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Vol. 23, No. 3

Licensee Contractor and Vendor Inspection Status Report

Quarterly Report
July – September 1999

U.S. Nuclear Regulatory Commission
Office Nuclear Reactor Regulation
Washington, DC 20555-0001

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Division of Inspection Program Management
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

ABSTRACT

This periodical covers the results of inspections performed between July 1999 and September 1999 by the NRC's Quality Assurance, Vendor Inspection, Maintenance and Allegations Branch that have been distributed to the inspected organizations.

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INTRODUCTION

A fundamental premise of the U. S. Nuclear Regulatory Commission (NRC) licensing and inspection program is that licensees are responsible for the proper construction and safe and efficient operation of their nuclear power plants. The Federal government and nuclear industry have established a system for the inspection of commercial nuclear facilities to provide for multiple levels of inspection and verification. Each licensee, contractor, and vendor participates in a quality verification process in compliance with requirements prescribed by the NRC's rules and regulations (Title 10 of the *Code of Federal Regulations*). The NRC does inspections to oversee the commercial nuclear industry to determine whether its requirements are being met by licensees and their contractors, while the major inspection effort is performed by the industry within the framework of quality verification programs.

The licensee is responsible for developing and maintaining a detailed quality assurance (QA) plan with implementing procedures pursuant to 10 CFR Part 50. Through a system of planned and periodic audits and inspections, the licensee is responsible for ensuring that suppliers, contractors and vendors also have suitable and appropriate quality programs that meet NRC requirements, guides, codes, and standards.

The NRC reviews and inspects nuclear steam system suppliers (NSSSs), architect engineering (AE) firms, suppliers of products and services, independent testing laboratories performing equipment qualification tests, and holders of NRC construction permits and operating licenses in vendor-related areas. These inspections are done to ensure that the root causes of reported vendor-related problems are determined and appropriate corrective actions are developed. The inspections also review vendors to verify conformance with applicable NRC and industry quality requirements, to verify oversight of their vendors, and coordination between licensees and vendors.

The NRC does inspections to verify the quality and suitability of vendor products, licensee-vendor interface, environmental qualification of equipment, and review of equipment problems found during operation and their corrective action. When nonconformances with NRC requirements and regulations are found, the inspected organization is required to take appropriate corrective action and to institute preventive measures to preclude recurrence. When generic implications are found, NRC ensures that affected licensees are informed through vendor reporting or by NRC generic correspondence such as information notices and bulletins.

This quarterly report contains copies of all vendor inspection reports issued during the calendar quarter for which it is published. Each vendor inspection report lists the nuclear facilities inspected. This information will also alert affected regional offices to any significant problem areas that may require special attention. This report lists selected bulletins, generic letters, and information notices, and include copies of other pertinent correspondence involving vendor issues.

INSPECTION REPORTS

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 8, 1999

Mr. Ron Fitzgerald, Director
Quality Assurance
Dept. 9500-1926
ABB-Combustion Engineering, Inc.
2000 Day Hill Road
Windsor, CT 06095

SUBJECT: NRC INSPECTION REPORT 99900401/1999201

Dear Mr. Fitzgerald:

This letter addresses the inspection of your facility at Windsor, Connecticut, conducted by Bill Rogers and Stephen Alexander of this office on June 30 through July 1, 1999. Following the onsite portion of the inspection, the NRC staff performed additional review of materials at the NRC office and conducted a final exit meeting, by telephone, on August 5, 1999, during which we discussed the findings with your staff.

Areas examined during the inspection are discussed in the enclosed report. This inspection consisted of an examination of procedures and representative records, interviews with personnel, and observations by the inspectors.

During this inspection, it was found that the implementation of your Quality Assurance program did not meet certain NRC requirements. ABB-Combustion Engineering, Inc., (CE) had not performed suitable qualification testing of a representative sample or performed an analysis to demonstrate the environmental qualification of the subject Litton-Veam electrical connectors installed in the Core Exit Thermocouple system provided to Palo Verde Nuclear Generating Station (Palo Verde). CE had not shown, with moisture present in the Litton-Veam connector during a portion of the environmental qualification test, that the single connector configuration tested would be representative of the installed multiple connector configuration at Palo Verde or that performing the environmental qualification test of the connector with the thermocouple maintained at a single temperature, would be representative of connector performance throughout the thermocouple operating range of the installed configuration at Palo Verde.

Please provide us within 30 days from the date of this letter a written statement in accordance with the instructions specified in the enclosed Notice of Nonconformance. We will consider extending the response time if you can show good cause for us to do so.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be placed in the NRC Public Document Room (PDR).

Sincerely,

Theodore R. Quay

Theodore R. Quay, Chief
Quality Assurance, Vendor Inspection, Maintenance
and Allegations Branch
Division of Inspection Program Management
Office of Nuclear Reactor Regulation

Docket No. 99900401

Enclosures: (1) Notice of Nonconformance
(2) Inspection Report 99900401/1999201

NOTICE OF NONCONFORMANCE

ABB-Combustion Engineering, Inc.
Windsor, Connecticut

Docket No. 99900401

Based on the results of an inspection conducted on June 30 through July 1, 1999, it appears that certain of your activities were not conducted in accordance with NRC requirements.

A. Criterion III, "Design Control," of 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," requires in part that "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," "the design control measures shall provide for verifying or checking the adequacy of design, such as by the performance of design reviews, by the use of alternate or simplified calculation methods, or by the performance of a suitable testing program," and " where a test program is used to verify the adequacy of a specific design feature in lieu of other verifying or checking processes, it shall include suitable qualifications testing of a prototype unit under the most adverse design conditions."

   Section 50.49 of 10 CFR Part 50 requires environmental qualification of core exit temperature instrumentation as follows: Section 50.49 requires qualification of electrical equipment important to safety as defined in Paragraph 50.49(b). Subparagraph 50.49(b)(3) specifies certain post-accident monitoring equipment. Subparagraph (b)(3) invokes, in associated Note 4, the specific guidance of Revision 2 of Regulatory Guide 1.97, "Instrumentation for Light-Water-Cooled Nulcear Power Plants to Assess Plant and Environs Conditions During and Following an Accident." Table 2, "PWR Variables" of Regulatory Guide 1.97, Under "Type C Variables" lists core exit temperature as a variable required to be monitored by Category I instrumentation.

   Contrary to the above, ABB-Combustion Engineering, Inc., (CE) had not performed suitable qualification testing of a representative sample or performed an analysis to demonstrate the environmental qualification of the subject Litton-Veam electrical connectors installed in the Core Exit Thermocouple system provided to the Palo Verde Nuclear Generating Station (Palo Verde). CE had not demonstrated, with moisture present in the Litton-Veam connector during a portion of the environmental qualification test, that performing an environmental qualification test of a single connector configuration would be representative of the installed multiple connector configuration at Palo Verde or that performing the environmental qualification test with the thermocouple maintained at a single temperature, would be representative of thermocouple operation throughout the thermocouple operating range of the installed configuration at Palo Verde.
   (Nonconformance 99900401/1999201-01)

Enclosure 1

Please provide a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555, with a copy to the Chief, Quality Assurance, Vendor Inspection, Maintenance and Allegations Branch, Division of Inspection Program Management, Office of Nuclear Reactor Regulation, within 30 days of the date of the letter transmitting this Notice of Nonconformance. This reply should be clearly marked as a "Reply to a Notice of Nonconformance" and should include for each nonconformance: (1) a description of steps that have been or will be taken to correct these items; (2) a description of steps that have been or will be taken to prevent recurrence; and (3) the dates your corrective actions and preventive measures were or will be completed.

Dated at Rockville, Maryland
this 8th day of September 1999

U.S. NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR REACTOR REGULATION

Report No:	99900401/1999201
Organization:	ABB-Combustion Engineering, Inc.
Contact:	Ron Fitzgerald, Director Quality Assurance
Nuclear Activity:	Designs, manufactures and supplies various safety-related systems to NRC Licensees
Dates:	June 30 - July 1, 1999
Inspectors:	Bill Rogers, Reactor Engineer Stephen Alexander, Reactor Engineer
Approved by:	Richard Correia, Chief Reliability and Maintenance Section Quality Assurance, Vendor Inspection, Maintenance and Allegations Branch Division of Inspection Program Management

Enclosure 2

1 INSPECTION SUMMARY

On June 30 - July 1, 1999, the U.S. Nuclear Regulatory Commission (NRC) performed an inspection at the ABB-Combustion Engineering, Inc., (CE) facility in Windsor, Connecticut. Subsequent to the onsite portion of the inspection, the staff performed additional review of materials at the NRC office and performed the final inspection exit meeting during a telephone conference on August 5, 1999.

The inspection was conducted to review selected portions of CE's quality assurance (QA) program, and its implementation, and the applicable programs and procedures used to design, manufacture and supply safety-related systems to NRC licensees. Specifically, the inspectors reviewed CE's activities related to the CE qualification of Litton-Veam electrical connectors used in the Core Exit Thermocouple system supplied to the Arizona Public Service Co. (APS), Palo Verde Nuclear Generating Station (Palo Verde) and other NRC licensees.

The inspection bases were:

- 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants."
- 10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants"
- 10 CFR Part 21, "Reporting of Defects and Noncompliance."

2 STATUS OF PREVIOUS INSPECTION FINDINGS

No previous finding were reviewed during this inspection.

3 INSPECTION FINDINGS AND OTHER COMMENTS

3.1 Background

On October 24, 1998, Palo Verde issued Licensee Event Report (LER) 98-008 which indicated that the CE qualification reports used to document the environmental qualification of Litton-Veam electrical connectors for the Core Exit Thermocouples (CET) used in Combustion Engineering plants may not adequately demonstrate appropriate equipment qualification. The LER stated that the CE qualification testing, of a single Litton-Veam connector containing one thermocouple circuit, did not represent the installed configuration at Palo Verde which contained multiple Litton-Veam connectors wired with several circuits.

The LER indicated that the multiple connector, multiple circuit configuration was not accurately represented since, during a portion of the CE qualification test, moisture

had been present inside the Litton-Veam connector. The LER indicated that CE had not accounted for the possible system interactions caused by the moisture present in the Litton-Veam connectors which might occur with additional connectors and circuits. The LER identified five general areas, all related to moisture intrusion, which APS had determined could potentially affect qualification: (1) system interaction related to multiple circuits, (2) system interaction related to multiple connectors, (3) maintaining the thermocouple at a single temperature during the qualification test, (4) the use of a supplemental Battery Effects Test to support qualification, and (5) the use of the Quality Safety Display Parameter Display System (QSPDS) to support qualification.

APS had determined that it would no longer use the original CE qualification reports to support the environmental qualification of the Litton-Veam connectors used for the CET system. APS had concluded that the use of an alternate Litton-Veam connector qualification report provided by the Litton-Veam company, combined with the action of replacing the Litton-Veam square section connector seal each time the connector was disconnected, demonstrated and maintained the environmental qualification of the Litton-Veam connectors used in the Palo Verde CET system.

CE had reviewed the APS LER, documented the existence of the LER and CE's conclusions in a November 4, 1998, letter, and provided this letter to other applicable NRC licensees. The CE conclusion was that CE had demonstrated the qualification of the Litton-Veam connectors and that the connector seals were not required to be replaced each time the connector is disconnected.

3.2 General Scope of Inspection and Environmental Qualification Requirements

The purpose of the inspection was to determine whether CE had taken adequate actions to demonstrate and document the environmental qualification of the Litton-Veam connectors as installed in the application at Palo Verde and other NRC licensees.

The inspectors reviewed the environmental qualification documentation prepared by ABB/CENP (then CE Power Systems) (CE) for the CET system, including cables and connections, supplied by CE to APS for installation at Palo Verde as post-accident monitoring equipment (Category 1, Type C Variable) as prescribed by Regulatory Guide 1.97, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident," Revision 2, dated December 1980 (RG 1.97) and required to be environmentally qualified by 10 CFR 50.49(b)(3).

The documentation reviewed included CE Nuclear Power Systems Report No. 14273-PE-5800, "Core Exit Thermocouple - Mineral Insulated Cable Environmental Qualification Program for Arizona Nuclear Power Project Palo Verde Nuclear Generating Station," Revision 02, dated December 1, 1987; Report No. 14273-PE-5802, "Income Instrument Assembly Environmental Qualification Program for Arizona Nuclear Power Project Palo Verde Nuclear Generating Station," Revision 01, dated July 30, 1987; and related documents. The inspectors also interviewed cognizant CE

staff, reviewed drawings of the tested equipment and examined samples of the tested equipment types.

3.3 Review of Test Results For the General Effects of Moisture Intrusion and Multiple Circuit Interaction

a. Inspection Scope

The inspectors performed a review to determine whether CE had adequately demonstated that the apparent moisture intrusion into the Litton-Veam connectors observed during a portion of the CE environmental qualification test would not have an unacceptable, adverse effect on the performance of the CETs being qualified for the multiple circuit application at Palo Verde

b. Observations and Findings

The inspectors examined the actual chart recorder output from the CETs during the CE environmental qualification test. The charts indicated that the signal from the CETs was steady and within the margin of error prescribed by Item II.F.2 of NUREG-0737 as referenced in RG 1.97 (+/-22°F) with respect to the reference thermocouples throughout the CE environmental test with the exception of a few seconds of perturbation roughly corresponding to the peak pressure transient near the beginning of the loss-of-coolant-accident (LOCA) simulation.

The CE environmental qualification report stated that the cable and connectors contained copper wires to simulate the presence of the ex-core leads for the rhodium detectors of the neutron flux, In-Core Instrumentation (ICI) system (a non-safety-related system). These leads were open ended in the thermocouple oven, as they would be in an installation, then passed through the LOCA chamber in the cables and the single Litton-Veam connector and were terminated outside the LOCA chamber at a terminal block set up to facilitate measurement of insulation resistance to ground. The CET element itself was grounded to its probe sheathing at the junction. According to the report, periodically during the testing, CE measured the insulation resistance to ground of each of the ICI leads with all the others grounded. The insulation resistance eventually deteriorated to as low as 2500 ohms to ground, measured at 10 Vdc. Examination of samples of the stainless steel-clad and mineral-insulated, multi-conductor cable and the Litton-Veam connectors of the type used in the equipment qualification test and installed at Palo Verde, as well as the drawings used to build the test specimens, confirmed the description of the tested configuration in the qualification report. Regardless of the low insulation resistance to ground, which was attributed principally to the moisture intrusion into the Litton-Veam connector, the CET output signal, as stated previously, was apparently unaffected.

The inspectors also performed a review to determine the effect, if any, of the interaction between the CET signal and any electrical signal that may be present on any of on the ICI wires. The inspectors determined the following: (1) the ICI rhodium detectors are only used to provide very low amplitude (below the mV range) pulses for

an indication of power range neutron flux distribution during reactor operation, (2) the ICI signal drops off to an undetectable level after reactor shutdown as neutron flux decays into the source range, and almost immediately with the boration of the coolant, and (3) no detectable neutron flux signal would be expected from the rhodium detector circuits, in the Litton-Veam connectors, when the CETs must perform their post design basis accident safety function. In addition, the inspectors determined that any effect of the presence of the ICI wires would have been indicated during the qualification test because representative wires were installed the tested cable and connectors.

c. Conclusion

The inspectors concluded that CE had adequately configured the test specimen to represent the multiple circuits present in the Palo Verde installation. The documentation of the test results indicated that the connector functioned adequately, with the moisture present during a portion of the environmental qualification test, with respect to multiple circuits. The inspectors did not identify a concern in this area.

3.4 Review of Test Results Related to Multiple Connector Interaction

a. Inspection scope

The inspectors performed a review to determine whether CE had adequately demonstated that the moisture intrusion into the Litton-Veam connectors observed during a portion of the CE environmental qualification test would not have an unacceptable, adverse effect on the performance of the CETs being qualified for the multiple connector application at Palo Verde.

b. Observations and Findings

The CE qualification reports for the CET equipment at Palo Verde did not address the potential effects of multiple connectors. The tested equipment included a single Litton-Veam connector exposed to the harsh environment of the LOCA simulation. The Palo Verde qualification report did not contain an analysis to reconcile the difference between the tested configuration and the configuration of the equipment installed at Palo Verde which could contain as many as five Litton-Veam connectors between the containment penetration and the reactor vessel head. The inspectors determined that CE had not configured the test or performed an analysis to demonstrate that there would not be an interaction between multiple connectors, due to moisture discovered during a portion of the environmental qualification test, and therefore that CE had not demonstrated that a single connector would be representative of a multiple connector application.

The inspectors reviewed a qualification report prepared by Southern California Edison (SCE) for the CE vessel head instrumentation connection system (including the CETs) installed at its San Onofre Nuclear Generating Station (SONGS), SCE EQ Document Package SONGS Unit No. 2 & 3 M38382, Revision 5, dated September 6, 1996. The

qualification report contained or referenced several CE environmental qualification documents that had also been used in support of the qualification of the CET cable and connector system at Palo Verde. The SCE document also contained analyses intended to address the limitations of those CE documents.

The inspectors determined, based on a limited review, that the SCE analysis may have had technical relevance to the issues of multiple connectors with the presence of moisture in the connector. However, CE had not prepared a review of the SCE analysis that was applicable to Palo Verde or included the SCE analysis in the Palo Verde qualification package.

c. Conclusion

The inspectors concluded that CE had not performed suitable qualification testing of a representative sample or performed an analysis to demonstrate that the single connector configuration, with moisture present during a portion of the environmental qualification test, would be representative of the installed multiple connector configuration at Palo Verde. This was identified as an example in Nonconformance 99900401/1999201-01.

3.5 Review of Test Results Related to Maintaining the Thermocouple at a Single Temperature During the Qualification Test

a. Inspection scope

The inspectors performed the review to determine whether CE had adequately demonstrated that maintaining the thermocouple at a single temperature during the CE environmental qualification test was representative of the installed configuration at Palo Verde considering the effect of the presence of moisture in the connector during a portion of the qualification test.

b. Observations and Findings

The inspectors reviewed the CE environmental qualification reports to determine whether CE had adequately demonstrated that testing the CET system with the temperature of the oven that contained the thermocouple element (external to the LOCA chamber) being held at a constant 400°F, was representative or predictive of the performance of the CET over the entire temperature range of 200°F to 2300°F through which the instrument is supposed to be qualified as prescribed by Table 2 of RG-1.97, considering the potential effects of the moisture intrusion.

The CE qualification reports for the CET equipment at Palo Verde did not address the effect of subjecting the thermocouple to its full temperature range during the qualification test. The testing was performed while maintaining the thermocouple at 400°F for which, at this temperature, the thermocouple would produce approximately 8 mV. Neither the environmental qualification test, nor the qualification report, accounted for any potential differences which could be experienced if the

thermocouple was heated throughout its operating range and produced correspondingly higher voltages (at 2300°F the thermocouple would produce approximately 50.8 mV) with consideration of the effects of the presence of moisture in the Litton-Veam connector.

The inspectors determined, based on a limited review, that the SCE analysis (previously discussed in Section 3.4) may have had technical relevance to the issues of the system response to the full range of CET output voltage with the presence of moisture in the connector. However, as stated previously, CE had not prepared a review of the SCE analysis that was applicable to Palo Verde nor included the SCE analysis in the Palo Verde qualification package.

c. Conclusion

The inspectors concluded that CE had not performed suitable qualification testing of a representative sample or performed an analysis to demonstrate that performing the environmental qualification test with the thermocouple maintained at a single temperature, with moisture present in the Litton-Veam connector during a portion of the qualification test, would be representative of the installed configuration at Palo Verde. This was identified as an example in Nonconformance 99900401/1999201-01.

3.6 Review of the Battery Effect Test

a. Inspection Scope

The inspectors performed a review to determine whether CE used the CE Test Report No. CE NSPD-230P, Supplement 1-P, (Battery Effects Test) to support the qualification of the CET system, including the Litton-Veam connectors, and whether demineralized water was representative of the composition of the moisture that would be present during a LOCA in the Palo Verde containment and could penetrate the degraded connector seals.

b. Observations and Findings

Review of the Battery Effects Test report revealed that demineralized water and a solution of Boric Acid consistent with containment chemical spray was used during the Battery Effects Test. Further, according to the report, the two halves of the tested connector were mated while submerged in the test solutions to ensure complete penetration of the solution into the space between the connector faces and among the conductor pins. The test was intended to assess the potential severity of the possible electro-chemical effects of this moisture under the worst-case conditions, but there was no indication that the environmental qualification depended on the results of this test, nor that CE had intended to take credit for it to support the environmental qualification.

c. Conclusion

The inspectors concluded that CE had performed a supplemental test to assess the potential effects of a worst case situation but there was no indication that the test was required for the original environmental qualification nor was there indication that the supplemental test invalidated any portion of the original qualification. The inspectors did not identify a concern in this area.

3.7 Review of the QSPDS Input Signal Processing Algorithm

a. Inspection Scope

The inspectors reviewed the documentation relating to the input signal processing algorithm for the quality safety parameter display system (QSPDS) to determine whether it could be expected to accommodate signal errors resulting from the moisture intrusion into the Litton-Veam connectors which was observed during a portion of the environmental qualification test.

b. Observations and Findings

The inspectors determined that there was a potential for increased uncertainties in the CET signal resulting from moisture intrusion into the CET cable connectors. The error had been determined to be able to exceed the specified tolerance for the CET signal on individual channels on a random basis. However, review of the associated documents and interviews with cognizant CE staff indicated that the QSPDS signal processing algorithm would be capable of rejecting erroneous signals, intermittent or sustained, from the various CETs such that the value of core exit temperature eventually displayed at any given time would be expected to represent a valid temperature. The inspectors determined that the QSPDS at Palo Verde is used for monitoring various safety-related parameters, but is not the primary instrumentation to be used by operators in executing the emergency operating procedures.

c. Conclusions

The inspectors concluded, on the basis of the review of the CET signal conditioning algorithm used by the QSPDS, that there was reasonable assurance that the QSPDS could accommodate the errors that might be introduced into the CET output signals by moisture intrusion into the CET cable connectors during a LOCA and still determine and display a valid core exit temperature value. The inspectors did not identify a concern in this area.

4 PERSONS CONTACTED

Ron Fitzgerald, Director Quality Assurance
Joseph Burger, Supervisor Field Services
Ted Bernard, Senior Project Manager
Mike Linden, Project Manager
Virgil Paggen, Licensing Engineer
Ed Sirica, Consulting Engineer Reactor Equipment

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

August 5, 1999

Mr. Kenneth Brayman
GENE
175 Curtner Ave.
M/C 117
San Jose, CA 95127

SUBJECT: NRC Inspection Report 99900403/1999201

Dear Mr. Brayman:

On July 20, 1999, the U.S. Nuclear Regulatory Commission (NRC) performed an inspection at the GENE facility in San Jose, California. The enclosed report presents the findings of that inspection. The inspection was conducted to review selected portions of your program relating to the supply of reactor vessel material surveillance capsules to the nuclear industry. This inspection specifically focused on activities related to the supply of the capsules for vessels manufactured by Chicago Bridge and Iron Works. The inspectors assessed GENE's conformance to their customer's procurement requirements and compliance with NRC regulations. Within the scope of this inspection, we found no instance in which GENE failed to meet NRC or customer requirements.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosures will be placed in the NRC's Public Document Room.

Sincerely,

Richard P Correia for

Theodore R. Quay, Chief
Quality Assurance, Vendor Inspection, Maintenance and Allegations Branch
Division of Inspection Program Management
Office of Nuclear Reactor Regulation

Docket No. 99900403

Enclosure: Inspection Report 99900403/1999201

U.S. NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR REACTOR REGULATION

Report no:	99900403/1999201
Organization:	GENE
Contact:	Kenneth Brayman (408) 925-6587
Nuclear Activity:	Manufacturer and supplier of components and services to the nuclear industry.
Date:	July 20, 1999
Inspectors:	Gregory C. Cwalina, Senior Reactor Engineer Matthew Mitchell, Materials Engineer
Approved by:	Richard P. Correia, Chief Reliability and Maintenance Section Quality Assurance, Vendor Inspection and Maintenance Branch Division of Inspection Program Management

Enclosure

1 INSPECTION SUMMARY

The NRC inspectors examined documentation related to the fabrication of reactor pressure vessel (RPV) surveillance specimens and surveillance capsules. Specifically, the inspectors reviewed the documentation for the surveillance materials and capsules associated with the RPVs manufactured by Chicago Bridge and Iron Works (CB&I) for four BWR/6 units (Clinton 1, Grand Gulf 1, Perry 1, River Bend 1) in the United States. Pertaining to the above, the inspectors examined the traceability of these materials to the original RPV materials.

No violations or nonconformances were identified.

2 STATUS OF PREVIOUS INSPECTION FINDINGS

No previous inspection findings were examined during this inspection.

3 INSPECTION FINDINGS AND OTHER COMMENTS

3.1 Review of the Fabrication History of Reactor Pressure Vessel Surveillance Specimens and Surveillance Capsules

a. Inspection Scope

The NRC inspectors reviewed GENE document files related to the fabrication of RPV surveillance specimens and surveillance capsules associated with RPVs fabricated by CB&I. Specifically, the inspectors reviewed the documentation for four BWR/6 facilities in the United States: Clinton 1, Grand Gulf 1, Perry 1, and River Bend 1. The inspection traced the documentation on the surveillance materials from the Certified Material Test Reports (CMTRs) for the RPV plate and weld materials; to the CB&I procedures for and records of fabrication for the surveillance specimens; to the shipping and receipt information as the specimens were transferred from CB&I to GE; and, finally, to the documentation on the fabrication of the capsules and their shipment to the facilities.

b. Observations and Findings

b.1 Document Review

The GENE documentation was presented in two categories: generic documents which were referenced or used in the development of each plant-specific case, and plant-specific documents. The package of generic documents included:

- Document No. 21A9477, "Purchase Specification Reactor Pressure Vessel"
- Document No. 21A9507, "Purchase Specification Reactor Pressure Vessel (RPV), Surveillance Samples"
- GE Drawing 166B7063, "Charpy Impact Specimen"
- GE Drawing 137C5365, "Charpy Impact Specimen"
- QCCI No. C-102.01, " Certification Procedure for Surveillance Program (SP), P/L 83X629 G001, G002"

- CB&I procedure STP-10, "Surveillance Test Specimen Preparation Plan," which defined the surveillance test specimen preparation plan that was used at CB&I for cutting, machining, and marking the Charpy specimens supplied for the GE surveillance programs.

The documentation provided in the plant-specific files began with the GE Purchase Orders for each of the RPVs and accompanying surveillance specimens. It continued with the Vendor Print File (VPF) associated with the surveillance test specimen production for each of the RPVs. The VPFs for each facility examined contained:

- CMTRs for the RPV plates and weld materials used to fabricate the surveillance specimens
- Welding procedures used to fabricate the surveillance welds
- Heat-treatment history for the surveillance materials
- Results of the non-destructive examinations (NDE) on the surveillance plates and weldments
- Cutting, machining, and dimensional verification and marking procedures used on the finished Charpy specimens.
- GE Product Quality Certification records that were required when the surveillance specimens were transferred from CB&I to GE and when the finished surveillance capsules were shipped from GE to the facilities.

b.2 Traceability

The inspectors review of the traceability of the surveillance materials and the documentation that accompanied them identified four primary tracking numbers associated with the surveillance materials for each RPV, as shown in the following table.

Reactor Vessel	General Electric Purchase Order Number	CB&I Contract Number	Vendor Production File Number	Reactor Vessel Code Number
River Bend 1	205-H8968	73-C112	3614-651-1	72
Clinton 1	205-H8989	73-6735	3653-615-1	78
Perry 1	205-AE028	73-C108	3521-502-1	70
Grand Gulf 1	205-AE027	73-C109	3519-738-1	67

Table 1 - RPV Tracking Numbers

In addition, each material type (surveillance plate, weld, and heat-affected zone (HAZ)) for each RPV's surveillance program was identified at CB&I and GE by a unique identifier as listed below.

Material Type	CB&I Identification ("P-number")	GE Identification
Base metal	P1	B
Weld	P2	W
Heat affected zone	P3	H

Table 2 - Material Type Identification

The GE Purchase Order Number linked the documentation for a RPV to the appropriate CB&I Contract Number and Vendor Print File Number for the fabrication of the surveillance program specimens. The CB&I contract number was the primary identifier of the documentation used to record the fabrication history (heat treatment, NDE, etc.) associated with the surveillance material for each RPV along with the P-number to identify which specific material was being discussed. In some cases, the reactor vessel number was used on the documentation (in lieu of the CB&I Contract number) along with the appropriate P-number since this also uniquely identified the RPV material to which the documentation applied.

Regarded the traceability of the surveillance materials themselves, the inspectors' noted that CB&I procedure STP-10 required that the original blocks of surveillance material be uniquely marked using the appropriate material P-number and the CB&I Contract Number. After sectioning into sub-blocks (approximately 7 inches by 6 inches by 3 inches), each sub-block was marked with the material P-number, CB&I Contract Number, and Reactor Code Number. Prior to cutting the Charpy specimens from the sub-block, the P-number and Reactor Code Number were stenciled on either end of what would become a finished Charpy specimen. This Charpy specimen marking convention was consistent with GE Drawing 166B7063, as referenced in CB&I procedure STP-10. Therefore, the inspectors concluded that, throughout this process, positive control was established for maintaining specimen identity and traceability.

The inspectors reviewed the material traceability process for the specimens during shipping to GE's Wilmington, North Carolina facility for insertion into the surveillance capsules. In one case (Clinton 1) this was a direct shipment from CB&I, while the others went via GE's San Jose facility. When the specimens arrived at Wilmington, they were inspected and the results appropriately documented. The inspectors found two characteristic comments noted on the receipt documentation for each surveillance material shipment: first, no certification documents were sent along with the specimens and second, the material samples were not marked in accordance with the GE drawing.

The first comment can be resolved by noting that all of the GE Product Quality Certification Documents were maintained at San Jose and were readily reproduced for this NRC inspection. The GE Quality Control procedures for surveillance program certification (QCCI No. C-102.01) did not require that the certification documentation be sent to Wilmington with the specimens. The

inspectors were satisfied that maintaining the documentation at GENE, San Jose, was acceptable.

The second comment stemmed from the fact that in the time between when the specimens were fabricated by CB&I (in the 1974 - 1975 time frame) and when they were received at Wilmington (in 1978), a new GE drawing on Charpy specimen fabrication had been produced (Drawing 137C5365). This drawing required that base material specimens be marked with a "B," weld material specimens with a "W," and HAZ materials with an "H," instead of the P-number designation used by CB&I (see Table 2 above). It was this drawing, 137C5365, that was being used by the GE staff during receipt inspection at the Wilmington facility, which resulted in their decision to have the specimens remarked. The NRC inspectors' noted that this remarking did not compromise the traceability of the material since it was evident that the Wilmington staff knew the correlation between the P-number marking and the material type such that they could unambiguously have them remarked before insertion into the capsules. The documentation regarding the shipment of the capsules to the appropriate facility was also reviewed and found to be in order.

c. Conclusions

Based on the information reviewed by the inspectors, it was concluded that the documentation provided by GENE for the four BWR/6 RPV surveillance programs was sufficient to assure traceability of the materials to the material used to manufacture the reactor pressure vessels.

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Information Notice 99-28	Recall of Star Brand Fire Protection Sprinkler Heads

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