



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

January 25, 2018

Mr. Kenichi Sakuma, General Manager  
Quality System Department,  
Nuclear Energy Business Unit  
IHI Corporation  
1 Shin-Nakahara-Cho  
Isogo-Ku, Yokohama 235-8501, Japan

SUBJECT: IHI CORPORATION'S NUCLEAR REGULATORY COMMISSION INSPECTION  
REPORT NO. 99901395/2017-201

Dear Mr. Sakuma:

On December 11-15, 2017, the U.S. Nuclear Regulatory Commission (NRC) staff conducted an inspection at the IHI Corporation (IHI) facility in Yokohama, Japan. The purpose of the limited scope inspection was to assess IHI's 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 Program Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities."

The enclosed report presents the results of the inspection. This technically-focused inspection specifically evaluated IHI's implementation of the quality activities associated with the design, fabrication, and testing of the conical roof structure components for the Shield Building of the Westinghouse Electric Company AP1000 reactor design for the domestic reactors being supplied to Vogtle Electric Generating Station, Units 3 & 4. During this inspection, the NRC inspection team looked at records and construction activities associated with inspections, tests, analyses, and acceptance criteria (ITAAC) from Revision 19 of the approved AP1000 Design Control Document. Specifically, these activities were associated with the ITAAC Number 3.3.00.02a.i.b (761). The NRC inspection team did not identify any findings associated with the ITAAC contained in Section 4 of the attachment to this report. The enclosed report presents the results of this inspection. This NRC inspection report does not constitute NRC endorsement of your overall quality assurance (QA) or 10 CFR Part 21 programs.

Based on the results of this inspection, the NRC inspection team found the implementation of your QA program met the requirements imposed on you by your customers or NRC licensees. No findings of significance were identified.

In accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding," of the NRC's "Rules of Practice," the NRC will make available electronically for public inspection a copy of this letter and its enclosure through the NRC Public Document Room or from the

NRC's Agencywide Documents Access and Management System, which is accessible at <http://www.nrc.gov/reading-rm/adams.html>.

Sincerely,

*/RA/*

John P. Burke, Chief  
Quality Assurance Vendor Inspection Branch-2  
Division of Construction Inspection  
and Operational Programs  
Office of New Reactors

Docket No.: 99901395  
EPID: 99901395/I-2017-201-0038

Enclosure:  
Inspection Report No. 99901395/2017-201  
and Attachment

SUBJECT: IHI CORPORATION'S NUCLEAR REGULATORY COMMISSION INSPECTION  
REPORT NO. 99901395/2017-201

Dated: January 25, 2018

DISTRIBUTION:

Public

RNease

TJackson

KKavanagh

ASakadales

shuji\_murao@nsr.go.jp

kazuyuki\_tomoda@ihi.co.jp

kenichi\_sakuma@ihi.co.jp

ConE\_Resource

NRO\_DCIP\_Distribution

**ADAMS Accession No.: ML18024A739**

\*via e-mail

NRO-002

|             |          |           |          |                 |          |
|-------------|----------|-----------|----------|-----------------|----------|
| <b>OFC</b>  | NRO/DCIP | NRO/DCIP  | RII/DCO  | NRO/DCIP        | NRO/DCIP |
| <b>NAME</b> | RPatel*  | RMclntyre | APonko*  | JOrtega-Luciano | JBurke   |
| <b>DATE</b> | 01/24/18 | 01/24/18  | 01/23/18 | 01/25/18        | 01/25/18 |

**OFFICIAL RECORD COPY**

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

Docket No.: 99901395

Report No.: 99901395/2017-201

Vendor: IHI Corporation  
1 Shin-Nakahara-Cho  
Isogo-Ku, Yokohama 235-8501, Japan

Vendor Contact: Mr. Kazuyuki Tomoda  
Quality Assurance Manager  
Phone: 81-45-759-2540

Nuclear Industry Activity: IHI Corporation is a holder of multiple N-type American Society of Mechanical Engineers (ASME) certificates under contract for the fabrication and manufacture of key AP1000 components for the U.S. market.

Inspection Dates: December 11-15, 2017

|             |                         |                 |             |
|-------------|-------------------------|-----------------|-------------|
| Inspectors: | Jonathan Ortega-Luciano | NRO/DCIP/QVIB-2 | Team Leader |
|             | Richard McIntyre        | NRO/DCIP/QVIB-2 |             |
|             | Raju Patel              | NRO/DCIP/QVIB-2 |             |
|             | Anthony Ponko           | R-II/DCO/IB4    |             |
|             | Shuji MURAO             | NRA             | Observer    |

Approved by: John P. Burke, Chief  
Quality Assurance Vendor Inspection Branch-2  
Division of Construction Inspection  
and Operational Programs  
Office of New Reactors

Enclosure

## **EXECUTIVE SUMMARY**

IHI Corporation  
99901395/2017-201

The U.S. Nuclear Regulatory Commission (NRC) staff conducted a vendor inspection at the IHI Corporation's (hereafter referred to as IHI) facility in Yokohama, Japan, to verify that it had implemented an adequate quality assurance (QA) program that complies with the requirements of Appendix B, "Quality Assurance 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." In addition, the NRC inspection also verified that IHI implemented a program under 10 CFR Part 21, "Reporting of Defects and Noncompliance." This was the second NRC inspection at this IHI facility. The last NRC inspection was conducted in September 2010 and the results are documented in inspection report (IR) No. 99901395/2010-201, dated October 26, 2010.

The Japanese Nuclear Regulatory Authorities (NRA) participated in the inspection as observer. These observations foster the sharing of international experiences with the construction of new reactors, oversight of vendors, and modular construction techniques consistent with the objectives of the Multinational Design Evaluation Program.

This technically-focused inspection specifically evaluated IHI's implementation of quality activities for the design, fabrication, and testing activities associated with the conical roof structure components of the Shield Buildings for the Westinghouse Electric Company (WEC) AP1000 reactor design being provided to the Vogtle Electric Generating Plant (VEGP) Units 3 & 4. Specific activities observed by the NRC inspection team included:

- Calibration of an Inside Micrometer (50mm - 75mm)
- Set-up and performed of partial-joint penetration (PJP) using Gas Metal Arc Welding (GMAW) process and Gas Tungsten Arc Welding (GTAW) of Compression Ring C01 Block of Shield Building (SB) Conical Roof for VEGP Unit 4 (SV4)
- Visual examination of tack weld fit-up that included cleanliness, dimensional inspection of root gap and groove angle of a complete joint penetration (CJP) for C02 Block on Traveler No. PCL-SV4-C222 Sequence No. 22-102 for SB Conical Roof for SV4
- Set-up and performed pre-heating of a PJP joint No. WG4-C01-12E2 for SB Conical Roof Compression Ring C01 block
- Perform weld material requisition and release of filler material to welder on work order No. 5901043 for Compression Ring C01 block of SB conical roof for SV4
- Set-up and performed magnetic particle (MP) examination of weld joint No. WG4-C01A-07a on a compression ring C01 Block of SB Conical Roof for SV4

In addition to observing these activities, the NRC inspection team verified that measuring and test equipment (M&TE) was properly identified, marked, calibrated, and used within its calibrated range.

These regulations served as the bases for the NRC inspection:

- Appendix B to 10 CFR Part 50
- 10 CFR Part 21

During the course of this inspection, the NRC inspection team implemented Inspection Procedure (IP):

- IP 36100, "Inspection of 10 CFR Part 21 and Programs for Reporting Defects and Noncompliance," dated February 13, 2012;
- IP 43002, "Routine Inspections of Nuclear Vendors," dated January 27, 2017;
- IP 43004, "Inspection of Commercial-Grade Dedication Programs," dated January 27, 2017;
- IP 65001.01, "Inspection of ITAAC-Related Foundations & Buildings," dated April 18, 2014;
- IP 65001.A, "Inspection of the As-Built Attributes for Structures, Systems, and Components (SSCs) Associated with ITAAC," dated September 25, 2013;
- IP 65001.B, "Inspection of the ITAAC-Related Welding Program," dated September 25, 2013;
- IP 65001.F, "Inspection of the ITAAC-Related Design and Fabrication Requirements," dated September 20, 2013.

The results of this inspection are summarized below.

#### Corrective Action

The NRC inspection team reviewed the corrective actions that IHI had taken to address nonconformances documented in IR No. 99901395/2010-201 dated October 26, 2010. The NRC inspection team reviewed the documentation that provided objective evidence that all corrective actions were completed and adequately implemented. Based on this review, the NRC inspection team closed all of the nonconformances documented in the 2010 IR.

#### Other Inspection Areas

The NRC inspection team determined that IHI is implementing its programs for training and qualification, 10 CFR Part 21, design control, commercial-grade dedication, control of purchased material, equipment, and services, control of special processes, traceability, inspection, control of M&TE, nonconforming material, parts, or components, and corrective action in accordance with the applicable regulatory requirements of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed and activities observed, the NRC inspection team also determined that IHI is implementing its policies and procedures associated with these programs. No findings of significance were identified.

## **REPORT DETAILS**

### **1. 10 CFR Part 21 Program**

#### **a. Inspection Scope**

The NRC inspection team reviewed IHI Corporation's (hereafter referred to as IHI) policies and implementing procedures that govern IHI's 10 CFR Part 21, "Reporting of Defects and Noncompliance," program to verify compliance with the regulatory requirements. In addition, the NRC inspection team evaluated the 10 CFR Part 21 postings and a sample of IHI's purchase orders (POs) for compliance with the requirements of 10 CFR 21.21, "Notification of Failure to Comply or Existence of a Defect and its Evaluation," and 10 CFR 21.31, "Procurement Documents." The NRC inspection team also verified that IHI's nonconformance and corrective action procedures provide a link to the 10 CFR Part 21 program.

Furthermore, for a sample of 10 CFR Part 21 evaluations performed by IHI, the NRC inspection team verified that IHI had effectively implemented the requirements for evaluating deviations and failures to comply. The NRC inspection team verified that the notifications were performed in accordance with the requirements of 10 CFR 21.21, as applicable.

The NRC inspection team also discussed the 10 CFR Part 21 program with IHI's management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

#### **b. Observations and Findings**

No findings of significance were identified.

#### **c. Conclusion**

The NRC inspection team concluded that IHI is implementing its 10 CFR Part 21 program in accordance with the regulatory requirements of 10 CFR Part 21. Based on the limited sample of documents reviewed, the NRC inspection team also determined that IHI is implementing its policies and procedures associated with the 10 CFR Part 21 program. No findings of significance were identified.

### **2. Design Control**

#### **a. Inspection Scope**

The NRC inspection team reviewed IHI's policies and implementing procedures that govern the design control program to verify their compliance with the regulatory requirements of Criterion III, "Design Control," 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 assessment included a review of the procedures, specifications, shop drawings, shop travelers, requests for information (RFIs), nonconformance reports (NCRs), and quality assurance (QA) practices associated with fabrication of structural subassemblies

for the AP1000 shield building (SB) conical roof. This review was to support future closure of ITAAC 3.3.00.02a.i.b (761) for Vogtle Electric Generating Plant (VEGP) Units 3 & 4.

The NRC inspection team reviewed procedures, specifications, work instructions, shop travelers, weld records, and shop drawings to verify that relevant technical requirements associated with fabrication of the SB conical roof structural subassemblies had been correctly translated from the construction documents into procurement specifications and fabrication packages.

The NRC inspection team verified that the shop drawing prepared by IHI for fabrication of the structural subassemblies were consistent with the engineering drawings, construction specifications, and QA requirements provided by the design authority, including any relevant engineering and design coordination reports (E&DCRs). The NRC inspection team also confirmed that any inconsistencies or errors on the engineering drawings that were identified by the structural detailers during development of the shop drawings were addressed through the RFI process; and that any required design changes were documented by the design authority using the E&DCR process.

The NRC inspection team observed in-process fabrication of compression ring subassemblies C01 and C02 for VEGP Unit 4 and reviewed completed shop travelers associated with fabrication of compression ring subassemblies C01, C02, and C03 for VEGP Unit 3. These subassemblies are fabricated using steel shapes and plates and are components of the SB conical roof at elevation 304'-93/16". The NRC inspection team reviewed the overall configuration, sizes of shapes and plates, dimensions, and connection details of the C01 and C02 subassemblies for VEGP Unit 4 to verify the subassemblies were being fabricated in accordance with the engineering drawings and technical requirements, including those documented in the respective updated final safety analysis reports (UFSARs).

The NRC inspection team also discussed the design control program with IHI's management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

b. Observations and Findings

No findings of significance were identified.

c. Conclusion

The NRC inspection team concluded that IHI is implementing its design control program in accordance with the regulatory requirements of Criterion III of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspection team also determined that IHI is implementing its policies and procedures associated with the design control program. No findings of significance were identified.



### 3. Control of Purchased Material, Equipment, and Services and Commercial-Grade Dedication

#### a. Inspection Scope

The NRC inspection team reviewed IHI's policies and implementing procedures that govern the implementation of its supplier oversight and commercial-grade dedication (CGD) programs to verify compliance with the requirements of Criterion III, Criterion IV, "Procurement Document Control," and Criterion VII, "Control of Purchased Material, Equipment, and Services" of Appendix B to 10 CFR Part 50.

The NRC inspection team reviewed the implementation of IHI's process for procurement control and audits of purchased material, equipment, and services. The NRC inspection team also reviewed IHI's CGD process to determine if it was effective for the dedication of commercial grade items (CGIs), included the appropriate definitions consistent with 10 CFR Part 21, and contained guidance specific to dedication activities, consistent with NRC and industry requirements. In addition, the NRC inspection team verified that IHI had implemented the corrective actions specific to notice of nonconformance 9990135/2010-201-01 (documented in NRC inspection report 9990135/2010-201). The 2010 NRC inspection finding identified that Section C of the IHI's quality assurance program description (QAPD) and Procedure IBR A13-30103 were not consistent with the definitions included in 10 CFR Part 21. This issue is discussed in detail in section 8 b.1 of this inspection report.

The NRC inspection team also reviewed the IHI US Safety-Related and American Society of Mechanical Engineers (ASME) Approved Vendors List (AVL) and a sample of sub supplier audits and commercial-grade surveys performed by IHI for safety-related and commercial-grade suppliers. This review included POs, material requisition forms, purchase specifications, QA program specifications, audit plans, audit reports, audit checklists, receiving inspection record reports, certified material test reports (CMTRS), certificate of conformance (CoC), certificates of analysis, and various reports of inspection activities specific to procurement and supplier oversight for VEGP Units 3 & 4. The sample consisted of safety-related audits and commercial-grade surveys performed by IHI for the supply of: commercial A240 S32101 duplex stainless steel plate; safety-related steel plates including those supplied by Kobe Steel Ltd (Kakagawa Plant); safety-related welding material from Kobe Steel (Fukuchiyama Plant); safety-related calibration services from IHI Corporation Corporate Research & Development, commercial plasma/laser cutting services, and safety-related chemical testing services. The suppliers were selected based on their scope of supply to IHI for the AP1000 VEGP C01 module and the SB conical roof compression ring fabrication.

Further, for the CGD activities mentioned above the NRC inspection team verified that IHI's CGD process contained a detailed technical evaluation as part of the CGD plan to support the identification of safety functions, failure modes, critical characteristics, and acceptance methods. For CGD activities and commercial-grade surveys, the NRC inspection team reviewed the purchase specification (with specific technical requirements), material requisition form, QA program specification, audit plan, audit report and checklist, receiving inspection reports, and applicable CoCs and CMTRS.

The NRC inspection team also discussed the supplier oversight and CGD programs with IHI's management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

b. Observations and Findings

Kobe Steel Weld Material Falsification

The NRC inspection team discussed with IHI and reviewed associated documentation related to the notification from Kobe Steel Ltd, specific to the improper conduct for quality related activities and falsification of data for welding material supplied to IHI that was used in US supplied components. IHI had received a letter from Kobe Steel Ltd. Welding Business Quality Management Department, dated November 16, 2017, describing their self-investigation activities performed of products manufactured and shipped within the last year that, concluded "that all products were confirmed to satisfy the customer's specifications as well as the requirements of industry standards and that all inspection activities certificate's that were issued were according to the respective actual test and/or inspection data." The letter, also stated that there was no problem with welding materials and certificates, material test reports and inspection certificates for a list of project identification numbers that are represented by VEGP Units 3 & 4 and Virgil C. Summer Nuclear Generating Station (VC Summer) Units 2 & 3.

On November 21-24, 2017, IHI conducted an additional audit to the regularly scheduled supplier audits of the Kobe Steel facilities at Kobe Steel Fukuchiyama and Ibaraki plants. As a result of this audit, IHI found no falsification in any inspection data on selected CMTRS or delivered materials to IHI utilized in several nuclear components. These included components such as containment vessels, CA01 structural modules and the SB conical roof structure for VEGP Units 3 & 4 and VC Summer Units 2 & 3.

The audit evaluated Kobe Steel's CMTR generation process, including product examination and chemical and mechanical testing results and documentation on the CMTRs. IHI concluded that the QA programs for the Kobe Steel Fukuchiyama and Ibaraki plants was adequately implemented to effectively supply the correct CMTR information for material delivered to IHI. IHI performed 100% sampling review of records for the SB conical roof project and found no falsification in the Fukuchiyama plant. IHI plans to conduct an audit at the Kobe Steel Fujisawa plant in 2018 to verify the self-investigation activities of the November 16, 2017, letter performed by the Kobe Steel Welding Business Unit, which concluded there is no problem with welding materials and certificates, material test reports and inspection certificates.

c. Conclusion

The NRC inspection team concluded that IHI is implementing its oversight of contracted activities and CGD program in accordance with the regulatory requirements of Criterion III, Criterion IV, and Criterion VII of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspection team also determined that IHI is implementing its policies and procedures associated with the oversight of contracted activities and CGD program. No findings of significance were identified.

#### 4. Material Traceability

##### a. Inspection Scope

The NRC inspection team reviewed IHI's policies and implementing procedures that govern material traceability to verify compliance with the regulatory requirements of Criterion VIII, "Identification and Control of Material, Parts, and Components," of Appendix B to 10 CFR Part 50.

The NRC inspection team verified that the identification markings used on the materials provided a clear and legible identification and do not adversely affect its function or the service life of the item. The NRC inspection team verified that the part number or trace code number was maintained on the item and in documents traceable to the item. The NRC inspection team also reviewed a sample of CMTR and CoC reports to verify compliance with the procurements document requirements for chemical composition, mechanical properties and/or dimension.

The NRC inspection team performed a walk-down of the welding and M&TE storage areas and reviewed the weld wires were adequately marked with manufacturer code, ASME / American Welding Society (AWS) material specification, and heat/lot number traceable to vendor. The M&TE storage area had equipment and gages identified by unique ID No with their calibration status traceable to vendor and known national standards.

The NRC inspection team also discussed the material traceability program with IHI's management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

##### b. Observations and Findings

No findings of significance were identified.

##### c. Conclusions

The NRC inspection team concluded that IHI is implementing its material traceability program in accordance with the regulatory requirements of Criterion VIII of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspection team also determined that IHI is implementing its policies and procedures associated with the material traceability program. No findings of significance were identified.

#### 5. Control of Special Processes

##### a. Inspection Scope

The NRC inspection team reviewed IHI's policies and implementing procedures that govern the control of special processes to verify compliance with the regulatory requirements of Criterion IX, "Control of Special Processes," of Appendix B to 10 CFR Part 50 and with the requirements of Subsection NCA, Subsection NB, Subsection NC, Subsection ND, of Section III, Section V, "Nondestructive Examination," and Section IX, "Welding and Brazing Qualification," of the ASME Boiler & Pressure Vessel (B&PV)

Code, 1998 Edition, 2000 Addenda, and American Society for Nondestructive Testing (ASNT) SNT-TC-1A, "Personnel Qualification and Certification in Nondestructive Testing."

The NRC inspection team performed a walk-down of the welding fabrication area and observed several welding activities. The NRC inspection team observed a complete joint penetration (CJP) and partial joint penetration (PJP) of weld joint using gas metal arc welding (GMAW) and gas tungsten arc welding (GTAW) weld process on a C01 block compression ring for SB conical roof for VEGP Unit 4 (SV4) project and also observed pre-heating of a PJP joint for SB conical roof sub-module. The NRC inspection team verified that the welders were following the welding procedure specification (WPS) qualified by a procedure qualification record (PQR) assigned and documenting the operation and weld wire in the traveler.

The NRC inspection team selected a sample of welders' performance qualification records (WPQR) and their annual continuity records to verify they were qualified to meet the requirements of ASME Section IX and AWS code. Each WPQR indicate the welding method, technique, material type and thickness range and the weld position qualified to.

A walk-down of the weld storage area was performed to verify weld materials were controlled to prevent degradation, inadvertent use, or loss of traceability in accordance with IHI's approved procedures. The NRC inspection team also observed the weld issuance requisition tickets that links the weld material issuance to shop traveler and the welder. It was noted that the weld area was kept clean and that the temperature and humidity were monitored daily using calibrated equipment. Further, the NRC inspection team verified that the weld machines had been periodically calibrated within the range of use, using known traceable standards and their calibration frequency maintained. The NRC inspection team reviewed CMTRs for the weld filler metal used for C01 block and verified that the material specifications for physical and chemical properties, and weldability test meet the ASME Section II and AWS Code requirements.

The NRC inspection team observed magnetic particle (MP) examination for C01 Module, performed by visible dry method, to verify that IHI's implementation was in accordance with its policies and procedures and applicable codes and standards. The NRC inspection team verified that the MP evaluation was performed by a qualified nondestructive examination (NDE) inspector utilizing approved procedures and calibrated equipment that were within the applicable inspection range. Further, the NRC inspection team reviewed sample of NDE reports to verify the quality of records meet the IHI NDE procedures and records were in compliance with AWS D1.1 or ASME Section V Code. The NRC inspection team also observed visual examination of tack weld fit-up that consist of cleanliness, dimensional inspection of the groove angle and groove gap.

The NRC inspection team reviewed the material test reports of the MP red powder and confirmed the material meet the ASME Section V Code requirements. The NRC inspection team reviewed IHI's "Written Practice for Nondestructive Testing Personnel Qualification and Certification," procedure and confirmed the education, training hours, written, basic and practical examination requirements for Level I, II, & III NDE inspector qualification met the requirements of American Society for Nondestructive (ASN)-SNT-TC-1A, "American Society for Nondestructive Testing Recommended Practice," as referenced in ASME Section III, Subsection NCA.

In addition, the NRC inspection team reviewed IHI forming procedure used for C01 block compression ring for SB conical roof for VEGP Units 3 & 4, and confirmed through review of sample forming operators qualification records that IHI forming operators were adequately qualified and their records were current to IHI written practice for qualification and certification of forming operators.

The NRC inspection team also discussed the manufacturing control program with IHI's management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

b. Observation and Findings

No findings of significance were identified.

c. Conclusion

The NRC inspection team concluded that IHI is implementing its control of special processes program in accordance with the regulatory requirements of Criterion IX of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, activities observed, interview with IHI personnel, NDE and welder qualification and certification records, the NRC inspection team also determined that IHI is implementing its policies and procedures associated with the control of special processes program. No findings of significance were identified.

6. Inspection

a. Inspection Scope

The NRC inspection team reviewed IHI's policies and implementing procedures that govern the inspection program to verify compliance with Criterion X, "Inspection" of 10 CFR Part 50 Appendix B.

The NRC inspection team reviewed IHI procedures and inspection plans associated with fabrication of AP1000 structural components to verify that the practices and processes being implemented to verify conformance with the design, and the associated acceptance criteria, conformed to the technical requirements specified by the purchaser.

The NRC inspection team reviewed a sample of shop travelers for the VEGP Units 3 & 4 compression ring subassemblies to verify that hold points had been established at appropriate steps in the fabrication process and any applicable inspections, including NDE requirements, had been performed.

The NRC inspection team reviewed a sample of completed inspection reports associated with the VEGP Units 3 & 4 compression ring subassemblies to verify the inspections were completed and documented in accordance with IHI procedures and the personnel performing the inspection were qualified to perform the relevant inspection activities in accordance with IHI policies.

The NRC inspection team reviewed a sample of nonconformance reports to verify that any deviations from requirements that were identified during inspections were appropriately documented and dispositioned in accordance with quality assurance requirements.

The NRC inspection team discussed the inspection program with IHI's management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

b. Observations and Findings

No findings of significance were identified.

c. Conclusion

The NRC inspection team determined that IHI is implementing its inspection program in accordance with the regulatory requirements of Criterion X of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspection team also determined that IHI is adequately implementing its policies and procedures associated with the inspection program. No findings of significance were identified.

7. Control of Measuring and Test Equipment

a. Inspection Scope

The NRC inspection team reviewed IHI's policies and implementing procedures that govern the M&TE program to verify compliance with the requirements of Criterion XII, "Control of Measuring and Test Equipment," of Appendix B to 10 CFR Part 50.

For a sample of M&TE reviewed, the NRC inspection team determined that the M&TE had the appropriate calibration stickers and current calibration dates, including the calibration due date. The NRC inspection team also verified that the M&TE had been calibrated, adjusted, and maintained at prescribed intervals prior to use. In addition, the calibration records reviewed by the NRC inspection team indicated the as-found or as-left conditions, accuracy required, calibration results, calibration dates, and the due date for recalibration. The NRC inspection team also verified that the selected M&TE was calibrated using procedures traceable to known industry standards.

The NRC inspection team observed storage of MT&E to verify that IHI's staff properly segregated, documented, and evaluated when M&TE was found out of calibration, lost, or out of service. The NRC inspection team also reviewed applicable procedures and sections of the quality assurance manual to verify provisions were in place that required IHI to (1) perform evaluations to determine whether previous inspection or test results were affected by M&TE found out of calibration, (2) appropriately notify affected customers, and (3) repair or replace devices consistently found out of calibration.

The NRC inspection team also discussed the M&TE program with IHI's management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

b. Observations and Findings

No findings of significance were identified.

c. Conclusion

The NRC inspection team concluded that IHI is implementing its M&TE program in accordance with the regulatory requirements of Criterion XII of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspection team also determined that IHI is implementing its policies and procedures associated with the M&TE program. No findings of significance were identified.

8. Nonconforming Materials, Parts, or Components and Corrective Action

a. Inspection Scope

The NRC inspection team reviewed IHI's policies and implementing procedures that govern the control of nonconformances to verify compliance with the requirements of Criterion XV, "Nonconforming Materials, Parts, or Components," and Criterion XVI, "Corrective Action," of Appendix B to 10 CFR Part 50.

The NRC inspection team reviewed a sample of corrective actions associated with nonconformance report (NCR), disposition notice (DN), vendor nonconformances, and internal and external audit findings to verify that the corrective action reports provide for documentation and description of the condition adverse to quality (CAQ), the cause and corrective actions taken to prevent recurrence, review and approval by the responsible authority, status of corrective actions reviewed, and follow-up action taken to verify timely and effective implementation of corrective actions.

The NRC inspection team toured the shop floor and verified that nonconforming materials, parts, and components were appropriately identified and tagged. The NRC inspection team verified for the sampled selected that each NCR and DN documented the nonconforming items with proper disposition action taken: reject, repair/rework, or use-as-is. For those that were not dispositioned as rejected, the NRC inspection team verified that the dispositions contained technical justifications documenting the nonconforming items as repair or use- as-is. In addition, the NRC inspection team noted that nonconformances to design requirements dispositioned as repair or use-as-is were subject to design control measures commensurate with those applied to the original design and were supported with objective evidence, WECTEC approval, and disposition control record (N&DCR). The NRC inspection team reviewed several sample of NCRs where IHI had performed detail technical evaluation to make a determination for 10CFR Part 21 applicability.

The NRC inspection team also discussed the nonconforming materials, parts, or components and corrective action program with IHI's management and technical staff. The attachment to this inspection report lists the documents reviewed by the NRC inspection team.

b. Observations and Findings

b.1 Corrective Action Associated with Nonconformance 99901395/2010-201-01

Nonconformance 99901395/2010-201-01 was issued for IHI's failure to adequately include procedural guidance in IHI Business Rule (IBR)-A13-30003 for the dedication of commercial-grade items. Specifically, IHI procedure and drawing No. 022K095 failed to include specific provisions: (1) or methodology for identification of the critical characteristics and their verification/acceptance methods to be performed during the conduct of the IHI vendor survey specific to the item being dedicated; (2) for the development of sampling inspection plans consistent with industry standards, and; (3) the procedure IBR A13-30003 failed to include the correct definitions from 10CFR 21.3.

During this inspection, the NRC inspection team reviewed IBR A13-30003, Revision H, dated October 20, 2011, and the associated documentation that provided objective evidence for the completion of the corrective actions. Specifically, the NRC inspection team verified that procedure IBR A13-30003 included provisions for the identification of the critical characteristics and other verification/acceptance methods. IBR A13-30003 also included the appropriate definitions from 10 CFR 21.3 applicable to CGIs, and includes the provisional guidance for the development of sampling inspection plans consistent with known industry standards. The NRC inspection team verified the IHI drawing No. 021K672, "CGI Dedication procedure for EPDM Gasket," was revised to include new requirements from revised IBR A13-30003. Further, the NRC inspection team confirmed through review of several survey reports of commercial-grade vendors, that IHI had adequately verified the critical characteristics at the vendor as part of dedication process. In addition, the NRC inspection team verified revisions made in the QAPD were consistent with revised IBRs and that IHI had performed training of its QA/QC personnel to the revised QAPD and IBRs. The NRC inspection team determined that IHI's corrective actions were adequate to address the identified finding. Based on its review, the NRC inspection team closed Nonconformance 99901395/2010-201-01.

b.2 Corrective Action Associated with Nonconformance 99901395/2010-201-02

Nonconformance 99901395/2010-201-02 was issued for IHI's failure to review conditions adverse to quality to determine the existence of trends. The NRC inspection team identified five instances involving IHI operators failing to appropriately follow procedures that led to nonconforming conditions for US and Chinese components. These five instances occurred over a 12 month period.

During this inspection, the NRC inspection team reviewed IHI's revised QAPD and verified they issued procedure IBR A13-30007, "Trend Analysis Procedure." In 2016, IHI restructured its internal procedure and had re-assigned a different numbering system, thus assigning then issued IBR A13-30007 as IBR A13-30106. The NRC inspection team reviewed the IHI's semi-annual trend analysis report 11MK101, Revision 0, dated May 13, 2011, which included analysis for trends of NCR, corrective action control sheets, self-assessment reports, vendor performance, semi-annual audit performed by authorized inspection agency, customer audits or comments and status of corrective action identified by past semi-annual trend analysis. Further, the NRC inspection team reviewed IHI's trend analysis reports



from 2011 through 2016 and noted that IHI had implemented the procedure to identify any adverse trends documented. The NRC inspection team determined that IHI's corrective actions were adequate to address the identified finding. Based on its review, the NRC inspection team closed Nonconformance 99901395/2010-201-02.

c. Conclusion

The NRC inspection team concluded that IHI is implementing its nonconforming materials, parts, or components and corrective action programs in accordance with the regulatory requirements of Criterion XV and Criterion XVI of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspection team also determined that IHI is implementing its policies and procedures associated with the control of nonconforming materials, parts, or components and corrective action. No findings of significance were identified.

9. Entrance and Exit Meetings

On October 11, 2017, the NRC inspection team discussed the scope of the inspection with Mr. Kazuyuki Tomoda, Quality Assurance Manager, and other members of IHI's management and technical staff. On October 15, 2017, the NRC inspection team presented the inspection results and observations during an exit meeting with Mr. Tomoda and other members of IHI's management and technical staff. The attachment to this report lists the attendees of the entrance and exit meetings, as well as those individuals whom the NRC inspection team interviewed.

## ATTACHMENT

### 1. ENTRANCE/EXIT MEETING ATTENDEES

| Name              | Title   | Affiliation | Entrance | Exit | Interviewed |
|-------------------|---|-------------|----------|------|-------------|
| Jonathan Ortega   | Inspection Team Leader  | NRC         | X        | X    |             |
| Richard McIntyre  | Inspector   | NRC         | X        | X    |             |
| Raju Patel        | Inspector   | NRC         | X        |      |             |
| Anthony Ponko     | Inspector   | NRC         | X        | X    |             |
| Kazuyuki Tomoda   | Quality Assurance Manager   | IHI         | X        | X    | X           |
| Haruei Myaguchi   | Technical Advisor   | IHI         | X        |      |             |
| Kenichi Sakuma    | General Manager<br>Quality System Department                        | IHI         | X        | X    |             |
| Takayuki Maruyama | General Superintendent<br>Yokohama Works                            | IHI         | X        | X    |             |
| Itaru Suzuki      | General Manager<br>Vessel & Chemical Reactor Engineering Department | IHI         | X        | X    |             |
| Masahori Imai     | General Manager<br>Manufacturing Department                         | IHI         | X        | X    |             |
| Kazuyuki Maeda    | General Manager<br>Procurement Department                           | IHI         | X        | X    |             |
| Takashi Hirano    | General Manager<br>Production Engineering Department                | IHI         | X        | X    |             |
| Taichi Nakamura   | Manager<br>Overseas Project Department                              | IHI         | X        |      |             |
| Trilam Inove      | Assistant Manager<br>Piping Engineering Department                  | IHI         | X        |      |             |
| Kei Iwashige      | Manager<br>Overseas Project Department                              | IHI         | X        | X    |             |

| Name              | Title  | Affiliation | Entrance | Exit | Interviewed |
|-------------------|--|-------------|----------|------|-------------|
| Masanori Igichi   | Manager Overseas Project Department                      | IHI         | X        |      |             |
| Hideyasu Shizawa  | Manager Vessel & Chemical Reactor Engineering Department | IHI         | X        | X    |             |
| Ryusuke Kawakami  | Manager Piping Engineering Department                    | IHI         | X        | X    |             |
| Takayuki Yagi     | Manager of Quality Control Group                         | IHI         | X        | X    | X           |
| Kouichirou Katou  | Manager Quality Assurance Group                          | IHI         | X        | X    |             |
| Nobukazu Ido      | Manager Quality Assurance Group                          | IHI         | X        |      | X           |
| Harunori Watanabe | Manager Quality Assurance Group                          | IHI         | X        | X    | X           |
| Kazuyuki Tomoda   | Quality Assurance Manager                                | IHI         | X        | X    |             |
| Akihide Nagasaka  | Quality Assurance Engineer                               | IHI         | X        | X    | X           |
| Yuto Ishiyama     | Engineer Piping Design Group                             | IHI         |          | X    |             |
| Daigo Utsumi      | Manager Production Control                               | IHI         |          | X    |             |
| Ryoichi Harikoshi | Quality Control Manager                                  | IHI         |          | X    |             |
| Hideaki Shikata   | General Manager of Control Management                    | IHI         |          | X    |             |
| Shunji Kobayashi  | Chief Engineer   | IHI         |          | X    |             |
| Isamu Ohno        | General Manager  | IHI         |          | X    |             |
| Toshiyuki Shimizu | Level II, QC Inspector                                   | IHI         |          | X    | X           |
| Ryoji Osafune     | Welding Engineer   | IHI         |          |      | X           |
| Makoto Nakamur    | QC Inspector/Level II                                    | IHI         |          |      | X           |
| Kaishi Komori     | QC Level Inspector                                       | IHI         |          |      | X           |
| Mitsuro Matsuda   | QC Level II Inspector                                    | IHI         |          |      | X           |
| Andy Tabinaki     | Translator   | Independent |          |      |             |

| <b>Name</b>             | <b>Title</b>                   | <b>Affiliation</b>  | <b>Entrance</b> | <b>Exit</b> | <b>Interviewed</b> |
|-------------------------|--------------------------------|---------------------|-----------------|-------------|--------------------|
| Atsushi Yamaki          | Interpreter                    | Simul International | X               |             |                    |
| Hisako Ueda             | Interpreter                    | Simul International | X               | X           |                    |
| Naoko Okuno             | Interpreter                    | Simul International |                 | X           |                    |
| Rod Cude                | Supplier Compliance Supervisor | SNC                 |                 | X           |                    |
| Rene Demetrie Hernandez | Lead Source Inspector          | WECTEC              | X               | X           |                    |

## 2. INSPECTION PROCEDURES USED

Inspection Procedure (IP) 36100, "Inspection of 10 CFR Part 21 and Programs for Reporting Defects and Noncompliance," dated February 13, 2012

IP 43002, "Routine Inspections of Nuclear Vendors," dated January 27, 2017

IP 43004, "Inspection of Commercial-Grade Dedication Programs," dated January 27, 2017

IP 65001.01, "Inspection of ITAAC-Related Foundations & Buildings," dated April 18, 2014

IP 65001.A, "Inspection of the As-Built Attributes for Structures, Systems, and Components (SSCs) Associated with ITAAC," dated September 25, 2013

IP 65001.B, "Inspection of the ITAAC-Related Welding Program," dated September 25, 2013, and

IP 65001.F, "Inspection of the ITAAC-Related Design and Fabrication Requirements," dated September 20, 2013.

## 3. LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

| <b>Item Number</b>   | <b>Status</b> | <b>Type</b> | <b>Description</b> |
|----------------------|---------------|-------------|--------------------|
| 99901395/2010-201-01 | CLOSED        | NON         | Criterion V        |
| 99901395/2010-201-02 | CLOSED        | NON         | Criterion XVI      |

#### 4. INSPECTIONS, TESTS, ANALYSES, AND ACCEPTANCE CRITERIA (ITAAC)

The NRC inspection team identified the ITAAC listed below related to components being fabricated and tested at IHI. At the time of the inspection, fabrication of AP1000 subassemblies for the compression ring of shield building conical roof for VEGP Unit 4 was in process. The NRC inspection team reviewed IHI procedures, work instructions, shop drawings, and fabrication records to verify that no conditions potentially impacting ITAAC closure were present. The NRC inspection team also reviewed shop travelers associated with subassemblies for the compression ring of the VEGP Unit 3 shield building conical roof that had been completed and shipped to the construction site to verify that the subassemblies met technical requirements and that any design deviations had been appropriately identified and reconciled through the design authority. The NRC inspection team verified that, in general, the VEGP Units 3 and 4 compression ring subassemblies were being, or had been, fabricated in accordance with the construction documents and that any design deviations identified during fabrication were documented in nonconformance reports and forwarded to the design authority for disposition. The NRC inspection team did not identify any discrepancies potentially impacting the acceptance criteria of the ITAAC listed below that had not previously been identified and documented in existing nonconformance reports. The ITAAC cited below are for future use by the NRC staff during the ITAAC closure process; the listing of these ITAAC does not signify that they have been met and/or closed. The NRC inspection team did not identify any findings associated with the ITAAC listed below.

| Nuclear Power Plant | ITAAC Index No. | ITAAC Section No. | Design Commitment   | Inspection, Test, Analysis  | Acceptance Criteria   |
|---------------------|-----------------|-------------------|---|---|---|
| VEGP Unit 3         | 761             | 3.3.00.02a.i.b    | 2.a) The nuclear island structures, including the critical sections listed in Table 3.3-7, are seismic Category I and are designed and constructed to withstand design basis loads as specified in the Design Description, without loss of structural integrity and the safety related functions. | i) An inspection of the nuclear island structures will be performed. Deviations from the design due to as-built conditions will be analyzed for the design basis loads. | i.b) A report exists which reconciles deviations during construction and concludes that the as-built shield building, including the critical sections, conform to the approved design and will withstand the design basis loads specified in the Design Description without loss of structural integrity or the safety-related functions. |
| VEGP Unit 4         | 761             | 3.3.00.02a.i.b    | 2.a) The nuclear island structures, including the critical sections listed in Table 3.3-7, are seismic Category I and are designed and constructed to withstand design basis loads as specified in the Design Description, without loss of structural integrity and the safety related functions. | i) An inspection of the nuclear island structures will be performed. Deviations from the design due to as-built conditions will be analyzed for the design basis loads. | i.b) A report exists which reconciles deviations during construction and concludes that the as-built shield building, including the critical sections, conform to the approved design and will withstand the design basis loads specified in the Design Description without loss of structural integrity or the safety-related functions. |

## 6. DOCUMENTS REVIEWED

### Policies and Procedures

- IHI Business Rule (IBR) A13-30000, "Quality Assurance Program Description For US Safety-Related Items, (For 10CFR50 Appendix B)," Revision 16, dated June 7, 2017
- IHI Project Quality Assurance Plan 5901040-00K080, "Shield Building Roof Structural Steel," Revision 4, dated November 20, 2017
- IBR A13-01001, "ASME Quality Assurance Manual for Nuclear Power Items," Revision 61, dated January 7, 2017
- IBR A13-02102, "Indoctrination and Training for Yokohama Works," Revision A, dated August 22, 2016
- IBR A13-02104, "Written Practice for Qualification & Certification of Inspection and Testing Personnel," Revision 0, dated March 6, 2017
- IBR A13-02105, "Written Practice for Qualification & Certification of Quality Control (QC) Personnel," Revision A, dated October 27, 2017
- IBR A13-02106, "Written Practice for Qualification & Certification of Nondestructive Examination Personnel," Revision C, dated October 25, 2016, for SNT-TC-1A, 1984, 1992, 1996, through 2011 Edition
- IBR A13-02107, "Training Procedure for Nondestructive Examination Personnel," Revision C, dated October 25, 2016
- IBR A13-05101, "Design Control Procedure (ASME Sec. III and NQA-1)," Revision B, dated December 4, 2017
- IBR A13-05102, "Engineering Control Procedure (ASME Sec. III and NQA-1)," Revision A, dated July 5, 2017
- IBR A13-09101, "ASME B&PV Code Section III—Vendor Control procedure, dated August 9, 2016
- IBR A1309102, "Control of Purchased Items and Services," Revision 0, dated February 24, 2017
- IBR A13-11102, "General Procedure for Special Process," Revision B, dated June 20, 2017
- IBR A13-17100, "ASME Control of Nonconforming Items," Revision D, dated March 7, 2017
- IBR A13-18101, "Corrective Action Program," Revision B, dated September 15, 2017
- IBR A13-30000, "Quality Assurance Program Description for US Safety-Related Items (for 10CFR Appendix B)," Revision 16, dated June 7, 2017
- IBR A13-30103, "Control Procedure for Dedication of Commercial Grade Items,"
- IBR A13-30106, "Guideline for The Trend Analysis," Revision 0, dated March 7, 2016
- IBR A13-30107, "Root Cause Analysis (RCA) Procedure," Revision 0, dated March 7, 2017
- IBR A500-54B, "Standard for Spec. of Quality Program: Calibration Services," dated December 7, 2017
- IBR A500-56, "Reporting Defects and Noncompliance under US NRC 10CFR21," dated December 7, 2017
- IBR A660-01B, "Standard for Maintenance of Measurement Equipment for ASME," dated February 17, 2017
- IBR A660-02A, "Standard for Maintenance for Calibration Standard," dated February 17, 2017

- IBR M13-020104, "Written Practice for Qualification & Certification of Inspection and Test Personnel including Painting/Coating," Revision 0, dated March 7, 2017
- IBR M13-15103, "Calibration and Maintenance Procedure for NDE Equipment," Attachment 3, "Calibration Procedure for MT Equipment (Yoke Type)," Revision A, dated April 21, 2017
- IBR M13-15103, "Calibration and Maintenance Procedure for NDE Equipment," Attachment 6, "Calibration Procedure for Uviometer and Illuminometer," Revision A, dated April 21, 2017
- Revision B, dated August 9, 2016
- Quality Operating Technique (QOT) A619-01A, "Painting Material Control Procedure," Revision A, February 17, 2017
- QOT A500-54, Standard for Specification of Quality Program: Calibration Service of M&TE, Revision A, dated December 7, 2017
- QOT A730-01A, "Control Procedure for Welding," Revision , dated February 17, 2017
- QOT A731-01, "Control Procedure for Tack Welding," Revision 0, October 18, 2017
- QOT A732-03, "Control Procedure o Welder/Welding Operator Qualification in accordance with AWS Code," Revision
- QOT A734-01, "Control Procedure of Welding Procedure Specification in Accordance with ASME Code," Revision A, dated February 17, 2017
- QOT A734-03, "Control Procedure of Welding Procedure Specification in accordance with AWS Code," Revision A, dated February 17, 2017
- QOT A760-01B, "Forming Control Procedure," Revision B, dated November 17, 2017
- QOT A762-01B, "Qualification Procedure of Forming Personnel," Revision B, dated November 11, 2017
- QOT-A732-01D, "Control Procedure of Welder/Welder Operator Qualification in accordance with ASME," Revision D, dated November 4, 2017
- Shop Guidance (SG)-QC-CAL-2017-1, "Calibration Procedure for Measurement Equipment," Revision 0, dated March 1, 2017
- Procedure Qualification Record (PQR) No. I-111AG, for Gas Metal Arc Welding (GMAW), for P1-P1 base metal qualification Revision 1, dated February 23, 2017, welder K. Kamikawa Welder Id W-515, on December 28, 2016, to ASME Section IX
- PQR No. I-111BG, "GTAW process qualifying carbon steel base metal," Revision 1, dated February 23, 2017, welder K. Kamikawa Welder Id W-515, on December 28, 2016, to ASME Section IX
- PQR Test Report (Ground with Dry), EPR-1106-1, Revision 0, dated November 9, 2009
- PQR Test Report No. PQR-UT-AWS01.01, dated November 29, 2014, for SV4/VS3 CA01 Module Qualification Test using Technique AWS01 Butt Joint CJP carbon steel materials
- Procedure 000R203, "Ultrasonic Examination Procedure," Revision 1, dated December 5, 2016
- Procedure 5901040-000H240, "Purchase Specification for Cutting Service," Revision 10, dated September 8, 2017
- Procedure 5901040-000H621, "Purchase Specification for Low Alloy Steel Plate ASTM A572 Gr. 50," Revision 1, dated August 18, 2016
- Procedure 5901040-000K004, "Engineering Input Check List," Revision 15, dated October 20, 2017
- Procedure 5901040-000K005, "Engineering Activity Plan," Revision 4, dated July 3, 2017

- Procedure 5901040-000K006, "Technical Document List," Revision 15, dated October 20, 2017
- Procedure 5901040-000K007, "Engineering Interface," Revision 3, dated October 6, 2017
- Procedure 5901040-000K009, "Engineering Method," Revision 1, dated July 28, 2016
- Procedure 5901040-000K010, "Verification Method," Revision 1, J dated July 28, 2016
- Procedure 5901040-000KS05, "APP-VL52-Z0-572 Material Specification for ASTM A572 Grade 50 for SC Shield Building," Revision 0, dated June 30, 2016
- Procedure 5901040-000R101, "General Welding Procedure," Revision 3, dated February 27, 2017
- Procedure 5901040-000R102, "General Repair Procedure," Revision 4, dated October 4, 2017
- Procedure 5901040-000R103, "Welding Material Control Procedure," Revision 4, dated March 10, 2017
- Procedure 5901040-000R105, "Weld Manual," Revision 2, dated February 22, 2017
- Procedure 5901040-000R106, "Distortion Correction Procedure," Revision 2, dated April 4, 2017, for WECTEC SB Conical Roof for SV3&4/VS2&3
- Procedure 5901040-000R107, "Temporary Weld Attachment Procedure," Revision 0, dated April 10, 2017, for SB Conical Roof for SV3&4/VS2&3
- Procedure 5901040-000R201, "General Inspection Procedure," Revision 2, dated March 31, 2017
- Procedure 5901040-000R203, "Ultrasonic Examination Procedure," Revision 1, dated December 5, 2017, for SB Conical Roof for SV3&4/VS2&3
- Procedure 5901040-000R204, "Liquid Penetrant Examination Procedure," Revision 0, dated November 10, 2017
- Procedure 5901040-000R204, "Liquid Penetrant Examination Procedure," Revision 1, dated January 13, 2016
- Procedure 5901040-00H680, "Purchase Specification for Welding Material (GTAW) (TG-S60A), Revision 0, dated July 6, 2016
- Procedure 5901040-06EGM765, "Purchase Specification for Welding Material (GMAW) (NSS-YM-3N)," Revision 0, dated July 6, 2016
- Procedure No. 5901040-000R201, "General Inspection Procedure," Revision 2, dated March 31, 2017, for SB Conical Roof for SV3&3/VS2&3
- Procedure No. 5901040-000R205, "Magnetic Particle Examination Procedure," Revision 2, dated May 8, 2017
- Welding Procedure IT-1126G, "Welding Procedure Specification," qualifying P1-P1 (carbon steel) materials for SB Conical Roof for SV3&4/VS2&3, Revision 1, dated January 29, 2017
- INF-PM-040-002, "Order Entry Review," Revision 0
- DG-5901040-000H621, "Design Guidance, Purchase Specification for ASTM Gr. 50," Revision 1, dated August 18, 2016



#### IHI Requests for Information (RFIs)

- RFI-IHI-040-015, "Clarification of Stiffener Plate Design in Compression Ring," Revision 0, dated August 30, 2016
- RFI-IHI-040-017, "Clarification of Connection Detail of Interior Member," Revision 0, dated August 25, 2016
- RFI-IHI-040-042, "Proposal for Un-weld Portions," Revision 0, dated October 26, 2016
- RFI-IHI-040-053, "Clarification of Dimensions for Plate ( $t=1/2$ ") between Compression Ring," Revision 0, dated November 8, 2016
- RFI-IHI-040-066, "Clarification of CJP Weld Configuration," Revision 0, dated December 9, 2016
- RFI-IHI-040-076, "Clarification of Field Weld Reparation for Splice between Two Compression Ring Subassemblies," Revision 0, dated December 22, 2016
- RFI-IHI-040-078, "Proposal for Straight Cut for Compression Ring Bottom Plate," Revision 0, dated December 28, 2016
- RFI-IHI-040-099, "Clarification for Marking Requirement of "Working Point," Revision 0, dated March 5, 2017

#### Drawings: Shop, Design, and Commercial-Grade Dedication

- Drawing 022K095, "Specification of Quality Program (CGI)," Revision 0, dated October 21, 2009
- Drawing 026H601, "Purchase Specification for Plates—SA-516 Grade 70," Revision 3, dated February 5, 2010, for Vogtle Units 3 and 4
- Drawing 026H601, "Purchase Specification for Plates—SA-516 Grade 70," Revision 5, dated October 14, 2009, for AP1000 China Sanmen airlocks and equipment hatches
- Drawing 026H671, "Purchase Specification for EPDM Gasket for CB&I," Revision 2, dated June 11, 2010
- Drawing 348B001, Parts list of CA01\_48 submodule, Revision 4 dated December 15, 2014
- Drawing 348B01, Detail-CA01\_48 submodule assembly A, Revision 4, dated August 20, 2014
- Drawing 5901040-000R201, "General Inspection Procedure," Revision 2, dated March 31, 2107
- Drawing 5901040-000RD01, "General Dimension Inspection Plan," Revision 4, dated July 3, 2017
- Drawing 5901040-C00A001, "General Notes of Shield Building Conical Roof Compression Ring," Revision 4, dated October 18, 2017
- Drawing 5901040-C00A002, "Detail Drawing of Shield Building Conical Roof Compression Ring Ship Loose Items C04-C09," Revision 0, dated March 16, 2017
- Drawing 5901040-C00B000, "Weld Joint Standards for Compression Ring," Revision 3, dated July 3, 2017
- Drawing 5901040-C00B001, "Parts List of Compression Ring C04, C05, C06, C07, C08, C09 Ship Loose Items," Revision 1, dated September 5, 2017
- Drawing 5901040-C00RD01, "Dimension Inspection Plan Comp. Ring," Revision 4, dated July 3, 2017
- Drawing 5901040-C01A002, "Detail Drawing of Shield Building Conical Roof Compression Ring C01 Assembly (1/2), Revision 3, dated August 31, 2017

- Drawing 5901040-C01A003, "Detail Drawing of Shield Building Conical Roof Compression Ring C01 Assembly (2/2), Revision 2, dated February 21, 2017
- Drawing 5901040-C01A102, "Detail Drawing of Shield Building Conical Roof Compression Ring C01 Weld Detail," Revision 3, dated February 27, 2017
- Drawing 5901040-C01B001, "Parts List of Compression Ring C01," Revision 3, dated October 10, 2017
- Drawing 5901040-C01B002, "Detail Drawing of Shield Building Conical Roof Compression Ring C01 Sub-Assembly," Revision 3, dated March 8, 2017
- Drawing 5901040-C01B003, "Detail Drawing of Shield Building Conical Roof Compression Ring C01 Parts Detail (1/2)," Revision 4, dated March 8, 2017
- Drawing 5901040-C01B004, "Detail Drawing of Shield Building Conical Roof Compression Ring C01 Parts Detail (2/2)," Revision 5, dated December 4, 2017
- Drawing 5901040-C02A002, "Detail Drawing of Shield Building Conical Roof Compression Ring C02 Assembly (1/2), Revision 3, dated August 31, 2017
- Drawing 5901040-C02A003, "Detail Drawing of Shield Building Conical Roof Compression Ring C02 Assembly (2/2), Revision 1, dated March 2, 2017
- Drawing 5901040-C02A102, "Detail Drawing of Shield Building Conical Roof Compression Ring C02 Weld Detail," Revision 2, dated March 9, 2017
- Drawing 5901040-C02B001, "Parts List of Compression Ring C02," Revision 3, dated October 10, 2017
- Drawing 5901040-C02B002, "Detail Drawing of Shield Building Conical Roof Compression Ring C02 Sub-Assembly," Revision 2, dated March 9, 2017
- Drawing 5901040-C02B003, "Detail Drawing of Shield Building Conical Roof Compression Ring C02 Parts Detail (1/2)," Revision 2, dated March 9, 2017
- Drawing 5901040-C02B004, "Detail Drawing of Shield Building Conical Roof Compression Ring C02 Parts Detail (2/2)," Revision 5, dated July 27, 2017
- Drawing 5901040-C02RW01, "Weld Map & Required NDE Comp. Ring C02," Revision 1, dated March 14, 2017
- Drawing 5901040-C03A002, "Detail Drawing of Shield Building Conical Roof Compression Ring C03 Assembly (1/2), Revision 2, dated August 31, 2017
- Drawing 5901040-C03A003, "Detail Drawing of Shield Building Conical Roof Compression Ring C03 Assembly (2/2), Revision 1, dated March 6, 2017
- Drawing 5901040-C03A102, "Detail Drawing of Shield Building Conical Roof Compression Ring C03 Weld Detail," Revision 1, dated March 6, 2017
- Drawing 5901040-C03B002, "Detail Drawing of Shield Building Conical Roof Compression Ring C03 Sub-Assembly," Revision 2, dated March 9, 2017
- Drawing 5901040-C03B003, "Detail Drawing of Shield Building Conical Roof Compression Ring C03 Parts Detail (1/2)," Revision 1, dated March 6, 2017
- Drawing 5901040-C03B004, "Detail Drawing of Shield Building Conical Roof Compression Ring C03 Parts Detail (2/2)," Revision 2, dated April 28, 2017
- Drawing C01B002, "Detail Drawing of Shield Building Conical Roof Compression Ring C01 Sub-Assembly," for Job No. 5901040 02BA1530, Revision 3, dated March 8, 2017

#### American Society of Mechanical Engineers (ASME) and Welding Records

- Repair Weld Record No. WR-G3-R04-R00RW0R-140, "SB Conical Roof for SV3, Roof Sector 04 Block, for Repair Joint No. WG3-R04B-12b-R," dated September 5, 2017, performed by T. Kusano Weld Id# 2431, using GMAW and GTAW process per WPS IT-1126G, Revision 1
- Repair Welding Record No. WR-G3-R16-R01W01-80, for NCR-041-SRG1, for SB Conical Roof for SV3, Roof Sector 16 block of weld joint WG3-R16D-25, T-Joint PJP+ Fillet performed on traveler NC-041-SRG1-B, dated September 27, 2017

#### Calibration, Heat Treatment, Non-Destructive Examination, Inspection and Test Records

- DTG-17-10479196, "Periodical Calibration Report for Thickness Gage (Capability: 20mm) dated May 9, 2017
- DTG-17-10479173, "Periodical Calibration Report for Thickness Gage (Capability: 20mm) dated May 9, 2017
- Receiving Inspection Record (RI) No. RI-040-000N660-2, dated May 10, 2017
- RI-040-00N680-1, dated February 23, 2017,
- Fit-up Inspection, Back Chipping and Final Inspection of Weld Repair Joint WG3-R048-12b-r, joint description G3-R04D-26 and G3-R048-12 dated September 5, 2017
- Coating Inspection Record No. CIR-041-SR42, "SB Conical Roof for SV3, WO# 5901041, equipment No. G3-R04," dated September 8, 2017
- MP Report No. MT-G4-C01 of Weld Joint Assembly No. WG4-C01A-07a, sequence No. 71-004-1C, dated December 13, 2017
- Calibration Record No. DT-2017-AY-A-CC011-1 for thickness film meter
- Calibration Record No. DT-2017-AY-A-CC010-1, for thickness film meter
- Certificate of Conformance for calibration of thickness standard serial No. 10479196, dated May 9, 2017
- Calibration record ECC-MY-09031 for MP Yoke Type A2, ID No. A209031, dated February 17, 2017
- Calibration record IHI-Y1-17-075, for temperature probe ID No. B-01233, dated October 10, 2017
- Calibration record ECC-LI-030003, for Light Meter ID No. 030003, dated May 10, 2018

#### Purchase Orders, Audit Reports, and Commercial-Grade Dedication

- Commercial Grade Dedication Plan (CGD) for Plasma/ Laser Cutting Services, 002K241, Revision 0, dated December 14, 2016
- CGD Survey report for Cutting Services, Revision 0, dated December 14, 2016
- IHI Audit/Survey Report of Kobe Steel Welding Solutions Fukuchiyama Plant, dated November 18, 2017
- Kobe Steel Additional Audit Plan (ASME/10 CFR Appendix B Qualification), dated November 17, 2017
- Purchase order (PO) No. BMCYJ-4, procurement of GTAW filler material Part No. TG-S60A dated December 13, 2016
- PO BMLA4-2, dated November 2017
- PO No. BMCYH-4, procurement of GTAW filler material Part No. TG-S60A dated December 13, 2016

### Nonconformance Reports

- Nonconformance Report (NCR)-043-G R16-001, issued on December 12, 2017, for R01B tail plate part/joint No. G4-R01B-04, during visual examination of cutting process at sequence No. KBC-102, on traveler No. PCL-SV4-YKBC, identified gas notches/gouges with NCR disposition action by QC Manager to repair on Repair traveler No. NC-043-GR16-001 using shop guide (SG) No. 006 of General Repair Procedure 5901040-000R102, Revision 4, for SV4 SB Conical Roof
- NCR -043-G R86-002, issued on December 12, 2017, for R08A tail plate part/joint No. G4-R08-04, during visual examination of cutting process at sequence No. KBC-172, on traveler No. PCL-SV4-YKBC, identified gas notches/gouges with NCR disposition action by QC Manager to repair using shop guide (SG) No. 006 of General Repair Procedure 5901040-000R102, Revision 4, for SV4 SB Conical Roof
- NCR-041-G-R42-036, dated July 8, 2017, "SV3 SB Conical Roof Part/Joint Name R04, work order No. 5901041, Process Sequence No. ZE-RS04-04" for process checklist PCL-SVE-RZZE-R04, unacceptable VT/PT/MT indication discovered in the weld joint and was disposition as minor repair using shop repair guidance (SG) No.002, Disposition as minor repair
- NCR-041-SC12, "Dimensional deviation of SV3 CR01 (Final DT)," dated July 11, 2017
- NCR-041-SC21, "Dimensional deviation of SV3 CR02 (Final DT)," dated June 14, 2017
- NCR-041-SC32, "Dimensional deviation of SV3 CR03 (Final DT)," dated July 11, 2017
- NCR-041-SM11, "Deviation from specified WPS," dated May 18, 2017
- NCR-041-SR42 – Remained weld defect found at monitoring after Final Inspection, dated August 28, 2017
- NCR-041-SR51 dated June 30, 2017, initiated for SB Conical Roof SV3 Dimensional deviation (Final Detail) for joint No. R05 on traveler No. PCS-SV3-R512 for Roof Sector 05, due to weld deformation, Disposition submit an N&DR No. APP-1278-GNR-850046, "IHI\_NCR-041-SR51\_R05\_Dimensional Deviation\_SV3\_Revision 1, approved as "Use-As-Is," dated August 4, 2017, with IHI closed NCR on August 9, 2017
- NCR-041-SRF1 – Dimensional deviation for SV3 RS15 (Final DT), October 20, 2017
- NCR-041-SRG1, "Incorrect Installation Direction," dated September 25, 2017
- NCR-041-SRG2 Notice of Nonconformity – Dimensional deviation for SV3 RS16 (Final DT), dated October 27, 2017
- NCR-041-SRL1, "Miss-machining of MC10x22," dated August 17, 2017
- NCR-40-SS02, "Carbozinc 859 temperature of coating material deviated from specified range, dated July 5, 2017

### Corrective Action Reports (Corrective Action Control Sheet)

- CACS-17-017, dated August 16, 2017, initiated for NCR-041-SR22, SR12, SR41, SR71, SR81, NCR-042-SR11, SR31, SR41 and SR51, as non-significant level 1 for improvement accuracy of product, fabrication sequence or method and results to be evaluated. Shop guidance for Roof Sector fabrication will be prepared to improve product manufacturing accuracy, results of final dimensional testing of Roof Sector SV3-R01 through R16 will be evaluated and effectiveness confirmed.
- CACS-17-019, dated July 21, 2017, as nonsignificant level 1 for improvement not requiring cause analysis for mill induced flaws found after painting for C-shapes MC10 channel supplied by TW Metals for Roof Sector. The CAR was withdrawn based on IHI acceptance of mill induced flaws and will treat one by one. The CAR closed on July 21, 2017

- CAR-17-024, dated August 7, 2017, initiated as nonsignificant level 1 as result from an external audit finding for 4 Roof sectors during temporary storage no identification of product on packing, and IHI deviated from its procedure. IHI took corrective action and closed on August 7, 2017
- CACS-17-026, dated August 10, 2017, initiated as non-significant level 1, for inadequate supplier audit frequency. The CAR closed
- CACS-17-027, dated August 31, 2017, initiated as significant level 2, for marking and storage of 4 Roof Sectors during temporary storage. Reviewed apparent cause analysis sheet and corrective action to correct the storage conditions. WECTEC NOUC No. 132175-D100-SB008, SB008-405-004-IHI-JPN-019-N00002, approved on September 21, 2017
- CACS-17-030, dated September 30, 2017, initiated for NCR-041-SR91 as non-significant level I, to improve the accuracy of applicable detail items
- CACS-17-031, dated October 10, 2017, initiated for safety-related weld defect found at monitoring of storage product after final inspection, as a result of NCR-041-SR42, corrective action was to improve marking for repairs
- CACS-16-072, dated March 31, 2017, initiated from internal audit, closed on March 31, 2017
- CACS-16-073, dated March 31, 2017, initiated from internal audit, closed on May 30, 2017

#### Corrective Action Requests Opened During the NRC Inspection

- CACS-17-038, CACS-17-039, CACS-17-042

#### Training Records

- Welder Performance Qualification Record (WPQR) for welder ID No. W-2431, qualified in GTAW process for carbon to carbon steel (P1-P1) base metal in 6G position to WPS TVPF-T-01G-QT Revision 1 qualified by bend test on August 5, 2009
- WPQR for welder ID No. W-2555, qualified in GTAW process, P1-P1 base metal in 6G position for WPS TVPF-T-01G-QT by bend test on August 5, 2009, recertified on November 13, 2012
- WPQR for welder ID No. W-1972, qualified in GMAW process, P1-P1 base metal, in 6G position for WPS TVPF-I-01G-QT by bend test on November 25, 2010, recertified on March 6, 2012
- WPQR for welder ID No. W-2705, qualified in GMAW process, P1-P1 base metal in 6G position for WPS TVPF-I-01G-QT by bend test on November 25, 2010, recertified on March 6, 2012
- Quality Control Qualification Records and Annual Performance Evaluation Records for Ryohei Kawano, Ryoichi Horikoshi, Mikihiro Kuruma, Toshiyuki Shimizu qualified as Level II
- Toshiyuki Shimizu Level II, Calibration and QC Inspector
- Certificate of Painting/Coating Inspection Personnel, certificate record for Takayuki Yagi Hidekki Yagi, Manabu Satou, and Keita Inoue all Level II
- Certificate No. CUT-I-1009, Revision 2, "Certification of QC Personnel Qualification," for Takayuki Yagi as Level III in UT, MT, PT, VT and Leak Testing, recertified on October 30, 2017 to IHI written practice IBR M13-02106

- Certificate No. CQC-I-1009, Revision 3, "Certification of QC Personnel Qualification," for Takayuki Yagi Level III QC, recertified on October 26, 2016, to IHI written practice IBR M13-02105
- Visual Acuity Record for Takayuki Yagi, Ryoichi Horikoshi, Mikihiro Kuruma, and Toshiyuki Shimzu
- Level II Penetrant Testing (PT) NDE qualification records and annual performance evaluation records for Ryoichi Horikoshi, Mikihiro Kuruma, and Toshiyuki Shimzu
- Level II MP qualification records and annual performance evaluation records for Yasuhiro Uenoyama, Ryoichi Horikoshi, Mikihiro Kuruma, and Toshiyuki Shimzu
- Level II UT qualification Records and annual performance evaluation records for Mikihiro Kuruma, Toshiyuki Shimzu, Ryoichi Horikoshi, and Makoto Nakamura
- Level II qualification record of NDE personnel ID No. MT-2C-052, reviewed and approved by IHI Level III on July 15, 2016
- IHI Document No. FOW-17-01, "Certificate of Forming Operator Qualification," for forming operators Masahiro Yanagisawa, Hiroaki Hanaya, Eli Takada, and Kazunori Hohjo

#### Miscellaneous

- 132175-D100.SB008, Attachment 2, "Inspection Attributes List (IAL) for Shield Building Conical Roof," Revision 6, dated March 2, 2017
- 132175-D100.SB008, Attachment 2, "Welding Preparation Guide for the Shield Building Conical Roof," Revision 7, dated March 2, 2017
- 132176-D100.SB008, "Purchase Order Revision, Vogtle EPC – Unit 3 & Site, Shield Building Conical Roof," Revision 16, dated October 19, 2017
- 132176-D100.SB008, "Purchase Order Revision, Vogtle EPC – Unit 4 & Site, Shield Building Conical Roof," Revision 16, dated October 19, 2017
- 132176-D100.SB008-SOW, "Scope of Work/ Supplemental QA Requirements for Shield Building Conical Roof Structural Steel," Revision 3
- 132176-D100.SB008-SOW, "Scope of Work/ Supplemental QA Requirements for Shield Building Conical Roof Structural Steel," Revision 3
- 5901043-000N621, "Material Requisition, ASTM A572 Gr. 50 (Part 1)," Revision B, dated February 21, 2017
- APP-1208-Z0-001, "Specification for the Fabrication and Field Erection of the SC Panels and the Conical Roof Steel Structure for the AP1000 Shield Building," Revision 2, dated January 8, 2016
- APP-1278-GEF-850002, "Manganese Limits for A572 Plate," Revision 0, dated December 4, 2015
- APP-1278-GF-850060, "[IHI to WEC] Clarification of Stiffener Plate Design in Compression Ring," Revision 0, September 7, 2016
- APP-1278-GF-850083, "Proposed Change to Ring Girder Top Flange," Revision 0, dated October 5, 2016
- APP-1278-GF-850099, "[IHI to WEC] Proposal for Un-weld Portions," Revision 0, dated October 28, 2016
- APP-1278-GF-850109, "[IHI to WEC] SSD-23 Dimension Clarification," dated Revision 0, November 29, 2016
- APP-1278-GF-850130, "[IHI to WEC] Clarification of CJP Weld Configuration," dated Revision 0, December 13, 2016

- APP-1278-GF-850140, “[IHI to WECTEC] Field Weld Preparation for Splice between Compression Ring Assemblies,” Revision 0, dated December 29, 2016
- APP-1278-GF-850144, “[IHI to WEC] Proposal for Straight Cut Compression Ring Bottom Plate,” Revision 0, dated January 10, 2017
- APP-1278-GF-850184, “[IHI to WEC] Clarification for Marking Requirement of “Working Point,” Revision 0, dated March 7, 2017
- APP-CA01-S4-004, 100, “Containment Building Module CA01 Isometric View,” Revision 5
- APP-CA01-S5-48001 rev 4, “Containment Building Module CA01 SUBMODULE CA01\_ Isometric View.”
- APP-SS01-GF-851818, “[IHI to WEC] Clarification of Connection Detail of Interior Member,” Revision 0, dated September 3, 2016
- AVL-007, “US Safety-Related / ASME Approved Vendors List,” 7th edition, Revision 6, dated December 8, 2017
- DN-018-302 Disposition Notice– Groove angle of test weldment used for Welder Qualification Performance Qualification (WPQ-AWS-T1) does not meet the requirements of AWS D1.1-2000, dated September 22, 2016
- DRR-5901040-000H621, “Design Review Report Type-1, Purchase Order Specification for Low Alloy Steel Plate A572 Gr. 50,” Revision 1, dated August 18, 2016
- DVR-5901040-000H621, “Design Verification Report, Purchase Specification for Low Alloy Steel Plate A572 Gr. 50” Revision 0, dated July 4, 2016
- IHI Document No. 00R104, “List of Qualified Welders and Welding Operators Qualification Records,” for Conical Roof Steel Structure for the AP1000 Shield Building Revision 11, dated September 4, 2017
- CMTR No. 7096-5, Hot-rolled Steel Plate, ASTM A572 Gr. 50 Type 1
- KOBE Steel Limited Welding Business Fukuchiyama Plant CMTR No. KN-0055, dated November 21, 2016, for weld filler material P/N TG-S60A size 2.00 mm diameter x 1000 mm length AWS A5.28 ER80S-G, traceable to identification No. GHA1509Y, reviewed and accepted by IHI on February 14, 2017
- LDN-5901040, “List of Nonconformity / Disposition Notice for SV3 &4/VS2 &3 SB Conical Roof,” Revision dated December 8, 2017
- Certified Material Test Report No. RINJQ-292-1-5, dated April 19, 2017, for welding material GMAW P/N NSSW-YM-3N, size 0.047 x 27.6 pounds each box, heat No. 6V9204, Lot No. 7W10180541, certified to AWS A5.28 to IHI Specification No. 5901040-00H660 for SB Conical Roof for SV3&4/VS2&3, reviewed and accepted by IHI QC on April 20, 2017
- NON-018-302 - 10CFR21010CFR50,55(e) Evaluation Sheet, Revision 0, dated September 22, 2016
- PDR-5901040-000H621, “Procurement Document Review Report, Purchase Specification for Low Alloy Steel Plate A572 Gr. 50,” Revision 0, dated July 4, 2016
- RI-043-000N621-2, “Receiving Inspection Record,” dated November 8, 2017