical characteristics of the item and verifying their acceptance by inspections, tests, or analysis performed by the purchaser or third party dedicating entity…."

Criterion III, "Design Control," of Appendix B to 10 CFR Part 50, states, in part, that "applicable regulatory requirements and the design basis are correctly translated into specifications, drawings, procedures, and instructions." It also states that "measures shall be established for the selection and review for suitability of application of materials, parts, equipment, and processes that are essential to the safety-related functions of the structures, systems, and components."

Criterion VIII, "Identification and Control of Materials, Parts, and Components," of Appendix B to 10 CFR Part 50, states, in part, that "measures shall be established for the identification and control of materials, parts, and components, including partially fabricated assemblies. These measures shall assure that identification of the item is maintained by heat number, part number, serial number, or other appropriate means, either on the item or on records traceable to the item."

Section 7.1, General, of Westinghouse Electric Company (WEC) Policy/Procedure 7.2, "Dedication of Commercial Grade Items," Revision 1, dated August 3, 2009, states, in part …that dedication activities required to ensure that a commercial grade item meets the quality and performance requirements specified for safety-related application shall be described in Commercial Dedication Instructions (CDIs)..."

Contrary to the above, for the test specimen used as part of the in-plane shear test, Westinghouse APP-1208-GQH-001, "Commercial Dedication Instruction," did not identify the appropriate controls to ensure that the critical characteristics for the steel plate and concrete aggregate size had been verified. (Violation 05200006/2010-202-01).

This is a severity level IV violation (Supplement II)

B. Criterion XI of Appendix B to 10 CFR Part 50, states in part, "A test program shall be established to assure that all testing required to demonstrate that structures, systems,

and components will perform satisfactorily in service is identified and performed in accordance with written test procedures which incorporate the requirements and acceptance limits contained in applicable design documents.

Contrary to the above, Westinghouse APP-1208-GQH-001, "Commercial Dedication Instruction," did not verify that the necessary procedures had been developed to assure that all testing required to demonstrate that structures, systems, and components will perform satisfactorily in service were identified and performed in accordance with written test procedures that incorporate the requirements and acceptance limits contained in applicable design documents. Specifically, procedures were not developed for the calibration and installation of the displacement sensors, nor for performance of the actual in plane shear test. (Violation 05200006/2010-202-02).

This is a severity level IV violation (Supplement II)

C. Criterion III to Appendix B to 10 CFR Part 50 states in part, "Measures shall also be established for the selection and review for suitability of application of materials, parts, equipment, and processes that are essential to the safety-related functions of the structures, systems, and components.

Contrary to the above, Westinghouse APP-1208-GQH-001, "Commercial Dedication Instruction," did not verify that the equipment chosen to measure the applied force to the test specimen was suitable for its intended function. Specifically, equipment was not installed to directly measure the force being applied to the test specimen. There were no load cells installed between the hydraulic actuators and the test specimen, so during the test, a direct measurement of the force being applied by the hydraulic actuators to the test specimen was not obtained. The method utilized to derive the applied force was from pressure transmitters installed on the input lines to the hydraulic actuators. This method of measuring the applied force relied upon unverified vendor information and did not account for frictional losses within the hydraulic actuators. (Violation 05200006/2010-202-03).

This is a severity level IV violation (Supplement II)

Pursuant to the provisions of 10 CFR 2.201, "Notice of Violation," Westinghouse is hereby required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN:Document Control Desk, Washington, DC 20555-0001, with a copy to the Chief, Quality and Vendor Branch 1, Division of Construction Inspection and Operational Programs, Office of New Reactors, within 30 days of the date of the letter transmitting this Notice of Violation. This reply should be clearly marked as a "Reply to a Notice of Violation" and should include for each violation (1) the reason for the violation, or, if contested, the basis for disputing the violation or severity level, (2) the corrective steps that have been taken and the results achieved, (3) the corrective steps that will be taken to avoid further violations, and (4) the date when full compliance will be achieved. Your response may reference or include previous docketed correspondence, if the correspondence adequately addresses the required response. Where good cause is shown, the NRC will consider extending the response time.

Because your response will be made available electronically for public inspection in the NRC Public Document Room or through the NRC's Agencywide Documents Access and Management System at http://www.nrc.gov/reading-rm/adams.html, to the extent possible, it

should not include any personal privacy, proprietary, or Safeguards Information so that it can be made available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If Safeguards Information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements."

Dated this 16th day of July 2010.

U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NEW REACTORS
DIVISION OF CONSTRUCTION INSPECTION AND
OPERATIONAL PROGRAMS

Docket No.:	05200006
Report No.:	05200006/2010-202
Vendor:	Westinghouse Electric Company 1000 Westinghouse Drive Cranberry Twp, PA 16066
Vendor Contact:	Mr. Michael M. Corletti Director, AP1000 Plant Engineering New Plants Engineering
Nuclear Industry:	This inspection was conducted to review testing being performed for Westinghouse by Purdue University, as related to the design of the AP1000 shield building, as detailed in Revision 17 to the AP1000 Design Control Document. The stated purpose of this testing was to show that the performance of the AP1000 shield building, which is a steel and concrete structure, can be acceptably analyzed using provisions of ACI 349, which is a code that was written for the analysis of reinforced concrete structures.
Inspection Dates:	May 25 – 28, 2010

Inspection Team:			
	Jeffrey Jacobson	NRO/DCIP/CQVB	Team Leader
	Richard McIntyre	NRO/DCIP/CQVB	
	Annie Ramirez	NRO/DCIP/CQVA	
	Bret Tegeler	NRO/DE/SEB1	

Approved by:	Juan Peralta, Chief Quality and Vendor Branch 1 Division of Construction Inspection & Operational Programs Office of New Reactors

ENCLOSURE 2

EXECUTIVE SUMMARY

Westinghouse Electric Company
05200006/2010-202

Background

This inspection was focused on the testing being performed for Westinghouse Electric Company (WEC) by Purdue University (Purdue) in support of the design of the AP1000 shield building. The stated purpose of this testing was to show that the performance of the AP1000 shield building, which is a steel and concrete structure, can be acceptably designed and analyzed using the provisions of American Concrete Institute (ACI) 349, which is a code that is applicable to the analysis of reinforced concrete nuclear power plant structures. Since Purdue University does not have an approved nuclear quality assurance program that meets the requirements of Appendix B to 10CFR Part 50, Westinghouse's approach was to dedicate the testing in accordance with 10CFR Part 21 requirements, as necessary to allow the test data to be utilized to support the design of a basic component (e.g. the shield building). The test involved applying a series of known shear forces to the test specimen in the horizontal direction, while at the same time measuring the resulting deflection and material strain at various points within the test specimen.

The specific areas of the dedication process that were reviewed by the team included: the test specimen; the test setup; the test procedure; the test equipment; instrumentation and data acquisition; and personnel training and qualifications. For each area within the dedication process the team reviewed the specified function, critical characteristics and verification methods as described within WEC instruction APP-1208-GQH-001, "Commercial Dedication Instruction."

Dedication of Test Specimen

The inspectors concluded that the WEC dedication activities conducted for the in-plane test specimen were not consistent with applicable regulatory requirements, internal WEC requirements, and industry practices for the dedication of commercial grade items. Specifically, WEC failed to test each piece of A36 plate material and conduct verification activities for the concrete aggregate size. This deficiency was identified as Notice of Violation 05200006/2010-202-01.

Dedication of Test Setup

The inspectors performed a detailed review of the applicable design drawings contained in the design report and compared the as-built dimensions to those shown in the report drawings. Although WEC documented several as-built departures from the design drawings, they were judged (by Purdue) to be insignificant to the test results. The inspectors reviewed the technical justifications for these departures and noted only one issue where the prototype material was different from the AP1000 design. The inspection team did not identify any deficiencies with the physical testing equipment and that the test setup accurately matched that described in the WEC design report, APP-1200-S3R-003, "Design Report for the AP1000 Shield Building."

Dedication of Testing Procedure

The inspectors identified that although Purdue had developed a test summary sheet containing loading protocol information, a comprehensive step by step test procedure was not developed for performing the actual test. The inspectors also noted that Purdue had an informal (or "skill-of-the-craft") process for performing load stabilization and initializing (or zeroing) instruments such as strain gauges and displacement sensors. No formal written procedures were developed. The NRC has identified this deficiency as part of Violation 05200006/2010-202-02.

Dedication of Test Equipment

The inspectors identified that there were no load cells installed between the hydraulic actuators and the test specimen, so during the test, a direct measurement of the force being applied by the hydraulic actuators to the test specimen was not obtained. Consequently, the actual force that was applied to the test specimen during the in-plane shear test was indeterminate. The NRC has identified this deficiency as Violation 05200006/2010-202-03.

Dedication of Instrumentation and Data Acquisition Equipment

The inspectors concluded that the verification methods used to ensure the correct electrical connection of the installed sensors were sufficient; however, no measurements were taken to ensure the displacement sensors were properly installed, and no acceptance criteria were developed to account for tolerances surrounding installation of the displacement sensors. The lack of installation procedures and tolerances for installation of the displacement sensors was identified as part of Violation 05200006/2010-202-02.

The inspectors also identified that WEC, through its dedication process, had not taken sufficient measures to verify the adequacy of the calibration of the installed sensors used to measure the displacement of the test specimen. As part of the inspection, the inspectors witnessed a simulated calibration of the sensors which was generally straightforward; however, the inspectors identified that it was not clear from the process what the actual calibration parameters were that were being controlled and what level of accuracy was being credited in the testing. The NRC has identified this deficiency as part of Violation 05200006/2010-202-02.

Dedication of Training and Qualification of Personnel

The inspectors concluded that the Purdue staff members involved with the testing program were adequately trained for their given tasks.

REPORT DETAILS

1. Background

This inspection was focused on the testing being performed for Westinghouse by Purdue University in support of the design of the AP1000 shield building. The acceptability of the shield building design is currently under review by the NRC staff as part of its review of Westinghouse's application for an amendment to the AP1000 certified design. The stated purpose of this testing was to show that the performance of the AP1000 shield building, which is a steel and concrete structure, can be acceptably designed and analyzed using the provisions of American Concrete Institute (ACI) 349, which is a code that is applicable to the analysis of reinforced concrete nuclear power plant structures. Since Purdue University does not have an approved nuclear quality assurance program that meets the requirements of Appendix B to 10CFR Part 50, Westinghouse is dedicating the testing activity in accordance with 10 CFR Part 21 requirements, as necessary to allow the test data to be utilized to support the design of a basic component (i.e., the shield building).

The test involved applying cyclic shear forces to the test specimen in the horizontal direction, while at the same time measuring the resulting deflection and material strain at various points within the test specimen. A more specific description of the test is contained in Section 7.12 of APP-1200-S3R-003, Revision 2, "Design Report for the Enhanced Shield Building." APP-1200-S3R-003 also contains a description of several other tests performed at Purdue relative to the design of the shield building; however, the scope of this inspection was limited to the in-plane shear test only. Portions of the in-plane shear test were witnessed by the Nuclear Regulatory Commission (NRC) inspectors during the inspection.

Westinghouse's approach to the dedication of the in-plane shear testing is contained in Commercial Dedication Instruction (CDI), APP-1208-GQH-001. The specific areas of the testing process that were reviewed by the team included: dedication of the test specimen; test setup; the test procedure; test equipment; instrumentation and data acquisition; and personnel training and qualification. For each area within the dedication process the team reviewed the specified function, critical characteristics and verification methods, as listed within the CDI.

Revision 1 of the CDI was issued on May 21, 2010, to better define the critical characteristic and acceptance criteria for the fabrication and testing services; however, this revision of the CDI did not specifically identify the safety function and associated critical characteristics for items that were procured commercially and dedicated for the test specimen, the associated testing equipment, data acquisition equipment and instrumentation. Consequently, as a result of the inspectors' concerns, WEC revised the CDI during the inspection. This revision 2, dated May 25, 2010, was presented to the team for review. This revision of the CDI still did not identify each item to be dedicated but broke dedication activities down into six areas and further identified the function, the specific critical characteristics and the verification methods that were applied. The six areas that were referenced in revision 2 included:

- In-plane test setup
- In-plane test specimen
- In-plane test procedure
- Testing equipment
- Instrumentation and data Acquisition

- Welding qualifications

The acceptance documentation that typically would be part of the verification activity was listed in a separate section, "Acceptance Documentation." This included generic references to: fabrication drawings, instructions and and/or specifications; material test reports; welder certifications; calibration records, personnel training and qualification records; deviation notices and test data and final report. The following sections of this inspection report document the results of the team's review of each of the six dedication areas.

2. Dedication of Test Specimen

2.a Inspection Scope

The inspectors reviewed section E.2 of the CDI which describes WEC's dedication methodology for the in-plane test specimen. Procedures reviewed included the following:

- WEC 7.2, "Dedication of Commercial Grade Items," Revision 1, dated August 3, 2009
- APP-1208-GQH-001, "Commercial Dedication Instruction," Revision 0, dated March 24, 2010
- APP-1208-GQH-001 "Commercial Dedication Instruction," Revision 1, dated May 21, 2010
- APP-1208-GQH-001, "Commercial Dedication Instruction," Revision 2, dated May 25, 2010

2.b Observations and Findings

Revision 2 of the CDI states that the function of the test specimen is to simulate behavior of the AP1000 shield building wall, with the critical characteristics listed as: the yield strength of the carbon steel plate, Nelson studs and tie bar (D2L); dimensions of the carbon steel plate, studs, and D2L; and concrete aggregate size and minimum compression strength. Verification methods specified by the CDI included having:

- the WEC headquarters engineer review and approve all specimen drawings
- the WEC onsite project manager review the material test reports for the steel plate, studs, and D2Ls
- samples of the steel material sent to an independent lab for verification of material properties
- the WEC headquarters engineer review and approve the concrete mix design
- the WEC project manager obtain concrete batch data on the day of cast
- the WEC project manager measure dimensions of steel plate, locations of D2Ls, and location of studs on the test specimen
- the WEC project manager witness concrete cylinder testing and verify that the concrete has the proper material strength (6000psi)
- the WEC project manager obtain batch records from the concrete vendor on day of cast
- the WEC project manager release materials for use in fabrication of test specimens

The in-plane shear wall plate material for the web and flange was procured from Benchmark Fabricated Steel (BFS) as commercial material. Purdue purchased six ¼ in x 72 in x 144 in A36 steel plates from BFS that were originally milled by NUCOR Steel Tuscaloosa, Inc. The Mill

Test Certificate (CMTR) was issued by NUCOR in September 2009 to Chapel Steel and identified the material heat number for each plate and also included the chemical composition as well as physical properties such as yield and tensile strength. Oversight of BFS or other commercial suppliers in the chain of supply by Westinghouse was never performed to verify that BFS had appropriate quality controls in place for material/heat number traceability.

All fabrication performed by BFS was conducted to Purdue supplied drawings. This included the welding of the shear studs and D2L and other manufacturing activities for cutting holes for the post tensioning rods on the web plate. The inspectors requested the results of the testing performed by Purdue to verify the chemical and physical properties for each plate received from BFS since they could not take credit for the CMTR for each plate since they had not verified traceability controls through audit or survey at BFS. Westinghouse stated that they had only tested one plate that represented the heat number of the material for all six plates.

The inspectors also reviewed the dedication activities performed for verification of the minimum concrete compression strength of 6000 PSI and the aggregate size. The inspectors reviewed the results from a sample of the concrete tests for air entrainment and slump verification and found them acceptable. Westinghouse, did not however, perform any actions to verify that the received concrete contained the correct aggregate size, since the concrete aggregate size was listed as a critical characteristic. The NRC has identified this deficiency as Notice of Violation 05200006/2010-202-01 for failure to test each piece of A36 plate material received from BFS and for failure to conduct verification activities for the concrete aggregate size.

The inspectors attempted to review the receipt inspection procedure and activities for the plates and other specimen items. The inspectors determined there was no formal documented receipt inspection procedure at Purdue. During discussions with the Westinghouse project manager at Purdue, it was described that he reviews the dimensional provisions of the drawings, verifies the dimensions with a check mark, and makes notations directly on the in-plane shear test drawing of any deviations. He stated that he would initiate a formal deviation report if any deviations from the drawing were identified. A formal receipt inspection with identified activities and acceptance tolerances was not performed. The inspectors reviewed examples where deviation reports had been issued and corrected as necessary.

2.c Conclusions

The inspectors concluded that the Westinghouse dedication activities conducted for the in-plane test specimen were not consistent with applicable regulatory requirements, WEC 7.2 requirements and industry practices for the dedication of commercial grade items. The WEC CDI and accompanying documentation did not contain an appropriate level of objective evidence to support the actual dedication activities that were conducted. This deficiency was identified as Notice of Violation 05200006/2010-202-01 for failure to test each piece of A36 plate material received from BFS and conduct verification activities for the concrete aggregate size.

3. Dedication of Test Setup

3.a Inspection Scope

The inspectors reviewed Section E.1. of the CDI that describes WEC's dedication methodology for the test setup. The inspectors also reviewed the in-plane test set-up to ensure that it was consistent with the test plan described in Section 7.12 of the Westinghouse Design Report for the AP1000 Enhanced Shield Building (the WEC Design Report), APP-1200-S3R-003. The

inspectors examined the installed configuration of the significant testing equipment used in the in-plane shear test (hydraulic actuators, pins and clevises, spreader beam, and bottom blocks). The staff reviewed the design report to verify that the testing equipment had been designed to withstand both monotonic and reversed cyclic loading with peak forces exceeding more than 1,000 kips. The inspectors reviewed design calculations for the pins, clevises, and spreader beams, to verify that these components were designed to remain elastic, stable, and deform minimally as to not affect the test results. The inspectors reviewed calculations for performing post-tensioning of the concrete bottom blocks such that the specimen would not move under test loading.

3.b Observations and Findings

The CDI states that the function of the test setup is to adequately apply in-plane loading to the test specimen, with critical characteristics of the test setup being: the dimensions of the steel plate; location of studs; location of anchorage to reaction blocks; and location of applied loads. The CDI states that these critical characteristics will be verified by having the WEC headquarters project engineer review and approve all setup calculations and drawings. In addition, the CDI states that the WEC on site project manager will verify dimensions and assembly of the setup.

The design report describes the 1/3-scale test intended to simulate a full-scale section of the AP1000 shield building. In section 7.12.2 of the report, WEC states that the significant specimen details are wall thickness (12-inches), steel plate thickness (0.25 inches), steel plate yield stress (50-60 ksi), stud diameter (0.25 inches), tie-bar diameter (0.25 in), and concrete strength (6 ksi) and aggregate size (0.75 inches). The test specimen is described in the report as a flanged shear wall with a single web and two opposing flanges. The flanges were designed to carry the bending moment in the specimen and the web was designed to carry most of the shear. The web section represented the AP1000 shield building structure and was the region of interest for the test. The inspectors verified that the test specimen was fixed to the testing floor with post-tensioned concrete blocks to resist sliding and load was applied using four double-acting hydraulic rams with 1,000 kip capacity (push) and 630 kip capacity (pull). The rams were connected to the test specimen top block (concrete) with clevises and pins.

The inspectors performed a detailed review of the applicable design drawings contained in the design report and compared the as-built dimensions to those shown in the report drawings. Although WEC documented several as-built departures from the design drawings, they were judged (by Purdue) to be insignificant to the test results. The inspectors reviewed the technical justifications for these departures and noted only one issue where the prototype material was different from the AP1000 design.

For the fabrication of the test specimen steel plates, WEC elected to use A36, Grade 50 material rather than A572, Grade 50, which is representative of the AP1000 design. The justification for this substitution was that the A572 material, in 0.25 inch thick plate, would have higher yield stress than the target yield range of 50-60 ksi. To address this issue, A36, Grade 50 material was selected for its comparable performance and expected yield in the target yield range. The inspectors reviewed the justification for this deviation and found the technical basis to be acceptable.

The inspectors reviewed the concrete material parameters used for the test and identified a discrepancy in the value of aggregate size used in the test specimen. Section 7.12.2 of the

design report states that the concrete will be made from 0.75-inch aggregate size. However, inspectors noted that 3/8-inch aggregate size was used in the fabrication of the test specimen. WEC stated that the discrepancy was due to an error in the report and that the use of 3/8 inch aggregate size would have minimal effect on test results. While the team did not dispute WEC's justification for using 3/8 inch aggregate size, it was noted that WEC had no procedures for verifying the nominal value of concrete aggregate size (See section 2.b of this report).

3.c Conclusions

The inspection team did not identify any deficiencies with the physical testing equipment. The inspectors determined that the test setup accurately matched that described in the WEC design report. The inspectors reviewed all deviation notices and found the justifications provided to be acceptable.

4. Dedication of Test Procedure

4.a. Inspection Scope

The inspectors reviewed section E.3 of the CDI that describes WEC's dedication methodology for the test procedure.

4.b Observations and Findings

The CDI states that the function of the in-plane test procedure is to specify the loading protocol and testing process. The CDI lists the critical characteristics of the test procedure as being a step by step test process which states the loads, cycles, and number of cycles per load. The CDI states that the critical characteristics will be verified by having Purdue submit all test procedures to the WEC headquarters engineer for review and approval and by having the WEC site project manager witness that the approved procedures are being followed by Purdue.

The inspectors identified that although Purdue had developed a test summary sheet containing loading protocol information, a comprehensive step by step test procedure did not exist. The inspectors also noted that Purdue had an informal (or "skill-of-the-craft") process for performing load stabilization and initializing (or zeroing) instruments such as strain gauges and displacement sensors, and that no formal written procedures were developed. The NRC has identified this deficiency as part of Violation 05200006/2010-202-02.

4.c Conclusions

Contrary to the CDI requirements, WEC had not verified that a step by step test procedure had been developed as necessary to incorporate the requirements and acceptance limits contained in applicable design documents. The NRC has identified this deficiency as part of Violation 05200006/2010-202-02.

5. Dedication of Test Equipment

5.a Scope

The inspectors reviewed section E.4 of the CDI that describes WEC's dedication methodology for the test equipment.

5.b Observations and Findings

The CDI states that the function of the test equipment is to perform concrete cylinder testing and to calibrate the load cells. The CDI lists the critical characteristics as being the use of a calibrated "Forney" load tester, calibration of pressure transducers in the tension and compression direction, and calibrated extensometers. The CDI states the critical characteristics will be verified by having:

- the WEC site project manager witness the concrete cylinder testing
- the WEC site project manager witness calibration of the test instruments
- the WEC site project manager witness cross check of instruments

The inspectors identified that Westinghouse, through its dedication process, had not ensured the validity of the resulting test data as related to the applied force to the test specimen. Specifically, there were no load cells installed between the hydraulic actuators and the test specimen, so during the test, a direct measurement of the force being applied by the hydraulic actuators to the test specimen was not obtained. Instead, the applied force was derived from pressure transmitters that were installed on the input lines to the hydraulic actuators. The process utilized at Purdue to derive the applied force involved first developing a calibration curve for the installed pressure transmitters using a smaller hydraulic actuator and a calibrated load testing device. This method of calibration, however, produces a calibration curve that is accurate only for a specific pressure transmitter/actuator combination. Purdue did not perform a similar calibration for the actual installed hydraulic actuators used to supply force to the test specimen as they were stated as being too large to fit into the calibrated load testing device. Instead, Purdue utilized the data derived from the calibration of the smaller actuator/pressure transmitter combination and then scaled the calibration by a factor that considered the effective areas of the two actuators. The team concluded that this method of calibration does not account for the difference in frictional losses between the two hydraulic actuators and was based upon unverified vendor supplied data for the effective areas of the actuators. The NRC has identified this deficiency as Violation 05200006/2010-202-03.

5.c Conclusions

The inspectors identified that there were no load cells installed between the hydraulic actuators and the test specimen, so during the test, a direct measurement of the force being applied by the hydraulic actuators to the test specimen was not obtained. Consequently, the actual force that was applied to the test specimen during the in plane shear test was indeterminate. The NRC has identified this deficiency as Violation 05200006/2010-202-03.

6. Dedication of Instrumentation and Data Acquisition Equipment

6.a Scope

The inspectors reviewed section E.5 of the CDI that describes WEC's dedication methodology for the test instrumentation and data acquisition equipment.

6.b Observations and Findings

The CDI states that the function of the instrumentation and data acquisition equipment is to acquire data for displacement, strain, rotation, and applied load of the test specimen. The CDI lists the critical characteristics as the dimensions of the installed strain gauges, displacement gauges and rotation sensors. The CDI states that the critical characteristics will be verified by having:

- the WEC headquarters engineer review and approve gauge and load locations
- the WEC onsite project engineer verify that a sample of 5% or more of the installed strain, displacement, and rotation sensors were properly installed
- the WEC onsite project engineer produce calculations or other supporting documentation to support proper operation of the data acquisition system, including software

The inspectors focused their review on the installation of the displacement sensors and the method being used at Purdue to measure the applied force to the test specimen as these parameters were seen as the most critical to ensuring the validity of the test results. The inspectors reviewed the installed instrumentation and discussed verification methods with the WEC onsite project engineer. Although not proceduralized, the inspectors concluded that the verification methods used to ensure the correct electrical connection of the installed sensors were sufficient. However, when questioned on what methods were used to ensure that the displacement sensors were properly positioned with respect to the test specimen, including the proper leveling, the WEC engineer indicated that this was done only on a visual basis. No measurements were taken to ensure the displacement sensors were level, and no acceptance criteria had been developed with regard to the allowable tolerances surrounding installation of the displacement sensors. Although the sensors appeared to be level to the naked eye, it was not clear what level of accuracy was being sought from the testing and what level of error was acceptable with respect to the sensor leveling. The lack of installation procedures and tolerances for installation of the displacement sensors was identified as part of Violation 05200006/2010-202-02.

The inspectors also identified that WEC, through its dedication process, had not taken sufficient measures to verify the adequacy of the calibration of the installed sensors used to measure the displacement of the test specimen under the applied force. The inspectors identified that Purdue had not developed any procedures for calibration of these sensors, nor had acceptance criteria been established for their performance. As part of the inspection, the inspectors witnessed a simulated calibration of the sensors which was generally straightforward; however, the inspectors identified that it was not clear from the process what the actual calibration parameters were that were being controlled and what level of accuracy was being credited in the testing. The NRC has identified this deficiency as part of Violation 05200006/2010-202-02.

6.c Conclusions

The inspectors determined that WEC, through its dedication process had not ensured the correct calibration and installation of the sensors used to measure displacement of the test specimen when subjected to the applied force. The NRC has identified these deficiencies as

part of Violation 05200006/2010-202-02.

7. Training and Qualification of Personnel

7.a Scope

The inspectors reviewed section E.6 of the CDI that describes WEC's dedication methodology for training of personnel.

7.b Observations and Findings

The CDI states that a critical characteristic for the training and qualification of personnel is the qualification of the test specimen welders. The CDI states that the qualifications of the welding personnel will be verified by having the welding vendor submit training certificates to American Welding Society (AWS) D1.1. The inspectors reviewed the training certificates included as part of the CDI and found them to be acceptable. Included in the dedication package were training certificates that showed that the welders were qualified in accordance with the "Nelson Stud Certification Program" and with the requirements of Section 7 of ANSI/AWS D1.1. Furthermore, the inspectors determined that the test specimen welds were not really critical as they were not for use in the actual nuclear plant and if they were done poorly and failed, they would tend to weaken the test specimen which would be conservative with regard to the test results.

The CDI, did not, however, address as a critical characteristic the training and qualification of the Purdue personnel that performed the testing, setup, and calibration activities. Proper training of the personnel that perform the testing and that are involved in the calibration and setup of the test instrumentation was determined by the inspectors to be critical to ensuring the validity of the resulting test data. In response to the team's questions, WEC provided training records for all Purdue staff involved in the testing program. The inspectors also witnessed portions of the testing and interviewed selected Purdue staff members involved in the testing program.

7.c Conclusions

The inspectors concluded that the Purdue staff members were adequately trained for their given tasks, even though this information had not been properly incorporated into the CDI.

ATTACHMENT

1. PERSONS CONTACTED

Name	Entrance	Exit	Organization	Interviewed
Amit Varma	x	x	Purdue/Test Director	x
Mike Corletti	X	X	Westinghouse/ Director of Engineering	
Michelle Merwin	X	x	Westinghouse/QA	x
John Deblasio	X	X	Westinghouse/ Licensing	
Michelle Preik	x	x	Westinghouse/QA	x
Penny Toniolo	x	x	Westinghouse/ System Engineer	x
Noele Creamer	x	x	Westinghouse/ Technical Editor	
Lee Tunon-Sanjur	X	X	Westinghouse/ Engineering	x
Keith Coogler	X	X	Westinghouse/ Project Engineer	x
Greg Grover		x	Westinghouse/Onsite Project Engineer	x

2. INSPECTION PROCEDURES USED

IP 43004, “Inspection of Commercial Grade Dedication Programs”
IP 35034, “Design Certification Testing Program”

3. LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

The following items were found during this inspection:

Item Number	Status	Type	Description
5200006/2010-202-01	Open	NOV	Test Specimen
05200006/2010-202-02	Open	NOV	Procedures
05200006/2010-202-03	Open	NOV	Suitability of Equipment