

July 18, 2008

Mr. Suk Kwan Kim, General Manager of Quality Assurance
Doosan Heavy Industries
555 Gwigok-Dong
Changwon, Gyeongnam
641-792 Korea

SUBJECT: NRC INSPECTION REPORT NO. 99901373/2008-201, NOTICE OF VIOLATION, AND NOTICE OF NONCONFORMANCE

Dear Mr. Kim:

On May 26–29, 2008, the U.S. Nuclear Regulatory Commission (NRC) conducted an inspection at Doosan's facility in Changwon, Korea. The enclosed report presents the results of this inspection.

This was a limited scope inspection that focused on assessing your compliance with the provisions of Title 10, Part 21 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." This NRC inspection report does not constitute NRC endorsement of your overall quality assurance or 10 CFR Part 21 programs.

During this inspection, the NRC found that the implementation of your quality assurance program failed to meet certain NRC requirements which are discussed in the enclosed Notice of Violation (NOV), Notice of Nonconformance (NON), and NRC inspection report. Specifically, a review of Doosan's 10 CFR Part 21 implementation identified that Doosan did not adopt appropriate procedures to evaluate deviations and failures to comply associated with substantial safety hazards. The enclosed NOV cites the violation of 10 CFR Part 21, and the enclosed inspection report discusses the circumstances surrounding it. Please note that you are required to respond to this letter and should follow the instructions in the enclosed NOV when preparing your response. The NRC will use your response, in part, to determine whether further enforcement action is necessary to ensure compliance with regulatory requirements.

In addition, the NRC inspectors found that the implementation of your quality assurance program failed to meet certain NRC requirements imposed on you by your customers. Specifically, the NRC inspectors determined that there were inadequacies in Doosan's policies, procedures, and implementing actions for the dedication of commercial grade items; the control of purchased material, equipment, and procedures; the control of nonconforming parts, material, and equipment; and corrective actions. The enclosed NON cites these nonconformances, and the enclosed inspection report describes the circumstances surrounding them. You are requested to respond to the nonconformances and should follow the instructions specified in the enclosed NON when preparing your response.

In accordance with 10 CFR 2.390, "Public Exemptions, Requests for Withholding," the agency will make a copy of this letter, its enclosures, and your response available electronically for public inspection in the NRC Public Document Room or from the NRC's Agencywide Documents Access and Management System (ADAMS), accessible at <http://www.nrc.gov/reading-rm/adams.html>. To the extent possible, your response should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request that such material be withheld from public disclosure, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21, "Requirements for the Protection of Safeguards Information."

Sincerely,

/RA/

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

Docket No.: 99901373

Enclosures: 1. Notice of Violation
 2. Notice of Nonconformance
 3. Inspection Report No. 99901373/2008-201

In accordance with 10 CFR 2.390, "Public Exemptions, Requests for Withholding," the agency will make a copy of this letter, its enclosures, and your response available electronically for public inspection in the NRC Public Document Room or from the NRC's Agencywide Documents Access and Management System (ADAMS), accessible at <http://www.nrc.gov/reading-rm/adams.html>. To the extent possible, your response should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request that such material be withheld from public disclosure, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21, "Requirements for the Protection of Safeguards Information."

Sincerely,

/RA/

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

Docket No.: 99901373

Enclosures: 1. Notice of Violation
2. Notice of Nonconformance
3. Inspection Report No. 99901373/2008-201

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NOTICE OF VIOLATION

Doosan Heavy Industries
555 Gwigok-Dong
Changwon, Gyeongnam
641-792, Korea

Docket Number 99901373
Inspection Report Number 2008-201

During an NRC inspection, conducted at Doosan Heavy Industries (Doosan) on May 26–29, 2008, a violation of NRC requirements was identified. In accordance with the NRC Enforcement Policy, the violation is listed below.

Section 21.21, “Notification of Failure to Comply or Existence of a Defect and Its Evaluation,” of the *Code of Federal Regulations* (10 CFR 21.21), paragraph 21.21(a), requires, in part, that each individual, corporation, partnership, or other entity subject to 10 CFR Part 21, “Reporting of Defects and Noncompliance,” shall adopt appropriate procedures to evaluate deviations and failures to comply associated with substantial safety hazards as soon as practicable.

In part, 10 CFR 21.21(a)(1) requires that deviations and failures to comply to identify defects and failures to comply associated to a substantial safety hazards be evaluated within 60 days of discovery in order to identify a reportable defect or failure to comply that could create a substantial safety hazard were it to remain uncorrected.

Paragraph 21.21(d)(3)(ii) requires that written notification to the NRC within 30 days following receipt of information by the director or responsible corporate officer on the identification of a defect or a failure to comply.

Contrary to the above, as of May 29, 2008, the Doosan 10 CFR Part 21 implementing procedure PQAP-1602, “Reporting of ‘Defects’ and ‘Failures to Comply Pursuant to 10CFR21,’” dated May 16, 2008, did not provide procedural guidance for (1) evaluating deviations and failures to comply to identify defects and failures to comply associated with substantial safety hazards within 60 days of discovery, (2) notifying the responsible officer within 5 days when it is determined that a defect that could cause a substantial safety hazard exists, and (3) providing written notification to the Commission within 30 days of the initial notification.

This issue has been identified as Violation 99901373/2008-201-01.

This is a Severity Level IV violation (Supplement VII).

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

ENCLOSURE 1

addresses the required response. Where good cause is shown, the NRC will consider extending the response time. Because your response will be made available electronically for public inspection in the NRC Public Document Room or through the NRC Agencywide Documents Access and Management System (ADAMS), to the extent possible, the response should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the public without redaction. ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21, "Requirements for the Protection of Safeguards Information."

Dated at Rockville, Maryland, this 18th day of July 2008

NOTICE OF NONCONFORMANCE

Doosan Heavy Industries
555 Gwigok-Dong,
Changwon, Gyeongnam 641-792, Korea

Docket Number 99901373
Inspection Report Number 2008-201

Based on the results of an NRC inspection conducted May 26–29, 2008, the NRC staff has found that certain of your activities were not conducted in accordance with NRC requirements.

- A. Section 21.3, “Definitions,” *Dedication*, of 10 CFR Part 21, “Reporting of Defects and Noncompliance,” states, in part, that the dedication process must be conducted in accordance with the applicable provisions 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” of the *Code of Federal Regulations* (10 CFR Part 50). It also states that dedication is an acceptance process undertaken to provide reasonable assurance that a commercial grade item to be used as a basic component will perform its intended safety function. This assurance is achieved by identifying the critical characteristics of the item and verifying their acceptability through inspections, tests, or analyses performed by the purchaser or third-party dedicating entity after delivery, supplemented as necessary by one or more of the following: commercial grade surveys, product inspections or witness at hold points at the manufacturer’s facility, and analysis historical records for acceptable performance.

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

Section 7.0, “Control of Purchased Material and Services,” of the Doosan Quality Assurance Manual QM-200, Revision 13, describes the controls in place to assure that purchased materials, fabricated items, and related services conform to the ASME code and other specified requirements. Section 7.0 also includes controls for the initial evaluation and approval of potential suppliers and periodic evaluation of approved suppliers.

Doosan Quality Procedure PQAP-0701, “Designation, Dedication and Control of Commercial Grade Item,” Revision 2, dated September 3, 2007, provides details and instructions describing the authority, responsibilities, and methods to be implemented by Doosan to designate, dedicate, and control commercial grade items (CGIs) in safety-related applications. Specifically, PQAP-0701 includes the guidance provided in EPRI NP-5652, “Guidelines for Utilization of Commercial Grade Items in Nuclear Safety Related Application (NCIG-07),” dated June 1988, for dedication activities.

Contrary to the above, as of May 26, 2008, Doosan’s CGI dedication procedures and sampling practice for dedicating commercial grade items did not provide reasonable

assurance that all commercial items received from its suppliers would conform to the applicable specification requirements. Specifically:

1. Doosan did not conduct commercial grade surveys to verify that the supplier's quality program included the requisite processes, such as material traceability and lot/batch controls, for the control of critical characteristics necessary to provide reasonable assurance that commercial grade items to be used as basic components will perform their intended safety function.
2. Doosan's CGI dedication process, as described in Doosan Quality Procedure PQAP-0701, is in nonconformance with the definitions outlined in Section 21.3 of 10 CFR Part 21. Specifically, it did not include the correct definitions for "Commercial Grade Item" and "Dedication," nor did it include any definition for "Basic Component" or "Dedicating Entity."

These issues have been identified as examples of Nonconformance 99901373/2008-201-01.

- B. Criterion VII, "Control of Purchased Material, Equipment, and Services," of Appendix B to 10 CFR Part 50 states, in part, that measures shall be established to ensure that purchased material, equipment, and services, whether purchased directly or through contractors and subcontractors, conform to the procurement documents. These measures shall include provisions, as appropriate, for source evaluation and selection, objective evidence of quality furnished by the contractor or subcontractor, inspection at the contractor or subcontractor source, and examination of products upon delivery.

As an ASME N-type Certificate Holder, the 2007 American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code requires Doosan to comply with the basic requirements and supplements of ASME NQA-1-1994, "Quality Assurance Requirements for Nuclear Facility Applications." Supplement 7S-1 to NQA-1-1994, "Supplementary Requirements for Control of Purchased Items and Services," describes acceptable methods for evaluating the capability of suppliers to provide items or services in accordance with the requirements of the purchase document and requires these methods to be documented.

Contrary to the above, on May 29, 2008, the NRC inspectors found that Doosan had procured a reactor vessel closure head from Japan Steel Works (JSW) in 2006 without sufficient documented justification of the basis for its approval of the JSW quality assurance (QA) program (i.e., a QA implementation audit or documented review of the supplier's history or QA documents). Additionally, the NRC inspectors found that Doosan's procedures lacked the requirement to document QA reviews of supplier performance history or quality records, if used for verification of the vendor's QA program implementation in lieu of an on-site audit. This issue is an example of Doosan's failure to provide documented evidence of its supplier's ability to provide items or services in accordance with the applicable procurement, regulatory, and ASME Boiler and Pressure Vessel Code requirements.

This issue has been identified as Nonconformance 99901373/2008-201-02.

- C. Criterion VII, "Control of Purchased Material, Equipment, and Services," of Appendix B to 10 CFR Part 50 requires, in part, that the effectiveness of the control of quality by

contractors and subcontractors be assessed at intervals consistent with the importance, complexity, and quantity of the product or services.

Section 7.3 of the Doosan QAM states that vendors who are placed in the approved vendor database are considered "approved" for a period of three years from the original survey or audit evaluation date, subject to annual audit or performance assessment.

Doosan Quality Control Procedure (QCP) 0701, "Vendor Evaluation," Revision 5, dated April 16, 2008, sets forth the specific requirements for vendor qualifications.

Contrary to the above, as of May 28, 2008, the NRC inspectors found that, inconsistent with the requirements of the Doosan QAM, QCP-0701 did not require annual evaluations of ASME Quality Service Certificate (QSC) or N certificate holders. The NRC inspectors also found that Doosan had failed to perform annual evaluations of its ASME QSC and N type certificate holders. These issues are examples of Doosan's failure to adopt and implement consistent requirements to verify continued satisfactory performance for ASME-certified suppliers.

This issue has been identified as Nonconformance 99901373/2008-201-03.

- D. Criterion VII, "Control of Purchased Material, Equipment, and Services," of Appendix B to 10 CFR Part 50 states, in part, that measures shall be established to assure that purchased material, equipment, and services, whether purchased directly or through contractors and subcontractors, conform to the procurement documents. These measures shall include provisions, as appropriate, for source evaluation and selection, objective evidence of quality furnished by the contractor or subcontractor, inspection at the contractor or subcontractor source, and examination of products upon delivery.

Section 7 of the Doosan QAM and QCP-0701 provide requirements for maintaining the database of approved vendors. These documents state that the database shall be prepared, maintained, and distributed by the QA Team, with the "master" or record copy being maintained in a controlled computer database.

Contrary to the above, on May 27, 2008, the NRC inspectors found a number of errors in Doosan's maintenance of its approved vendor database, at least one of which may have caused the three year inspection interval to be exceeded. These issues are examples of Doosan's failure to adequately maintain its approved vendor database so that it is up-to-date and correct, as required by Doosan QA program requirements.

These issues have been identified as examples of Nonconformance 99901373/2008-201-04.

- E. Criterion XV, "Nonconforming Materials, Parts, or Components," of Appendix B to 10 CFR Part 50 states, in part, "measures shall be established to control materials, parts, or components which do not conform to requirements. These measures shall include, as appropriate, procedures for identification, documentation, segregation, disposition, and notification to affected organizations."

Doosan Procedure NQCP-1501, "Nuclear Business Group Quality Control Procedure NQCP-300," Revision 8, dated May 16, 2008, defines responsibilities and procedures for handling nonconformances in supplies and services for nuclear facilities. The procedure

contains instructions for the Nuclear Power Plant Quality Control department (NQC) to use in determining whether conditions identified in nuclear items supplied to the U.S. customers represent a substantial safety hazard and in documenting the results of the evaluation on a nonconformance report (NCR).

Contrary to the above, on May 27, 2008, the NRC inspectors identified that two of the NCRs for U.S. components were not evaluated for the applicability of 10 CFR Part 21 as required by NQCP-1501. After further investigation, Doosan identified an additional two NCRs for U.S. components that were not evaluated for the applicability of 10 CFR Part 21.

This issue has been identified as Nonconformance 99901373/2008-201-05.

- F. Criterion XVI, "Corrective Action," of Appendix B to 10 CFR Part 50 states, in part, "measures shall be established to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances are promptly identified and corrected. In the case of significant conditions adverse to quality, the measures shall assure that the cause of the condition is determined and corrective action taken to preclude repetition."

Doosan Procedure QCP-1602, "Quality Control Procedure QCP-300 Control of Corrective Action," Revision 3, dated April 16, 2008, defines responsibilities and procedures for handling nonconformances and ineffective control identified by the customer. PQAP-1602, "Reporting of 'Defects' and 'Failures to Comply Pursuant to 10 CFR 21,'" defines the various control systems in place within Doosan to identify, control and resolve quality problems. According to PQAP-1602, these systems include activities such as design reviews, source and receipt inspections, tests, nonconformance reports, corrective action reports, and trend analyses.

Contrary to the above, as of May 26, 2008:

1. QCP-1602 did not provide instructions for evaluating the applicability of 10 CFR Part 21 in the corrective action process, and Exhibit 1 of QCP-1602 presented a sample Corrective Action Report (CAR) form that did not include a 10 CFR Part 21 determination.
2. Ten of the 14 CARs generated to address deficiencies for U.S. components were not evaluated for the applicability of 10 CFR Part 21 by Doosan.

These issues have been identified as examples of Nonconformance 99901373/2008-201-06.

Please provide a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with a copy to the Chief, Quality and Vendor Branch 1, Division of Construction Inspection and Operational Programs, Office of New Reactors, within 30 days of the date of the letter transmitting this Notice of Nonconformance. This reply should be clearly marked as a "Reply to a Notice of Nonconformance" and should include (1) a description of steps that have been or will be taken to correct this item, (2) a description of steps that have been or will be taken to prevent recurrence, and (3) the dates your corrective action and preventive measures were or will be

completed. Where good cause is shown, the NRC will consider extending the response time.

Because your response will be made available electronically for public inspection in the NRC Public Document Room or the NRC Agencywide Documents Access and Management System (ADAMS), to the extent possible, it should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the public without redaction. ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21, "Requirements for the Protection of Safeguards Information."

Dated at Rockville, Maryland, this 18th day of July 2008

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

Docket No.: 99901373

Report No.: 99901373/2008-201

Vendor: Doosan Heavy Industries & Construction
555 Gwigok-Dong
Changwon, Gyeongnam
641-792 Korea
Phone: +81-78-672-4247
Fax: +81-78-672-3145

Vendor Contact: Mr. Suk Kwan Kim, General Manager of Quality Assurance
Tel: +82-55-278-5791
sukkwan.kim@doosan.com

Nuclear Industry: Doosan is one of the world's largest manufacturers of reactor vessels, steam generators, reactor internals, and balance of plant components for the nuclear industry worldwide. Doosan manufactures safety-related and American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code items and components.

Inspection Dates: May 26–29, 2008

Inspectors: Kerri Kavanagh, NRO/DCIP/CQVP Team Leader
Richard McIntyre, NRO/DCIP/CQVB
Sabrina Cleavenger, NRO/DCIP/CQVB

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

EXECUTIVE SUMMARY

Doosan Heavy Industries
99901373/2008-201

The purpose of this inspection was to verify that Doosan Heavy Industries (Doosan) 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, Part 50, "Domestic Licensing of Production and Utilization Facilities," of the *Code of Federal Regulations* (10 CFR Part 50). The inspection also verified that Doosan implemented a program under 10 CFR Part 21, "Reporting of Defects and Noncompliance," that met the regulatory requirements of the U.S. Nuclear Regulatory Commission (NRC). The inspection was conducted at Doosan's facility in Changwon, Korea.

The NRC inspection bases were the following:

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

The NRC staff implemented Inspection Procedure (IP) 43002, "Routine Inspections of Nuclear Vendors" and Inspection Procedure 36100, "Inspection of 10 CFR Part 21 and 50.55(e) Programs for Reporting Defects and Nonconformance" during the conduct of this inspection.

During the NRC inspection at Doosan, the Korea Institute of Nuclear Safety (KINS) conducted a parallel, independent inspection of Doosan's QA Program and its implementation. Daily meetings were conducted between the KINS inspection team and the NRC inspectors to compare and discuss observations and/or findings. The KINS and NRC inspectors also discussed ongoing inspection activities throughout the day during the inspection to share issues and foster the collaborative nature of the inspection.

There were no previous NRC inspections performed at Doosan's facility in Changwon, Korea, prior to this inspection. The NRC inspectors reviewed Doosan's QA program and implementation procedures governing key fabrication activities. The inspection team also evaluated Doosan's implementation of 10 CFR Part 21 for evaluating deviations and reporting of defects that could cause a substantial safety hazard. The results of the inspection are summarized below.

With the exception of the areas described below, the NRC inspectors concluded that Doosan's QA policies and procedures were in compliance with the applicable requirements of 10 CFR Part 21 and Appendix B to 10 CFR Part 50 and that Doosan personnel were implementing these policies and procedures effectively.

10 CFR Part 21 Program

The NRC inspectors cited Violation 99901373/2008-201-01 based on inadequate procedural guidance to implement the requirements of 10 CFR Part 21. Specifically, Doosan's 10 CFR Part 21 implementing procedure PQAP-1602, "Reporting of 'Defects' and 'Failures to Comply Pursuant to 10 CFR 21,'" dated May 16, 2008, did not include guidance for (1) evaluating deviations and failures to comply to identify defects and failures to comply associated with substantial safety hazards within 60 days of discovery, (2) notifying the responsible officer within 5 days when it is determined that a defect that could cause a substantial safety hazard exists, and (3) providing written notification to the Commission within 30 days of the initial notification.

Design Control

The NRC inspectors issued Nonconformance 99901373/2008-201-01 in response to Doosan's failure to conduct commercial grade surveys to verify that its suppliers' commercial quality controls included the necessary provisions for the control of critical characteristics as part of commercial grade dedication activities.

Control of Purchased Material, Equipment, and Services

The NRC inspectors issued three nonconformances for failures on the part of Doosan to meet requirements imposed on them by U.S. customers through contractual agreements. The NRC inspectors issued Nonconformance 99901373/2008-201-02 in response to Doosan's failure to provide documented evidence of its supplier's ability to provide items or services in accordance with the applicable procurement, regulatory, and American Society of Mechanical Engineers (ASME) Code requirements during the procurement of a reactor vessel closure head (RVCH) from Japan Steel Works (JSW) in 2006.

The NRC inspectors issued Nonconformance 99901373/2008-201-03 upon finding that Doosan's policies and procedures did not require annual evaluations of ASME Quality System Certificate (QSC) or N certificate holders to verify continued satisfactory performance for ASME-certified suppliers.

The NRC inspectors issued Nonconformance 99901373/2008-201-04 based on Doosan's failure to adequately maintain its approved vendor database so that it is up to date and correct, as required by Doosan's QA program requirements.

Nonconforming Materials, Parts, or Components

The NRC inspectors issued Nonconformance 99901373/2008-201-05 as a result of finding that Doosan had failed to evaluate two of the nonconformance reports (NCRs) for U.S. components for the applicability of 10 CFR Part 21 requirements as required by Doosan procedures.

Corrective Action

The NRC inspectors issued Nonconformance 99901373/2008-201-06 because Doosan's Quality Control (QC) procedures did not provide instructions for evaluating the applicability of 10 CFR Part 21 requirements in the corrective action process. In addition, an exhibit in the procedure presented a sample corrective action report (CAR) form that did not include a 10 CFR Part 21 determination. The nonconformance is also the result of the NRC inspectors' finding that Doosan did not evaluate 10 of the 14 CARs generated to address deficiencies for U.S. components for the applicability of 10 CFR Part 21.

Report Details

1. 10 CFR Part 21 Program

a. Inspection Scope

The NRC inspectors reviewed the Doosan Quality Assurance Manual (QAM) and implementing policies and procedures that govern the 10 CFR Part 21 process, including PQAP-1602, "Reporting of 'Defects' and Failures to Comply Pursuant to 10CFR21," Revision 4, dated May 16, 2008. The NRC inspectors also discussed the 10 CFR Part 21 process with members of Doosan's management and technical staff and sampled Doosan's 10 CFR Part 21 program implementation activities.

b. Observations and Findings

b.1 10 CFR Part 21 Procedure and Implementation

PQAP-1602 outlines the process used at Doosan for the reporting of defects and nonconformance discovered by Doosan or reported to Doosan by its suppliers or customers. The procedure provides for the review of such deviations by a group consisting of representatives of the Design Engineering (DE) department and the Nuclear Quality Control (NQC) department. The group decides whether any identified deviation is a defect or a failure to comply. Upon evaluation of Doosan's 10 CFR Part 21 implementation activities, the NRC inspectors learned that Doosan had not performed any 10 CFR Part 21 evaluations.

The NRC inspectors determined that PQAP-1602 does not address all the requirements of 10 CFR Part 21.21. Specifically, PQAP-1602 does not specify the requirement of 1) paragraph 21.21(a)(1) for evaluating deviations and failures to comply to identify defects and failures to comply associated with substantial safety hazard as soon as practicable, and, in all cases within 60 days of discovery, in order to identify a reportable defect or failure to comply that could create a substantial safety hazard, were it to remain uncorrected; 2) paragraph 21.21(a)(3) for ensuring that a director or responsible officer is informed as soon as practicable, and, in all cases, within 5 working days after completion of the evaluation of a deviation or failure to comply where it was determined that the deviation or failure to comply is a defect that could cause a substantial safety hazard; and 3) paragraph 21.21(d)(3)(ii) for providing a written notification to the NRC within 30 days following receipt of information by the director or responsible corporate officer on the identification of a defect or failure to comply. The NRC inspectors identified this issue as Violation 99901373/2008-201-01.

c. Conclusions

Except for the issues identified in Violation 99901373/2008-201-01, the NRC inspectors concluded that the Doosan 10 CFR Part 21 program requirements are consistent with the regulatory requirements.

2. Commercial Grade Item Dedication

a. Inspection Scope

The NRC inspectors reviewed the Doosan QAM and implementing procedures that govern the dedication of commercial grade items provided by Doosan for use in safety-related applications to verify compliance with applicable regulatory requirements. Documents reviewed included:

- Doosan Quality Procedure, PQAP-0701, Revision 2, “Designation, Dedication and Control of Commercial Grade Item,” dated September 3, 2007
- Doosan CGI Dedication Procedure, PV-CEDM-CGI-001, Revision 0, “Commercial Grade Item (CGI) Dedication Procedure for Palo Verde Unit 1, 2, & 3 – CEDM Motor Assemblies,” dated June 29, 2006

To verify the implementation of the Doosan CGI dedication process, the NRC inspectors performed a review of PQAP-0701 and PV-CEDM-CGI-001, and the Document Transmittal Form (return copy) that documents the Palo Verde review and approval of documentation related to Doosan dedication for Palo Verde. The NRC inspectors also reviewed the Manufacturing Specification (PV-132ES-001) for Control Element Drive Mechanism, PV-CEDM-CGI-001, Revision 0, and three specific ASME SA material specifications.

The NRC inspectors also conducted a limited review of Purchase Specification NPS-11105F, “General Requirement for Non-code Material (for Foreign Company)” and four Commercial Grade Item (CGI) Evaluation and Verification Reports for piece parts (latch and magnet assembly return spring, locking cup, latch spacer, and socket head cap screw) that were procured in quantity by Doosan as commercial grade and dedicated for the Palo Verde CEDM motor assemblies.

b. Observations and Findings

Doosan procedures PQAP-0701 and PV-CEDM-CGI-001 provide the details and instructions describing the authority, responsibilities, and methods to be implemented by Doosan or its supplier to designate, dedicate, and control commercial grade items (CGI) in safety-related applications.

During the review of these Doosan procedures, the NRC inspectors noted that the procedures did not include the correct definitions for “Commercial Grade Item” and “Dedication,” as defined in 10 CFR Part 21. The NRC inspectors also noted that these procedures did not include any definition for “Basic Component” or “Dedicating Entity.” This omission is significant since the terms “Basic Component” and “Dedication” embody the regulatory process that, once effectively implemented, culminates in a successful CGI dedication program. This issue is identified as an example of a failure to adopt effective dedication procedures and is being identified as part of Nonconformance 99901373/2008-201-01.

As a result of feedback from KINS of its parallel inspection performed of CGI dedication for Korean contracts, the NRC inspectors were aware that Doosan had performed CGI dedication for parts and materials previously supplied to Palo Verde Units 1, 2, and 3. During discussions with Doosan, there was some initial confusion regarding whether Doosan had performed CGI dedication for components being sent to the U.S. market. However, through further discussions, the NRC inspectors and Doosan personnel were able to effectively communicate and understand that the scope of Doosan’s CGI dedication was limited to Palo Verde. The NRC inspectors were able to gain insights on Doosan’s control and oversight policies for the suppliers of these CGIs through the review of Purchase Specification NPS-11105F and the examination of the CGI Evaluation and Verification Reports for latch and magnet assembly return springs, locking cups, latch spacers, and socket head cap screws that were procured in quantity by Doosan for Palo Verde.

Doosan Quality Procedure PQAP-0701, “Designation, Dedication and Control of Commercial Grade Item,” Revision 2, dated September 3, 2007, provides details and instructions describing the authority, responsibilities, and methods to be implemented by Doosan to designate,

dedicate, and control CGIs in safety-related applications. PQAP-0701 includes the guidance provided in EPRI NP-5652, "Guidelines for Utilization of Commercial Grade Items in Nuclear Safety Related Application (NCIG-07)," dated June 1988, for dedication activities. EPRI NP-5652 provides four methods of accepting a CGI, including: Method 1, "Special Tests and Inspection"; Method 2, "Commercial Grade Survey of Supplier"; Method 3, "Source Verification"; and Method 4, "Acceptable Supplier/Item Performance Record."

However, the NRC inspectors learned that Doosan does not perform commercial grade surveys for suppliers whose critical characteristics are verified and accepted through testing of a sample based on EPRI 5652, Method 1. Doosan stated they were using a combination of a "desk top" qualification review of the commercial supplier's quality program, in combination with Method 4, which verifies the performance history of the item and/or supplier. At Doosan, however, this performance record qualification/acceptance of the supplier's capabilities is based solely on initial receipt inspection of the items procured from the supplier. Based on this qualification process, Doosan would then perform testing, on a sampling basis, as identified in PV-CEDM-CGI-001, to verify the identified critical characteristics.

The NRC inspectors explained that when sampling is used as part of the dedication process to verify critical characteristics (e.g., material composition), a commercial grade survey must also be performed by the dedicating entity to verify that the supplier's commercial quality programs include the requisite processes (e.g., material traceability and lot/batch controls) for effectively controlling the specified critical characteristics. The NRC inspectors noted that Doosan's CGI dedication program and procedures did not include requirements for conducting commercial grade surveys and did not include requirements to identify the products and their critical characteristics to verify that the commercial grade suppliers have the capabilities and processes to control the identified critical characteristics.

The verification of traceability and lot/batch control during the surveys provides assurance of the homogeneity of the product lots and provides the basis for sampling as an adequate method to verify critical characteristics. During the sample testing for verification of critical characteristics, the sampling plans rely on those batch/lot controls to provide reasonable assurance that the commercial grade items not sampled during inspection also have the required chemical and physical properties required by the applicable material specification.

Based on the Doosan process described above, the NRC inspectors concluded that Doosan's sampling practice for dedicating commercial grade items does not provide reasonable assurance that all parts supplied as basic components for use in nuclear safety-related applications conform to the applicable procurement specification requirements. This issue is identified as an example of a failure to adopt an effective dedication program and is being identified as part of Nonconformance 99901373/2008-201-01.

c. Conclusions

Through this limited review of Doosan's CGI dedication process and practices, the NRC inspectors determined that Doosan is not adequately implementing a commercial dedication process in compliance with regulatory and industry guidance, as identified in Nonconformance 99901373/2008-201-01. Doosan's sampling practice for dedicating commercial grade items does not provide reasonable assurance that all items received from its suppliers conform to the specification requirements. The NRC inspectors concluded that the approach by which Doosan implements its dedication program does not assure the uniform quality of the basic components that Doosan supplies for use in safety-related applications. As a result, there is insufficient justification and technical basis for accepting the results of Doosan's dedication of commercial grade items for use in safety-related applications when sampling has been utilized.

3. Control of Purchased Material, Equipment, and Services

a. Inspection Scope

The NRC inspectors reviewed Doosan QA policies and procedures for the control of purchased material, equipment, and services to verify compliance with the quality assurance requirements of Criterion VII, "Control of Purchased Material, Equipment, and Services," of Appendix B to 10 CFR 50. Specifically, the NRC inspectors reviewed measures established by Doosan to select, qualify, and oversee vendors supplying basic components, as described in the following procedures:

- Doosan QAM, QM-200, Section 7, "Control of Purchased Items and Services" Revision 11, dated January 31, 2008
- Nuclear Business Group Quality Control Procedure (QCP) 0701, "Vendor Evaluation," Revision 5, dated April 16, 2008

The NRC inspectors evaluated Doosan's implementation of these policies and processes by reviewing a sample of vendor audit reports completed by Doosan, including:

- Doosan audit report VAR-0602-07 for Doosan's audit of Curtiss-Wright Electro-Mechanical Corporation, conducted February 6-10, 2006 and the corresponding Vendor Evaluation Report, VAER-0602-07, in which Doosan approved Curtiss-Wright's corrective actions related to the audit findings. Audit report checklist contained in NIAC Audit Report No. 12093.
- Doosan audit report VAR-0605-02, for Doosan's audit of Japan Steel Works, conducted May 11-12, 2006 and the corresponding Vendor Audit Check List, VACL-0605-02.
- Doosan audit report VAR-0805-01, for Doosan's audit of Chosun Steel & Wire Company, Ltd., and the corresponding checklist VSCL-0805-01, dated May 7, 2008, and Vendor Audit Deficiency Reports (VADR): VADR-0805-01-01, VADR-0805-01-02, and VADR-0805-01-03.

In addition to Doosan QAM Section 7, the NRC inspectors reviewed the following documents in order to evaluate the adequacy of the methods Doosan uses to accept basic components from its suppliers:

- Nuclear Business Group Quality Control Procedure NQCP-0703, "Control of Received Items and Material," Revision 3, dated April 16, 2008
- NQCP-0705N, "Control of Welding Material," Revision 5, dated January 31, 2008

The NRC inspectors also reviewed a sample of source reviews, receipt inspection reviews, and material purchase specifications to evaluate the adequacy of Doosan's measures for verifying the attributes and quality of purchased material.

b. Observations and Findings

b1. Policies and Procedures for Vendor Qualification

According to Section 7.3 of Doosan's QAM, the QA Team General Manager is responsible for the survey, evaluation, and approval of vendors. QCP-0701 identifies four methods for the initial evaluation and qualification of vendors. These methods include: 1) a review of the vendor's performance history, 2) a review of quality records, 3) verification of acceptance of a Quality System Certificate, and 4) a direct on-site facility survey. Material organizations and suppliers of subcontracted services that do not hold an ASME certificate may only be qualified via an on-site audit.

As an ASME N-type Certificate Holder, the 2007 ASME Boiler and Pressure Vessel Code requires Doosan to comply with the basic requirements and supplements of ASME NQA-1-1994, "Quality Assurance Requirements for Nuclear Facility Applications." Supplement 7S-1 to NQA-1-1994, "Supplementary Requirements for Control of Purchased Items and Services," describes the three acceptable methods for evaluating the capability of suppliers to provide items or services in accordance with the requirements of the purchase document. Supplement 7S-1 to NQA-1-1994 also requires these methods to be documented. Documentation of this evaluation represents the basis for the Certificate Holder's approval of the supplier's QA program and implementation.

The NRC accepts ASME accreditation as evidence that the holder of the accreditation has a documented QA program that meets the requirements of Appendix B to 10 CFR 50. However, this recognition applies only to programmatic aspects of the QA programs, and holders of operating licenses and construction permits, as well as their contractors (e.g., Doosan), are still responsible for ensuring that the suppliers are effectively implementing their approved QA programs. This implementation evaluation should be accomplished and documented through one or more of the three methods identified in NQA-1-1994. QCP-0701 is consistent with the methods described in Supplement 7S-1 to NQA-1-1994. However, QCP-0701 also allows Doosan to qualify vendors based solely on the acceptance of the vendor's ASME certification.

The NRC inspectors found that Japan Steel Works (JSW) had been added to Doosan's approved vendor (AV) database on July 1, 2004 based on their ASME certification. The first QA implementation audit of JSW was completed by Doosan on May 11, 2006. However, in 2005, prior to this implementation audit, JSW was awarded a contract by Doosan's Japan facility to supply a forging for Entergy's Waterford Unit 3 Replacement RVCH. The forging, procured under Order No. 2005003049, was completed by JSW in April, 2006, with the Certified Material Test Report (CMTR) being affirmed by JSW on April 28, 2006.

In this case, the Replacement RVCH was completed prior to the completion of an evaluation or on-site audit of JSW, and Doosan was unable to provide sufficient documented justification for the basis of its approval of JSW's QA program implementation. Additionally, QCP-0701 lacked controls, consistent with NQA-1-1994 provisions, requiring the documentation of QA reviews of supplier performance history or quality records, when used for verification of the vendor's QA program implementation in lieu of an on-site audit. These failures of Doosan to impose adequate procedural controls for the documentation of supplier evaluations and to provide documented evidence of its supplier's ability to provide items or services in accordance with the applicable procurement, regulatory, and ASME Code requirements have been identified as examples of Nonconformance 99901373/2008-201-02.

According to Section 7.3.5.3 of the Doosan QAM, "Vendors placed on the AV shall be considered "approved" for a period of three (3) years from the original survey or audit evaluation

date subject to annual audit or performance assessment, unless removed earlier by the QA Team General Manager. A vendor's approval status may be extended by the QA Team General Manager for up to one year intervals based upon continued satisfactory performance as determined by annual evaluation.”

QCP-0701 requires material organizations and suppliers of subcontracted services for ASME Code applications who do not hold ASME certificates to have a triennial on-site audit and annual audits or performance assessments. However, for vendors who were placed in the AV database based upon possession of an ASME QSC or N type certificate, QCP-0701 only requires that the vendor be evaluated by an on-site audit at least triennially and, inconsistent with the requirements of the QAM, provides no requirements for annual evaluations.

Contrary to Doosan's QAM, upon sampling approximately 10 certificate holders, the NRC inspectors found that no annual evaluations had been completed for any approved vendors that are ASME certificate holders in the sample population. The Doosan staff also stated that it was not their policy to complete annual evaluations of ASME certificate holders. The failure to adopt and implement consistent requirements to perform annual supplier evaluations to verify continued satisfactory performance has been identified as Nonconformance 99901373/2008-201-03.

b2. Review of Vendor Survey Reports

For a sample of reports from audits Doosan conducted of its suppliers, the NRC inspectors verified that during such audits, Doosan adequately evaluated the vendor's compliance with the applicable requirements of Appendix B to 10 CFR Part 50, 10 CFR Part 21, and ASME Boiler and Pressure Vessel Code Section III, "Rules for Construction of Nuclear Facility Components." The NRC inspectors verified that Doosan had approved the vendor's corrective actions for any findings issued, and that the approval was documented in a Vendor Evaluation Report. The NRC inspectors also verified that audit check lists were prepared and completed for the audit and contained sufficient objective evidence to support the conclusions made by Doosan. The NRC inspectors also verified that the scope of supply identified in Doosan's AV database was consistent with the materials supplied to Doosan by each vendor in the sample population.

b3. Maintenance of the Approved Vendor Database

According to Section 7 of the Doosan QAM and QCP-0701, the database of approved vendors shall be prepared, maintained, and distributed by the QA Team, with the "master" or record copy being maintained in a controlled computer database. The QA department also has the responsibility for approving the addition and deletion of vendors to/from the database. Departments with procurement authorization have read-only access to the AV database.

The NRC inspection team reviewed listings from the AV database and cross-referenced the information with applicable survey, audit, and evaluation records furnished by Doosan. The database of approved vendors contains the following information for each vendor, as applicable: 1) the vendor name and address, 2) a reference for the latest audit or report number, 3) the date on which the vendor was added to the approved vendor database, 4) the expiration date (which indicates ASME certification expiration, if applicable. If not applicable, it indicates the survey/audit expiration date), 5) the evaluation due date (which indicates the date a triennial survey, annual audit, or evaluation is due), 6) vendor work scope, and 7) remarks relevant to the vendor, recent evaluations, etc. For vendors qualified by virtue of possession of an ASME N type Certificate or QSC, the AV database lists the applicable ASME Certificate serial numbers and respective expiration dates. For vendors qualified by Doosan survey, the AV database lists

the applicable Vendor Survey/Audit Report number (or Vendor Evaluation Report number) and the revision number and date of the vendor's QA Manual approved by Doosan.

The NRC inspectors found that the evaluation due date listed in the database for the material organization Soudokay was greater than three years from the date of the most recent evaluation. The NRC inspectors also found that the evaluation due date for Special Metals Company, a material organization, had not been updated after the last evaluation even though the vendor had been approved with comments. The NRC inspectors also found that a vendor audit report for Chosun Steel & Wire was supplied for review by Doosan staff; however, the report number was not reflected in the applicable "Report No." field in the database. Instead, the previous report number was included in the listing.

Upon identifying these issues to Doosan staff, the errors were promptly corrected and a review of the entire approved vendor listing was completed by QA staff. During the review, Doosan made an additional 14 revisions to the approved vendor database. As stated by Doosan staff, these issues stemmed from confusion among Doosan personnel as to the meaning of the "Approval Date" field, which is not defined in the Doosan QAM or procedures.

Doosan's failure to adequately and accurately maintain its approved vendor database, as required by Doosan QA program requirements, is identified as Nonconformance 99901373/2008-201-04.

b4. Source and Receipt Inspections

Section 7 of the Doosan QAM provides the necessary requirements on the use of source verifications to support the acceptance of a basic component. The QAM states that the applicable Quality Control (QC) department general manager shall be responsible for ensuring that source verification is performed at intervals consistent with the importance and complexity of the purchased items or services, and source verifications shall be performed in accordance with Work Instructions or Process Specifications that are prepared, reviewed, approved, and issued by the applicable QC department and meet all applicable requirements of the ASME Code, customer documents, and purchase documents. The results of source verifications are documented on Source Inspection Reports (SIRs).

The NRC inspectors verified the use of a source inspection by Doosan to verify and accept JSW's ultrasonic testing of the Palo Verde Replacement RVCH and to accept JSW-supplied documentation for drop weight testing, identification, NDE, and mechanical and dimensional checks for the Waterford Unit 3 Replacement RVCH (Entergy). The NRC inspectors verified 1) that an inspection plan, work instruction, or process specification had been prepared, reviewed, and approved for use during the source verifications, 2) that a checklist was established that adequately verified that the requirements of the ASME Code and Purchase Specification had been met, and 3) that the results of the source inspection were documented on the SIR through completion of the checklist, marking of the "acceptable" block, and signature of the witness.

NQCP-0703 and Section 7 of the Doosan QAM describe Doosan's policies and methods for using receipt inspections to support the acceptance of a basic component from a supplier. QCP-0705N provides controls specific to welding materials to ensure that welding materials are adequately and properly controlled from the time of acceptance via receipt inspection through storage, issue, use, and return to stock, if necessary. Receipt inspection of welding material is performed in accordance with the requirements of NQCP-0703.

Through a sampling of Doosan receipt inspections and the corresponding purchase specifications, the NRC inspectors verified that Doosan receipt inspectors had verified the

attributes specified in purchase documents. The NRC inspectors also verified that the requirements specified in the purchase specification were verified by Doosan during the receipt inspection. Through a document review of the CMTR, the NRC inspectors confirmed that the purchase specification requirements were verified by the receipt inspector and that the receipt inspector conducted verifications of purchased item identification, dimensions, quantity, and condition (visual inspection) as required by Doosan procedures. The NRC inspectors also verified that the applicable vendors were listed on Doosan's approved vendor list, had been audited within the applicable timeframe, and were approved for a scope of supply consistent with the received items.

c. Conclusions

Except for the issues identified in Nonconformances 99901373/2008-201-02, 99901373/2008-201-03, and 99901373/2008-201-04, the NRC inspectors concluded that Doosan's policies and procedures for procurement control comply with the quality assurance requirements of Criterion VII of Appendix B to 10 CFR Part 50 and that Doosan personnel were implementing these policies and procedures effectively.

Based on the records reviewed, the NRC inspectors concluded that Doosan's reports for evaluations of its suppliers contained sufficient objective evidence to support the qualification and requalification of the vendors by Doosan. The NRC inspectors also concluded that the requirements set forth in customer design documents were effectively translated into purchase specifications and that purchase specification requirements were successfully verified by Doosan through source and receipt inspections.

4. Control of Production and Special Processes

a. Inspection Scope

The NRC inspectors reviewed the Doosan QAM and implementing policies and procedures that govern the control of production and special processes. Specifically, the inspectors reviewed Doosan QAM Section 9.0, "Control of Processes," Section 10, "Inspections," and Section 11, "Test Control," of the Doosan QAM, Revision 13, dated January 31, 2008. The NRC inspectors also reviewed Nuclear BG Quality Control Procedure NQCP-300, QCP NQCP-0901, "Control of Production Processes," Revision 5, dated April 16, 2008.

The NRC inspectors evaluated ongoing activities such as welding, non-destructive examination (NDE), inspection, and testing for United States replacement components. These included the Entergy Waterford Unit 3 and Arkansas Nuclear One (ANO) Unit 2 Replacement RVCHs, Arizona Public Service Company (APS) Palo Verde Unit 1, 2, and 3 Replacement RVCHs, and Tennessee Valley Authority (TVA) Sequoyah replacement steam generator (RSG). The NRC inspectors reviewed all the pertinent documents that were generated to support these fabrication activities to verify compliance with Doosan program requirements and verify adequate implementation of those requirements.

For the Waterford Unit 3 Replacement RCVH, the NRC inspectors reviewed documentation related to J-groove Inconel preheat and buttering welding activities performed on weld joint number 701-01-07. This documentation included the quality plan, shop traveler (100329484), fabrication drawing, welding procedure specification (WPS), procedure qualification record (PQR), material purchase specification, General Welding Procedure for Replacement RVCH (PS-ETN-101), Table of Certified Welder or Welding Operator (for welders who performed j-groove welding activities on this penetration), the weld material transfer inspection report for

weld material heat number 31333 from a domestic Korean job to the Waterford Replacement RVCH, and the CMTRs for the Inconel buttering weld material.

In order to verify the Doosan process for welding material control, the NRC inspectors interviewed personnel at the Welding Material Crib (including the crib keeper) and reviewed applicable records to verify material control process implementation. These records included the Welding Material Control Log (WMCL) and Welding Material Issue Cards (WMICs).

The NRC inspectors reviewed documentation for NDE activities for the Waterford Replacement RVCH liquid penetrant (PT) examination (Traveler No.100329484, Operation 150/155) performed for the Inconel J-groove buttering welding on head penetrations 4 through 7 and witnessed magnetic particle (MT) activities (Traveler No. 100473555, Operation 300) performed for the Sequoyah Unit 2 RSG pad and recirc-nozzle build-up welding and the welds for the support pins on the inner intermediate vessel assembly (transition cone to intermediate shell). The NRC inspectors reviewed the applicable Waterford and Sequoyah shop travelers, the Sequoyah RSG Intermediate Assembly Integrated Quality Plan, QP-S2RSG45, the fabrication drawing, the applicable liquid penetrant and magnetic particle nondestructive examination procedures, the NDE examiner Personnel Qualification Certificate records, calibration records for the various equipment used for NDE, and the final examination documentation results of NDE activities, including a Welding Defect Notice (WDN-080136) for a linear indication on the as-ground condition identified during the MT examination of one of the intermediate vessel assembly build-up weld area joints.

b. Observations and Findings

QAM Section 9 describes the system used to control special processes used for the manufacture of casting and forging materials and fabrication operations for the construction of ASME Code Section III items. Section 9.3 describes the process for preparation, issue, distribution, and implementation of shop travelers for manufacturing operations. Section 9.6 describes the general welding process requirements and limitations, and Section 9.8 describes controls for performance of NDE activities and for qualification and certification of NDE personnel.

QAM Section 10 describes requirements for the control of inspections performed to accept materials, processes, and products associated with ASME Code item manufacturing and construction. QAM Section 11 describes the controls for tests performed to verify that items conform to specified requirements and to demonstrate that the items will perform satisfactory in service.

Doosan Procedure NQCP-0901 details the authority, responsibilities, and methods implemented to control production processes such as welding, heat treatment, and NDE. This procedure also provides additional details for the preparation and implementation of quality plans and shop travelers for manufacturing operations.

Through review of applicable QAM sections and QCPs and observation of specific manufacturing activities for the Sequoyah Unit 2 RSG and the Waterford Unit 3, ANO Unit 2, and Palo Verde Units 2 and 3 Replacement RVCHs, the NRC inspectors confirmed that the Doosan manufacturing process uses the shop traveler as the method for controlling shop production activities. The shop traveler incorporates witness and hold points for the customer, authorized nuclear inspector (ANI), and Doosan QC, as applicable, and identifies the applicable drawings, material specifications, work instructions, and procedures applicable to the manufacturing operation activity being performed. The shop traveler serves to assure that the fabrication activities are accomplished in accordance with specified requirements and

conducted in the correct operational sequence. The shop traveler also has the function of a work identification and check point for each work operation performed.

The NRC inspectors observed samples of fabrication and special process activities, as discussed below, for the contracts mentioned above to verify implementation of the Doosan QAM and implementing processes and procedures. These activities included:

Welding

All welding on ASME Code materials and fabrication of ASME Code items is performed by qualified welders and welding operators in accordance with approved welding procedure specifications (WPS). Each Doosan WPS, welder, and welding operator is qualified in accordance with the requirements of the QAM and ASME Section III and Section IX, "Welding and Brazing Qualifications."

As a result of the review of documentation related to J-groove Inconel preheat and buttering welding activities performed on weld joint number 701-01-07 for the Waterford Unit 3 Replacement RCVH, the NRC inspectors confirmed that the welding material CMTRs complied with purchase and material specification requirements and verified completion and sign off of all required shop traveler, QC, customer, and ANI witness or hold points.

Control of Weld Material

The NRC inspectors verified Doosan's process for welding material control through direct interview of personnel and observation of welding material control activities. Doosan employs the use of a Welding Material Control Log (WMCL) and Welding Material Issue Cards (WMICs) to control welding material. A WMCL is prepared and maintained by Nuclear Manufacturing Engineering (NME) for each Doosan contract. WMICs are issued by the welding foreman and maintained by the crib keeper and are physically maintained with the issued welding material unless the heat/lot number of the welding material is identified on the material itself.

The NRC inspectors verified the implementation of this process for the withdrawal and release of covered electrodes and flux from the welding crib. The NRC inspectors verified that the welding material was controlled using the WMIC and the correct heat/lot number of the welding material was identified on the WMIC released by the crib keeper. All activities observed were in compliance with the Doosan QA program and procedural requirements.

Nondestructive Examination (NDE)

After reviewing documentation for NDE activities for the Waterford Replacement RVCH PT examination and witnessing MT activities performed for Sequoyah Unit 2 RSG pad and recirc-nozzle build-up welding and support pin welds, the NRC inspectors concluded that all NDE on ASME Code materials and fabrication of ASME Code items were performed consistent with Doosan QA program requirements and were conducted by personnel who had been qualified and certified in accordance with Doosan written practice QCP-0204, "NDE Personnel Certification Program." While witnessing the MT examinations for the Sequoyah RSG, the NRC inspectors verified that all activities were performed to Doosan QAM and procedural implementation requirements by appropriately qualified and certified examination personnel.

The NRC inspectors also observed the Doosan Quality Control Inspector (QCI) performing the hold point inspection activities as required by the Sequoyah RSG 2B MT Traveler (Traveler No. 100473555, Operation 300). All activities were performed to Doosan QAM and procedural implementation requirements by appropriately qualified and certified examination personnel.

Inspection

QAM Section 10.0, "Inspection" describes the requirements for inspections performed to accept materials, processes, and products associated with the manufacturing and construction of ASME Code items. The NRC inspectors witnessed Doosan QC inspection activities performed for Sequoyah Unit 2 RSG Traveler Operation No. 290, which entailed a QCI visual and dimensional inspection of the build-up welding of the pads, recirc-nozzles, and various support pins on the inner intermediate vessel assembly (transition cone to intermediate shell). Prior to witnessing the inspection activities, the NRC inspectors reviewed the Sequoyah shop traveler, the fabrication drawing, the Integrated Quality Plan QP-S2RSG45, General Welding Procedure for RSG Sequoyah Unit 2 (PS-KGN-101) referencing grinding activities, Process Specification PS-55103S2 (Visual and Dimensional Inspection Procedure) for Sequoyah Unit 2 RSG, the applicable WPS, and the Personnel Qualification Record for the QC inspector, and the final documentation of visual and dimensional inspection activities.

The inspector also observed the ANI from Hartford Steam Boiler (HSB) Global, the Westinghouse (customer representative) inspector, and the Doosan QC inspector perform their witness or hold point inspection activities as identified on the Sequoyah RSG 2B MT Traveler (Traveler No. 100473555, Operation 290). The NRC inspectors noted that the Doosan QC inspector was very knowledgeable and effective in performing all inspection activities as part of Operation 290.

c. Conclusions

The NRC inspectors concluded that overall, Doosan had established appropriate and effective means to control fabrication activities and special processes such as welding, NDE, inspection, test and material control for supply of Replacement RVCHs and RSGs. Based on the sample reviewed, the NRC inspectors concluded that the Doosan QAM and associated fabrication and special process procedures and activities were being effectively implemented by qualified personnel, using qualified equipment and processes. These conclusions are based on the review of a sample of Doosan documentation, observations of fabrication, test, and inspection activities (as described above), and interviews with Doosan, customer, and ANI personnel.

5. Nonconformance Control

a. Inspection Scope

The NRC inspectors reviewed the Doosan QAM and implementing policies and procedures that govern the control of nonconformances to assess compliance with the requirements of Criterion XV, "Nonconforming Materials, Parts, or Components," of Appendix B to 10 CFR Part 50. The NRC inspectors reviewed Section 15, "Nonconformance Control," of the Doosan QAM, Revision 13, dated January 31, 2008, which describes the nonconformance control process for Doosan. The NRC inspectors also reviewed NQCP-1501, "Nuclear Business Group Quality Control Procedure NQCP-300," Revision 8, dated May 16, 2008, which defines responsibilities and procedures for handling nonconformances in supplies and services for nuclear facilities.

The NRC inspectors evaluated a sample of NCRs associated with the six components being manufactured at Doosan for U.S. utilities to verify compliance with program requirements and adequate implementation of those requirements.

b. Observations and Findings

b.1 Policies and Procedures for the Control of Nonconformances

Section 15 of the Doosan QAM describes the process for identifying, documenting, segregating, evaluating, and handling nonconformances, as well as for notifying affected organizations and customers. Procedure NQCP-1501 describes the process for identifying, evaluating, reporting, and correcting nonconformances. The procedure contains process flow diagrams and sample reporting forms that further describe and govern the nonconformance process.

The NRC inspectors determined that Section 6.4.14 of NQCP-1501, "Determination of 10 CFR 21 Applicability," contained instructions for NCRs generated by the Nuclear Power Plant Quality Control (NQC) department, for nuclear items supplied to customers in the United States, to determine whether the identified condition represents a substantial safety hazard and to document the results of the evaluation on the NCR. The NRC inspectors noted that Exhibit 2 of NQCP-1501 included Revision 8 of a sample NCR form, which did not include provisions for performing a 10 CFR Part 21 determination. The NRC inspectors discussed with Doosan the rationale for having the engineering team document the 10 CFR Part 21 applicability on the NCR form instead of modifying the standard NCR form to include a 10 CFR Part 21 determination. During discussions with Doosan personnel, it was revealed that NQC is not the only department that uses the NCR form. As a result, as allowed by NQCP-1501, the NRC inspectors found that other Doosan departments were generating NCRs on nuclear components supplied to customers in the U.S. without evaluating the applicability of 10 CFR Part 21. The NRC inspectors identified this issue as Nonconformance 99901373/2008-201-05.

b.2 Review of Nonconformance Reports

Upon evaluation of 15 of the 31 NCRs initiated for all issues associated with the six components being manufactured at Doosan for U.S. utilities, the NRC inspectors noted that each NCR contained a detailed description of the concern and at least one proposed corrective action associated with the identified deficiency. The NRC inspectors verified that the NCRs included the appropriate review and signoff and, when applicable, verified that each corrective action is assigned to a lead organization responsible for its completion. However, the NRC inspectors identified that two of the NCRs were not evaluated for the applicability of 10 CFR Part 21 as required by NQCP-1501. After further investigation, Doosan identified an additional two NCRs that were not evaluated for applicability of 10 CFR Part 21 requirements. Doosan attributed these missed evaluations to the lack of a 10 CFR Part 21 determination on the standard NCR form. The NRC inspectors identified this issue as another example of Nonconformance 99901373/2008-201-05.

c. Conclusions

Except for the examples identified as part of Nonconformance 99901373/2008-201-05, the NRC inspectors concluded that the Doosan program requirements for the control of nonconformances are consistent with the regulatory requirements of Criterion XV of Appendix B to 10 CFR Part 50. Based on the NCRs reviewed, the NRC inspectors determined that the Doosan QAM and associated nonconformance procedure were being effectively implemented.

6. Corrective Action Program

a. Inspection Scope

The NRC inspectors reviewed Section 16, "Corrective Action," of the Doosan QAM and implementing procedure QCP-1602, "Quality Control Procedure QCP-300 Control of Corrective Action," Revision 3, dated April 16, 2008, to assess compliance with the requirements of Criterion XVI, "Corrective Action," of Appendix B to 10 CFR Part 50.

The NRC inspectors also evaluated a sample of Corrective Action Reports (CARs) associated with the six components being manufactured at Doosan for U.S. utilities to verify compliance with the corrective action program requirements and adequate implementation of those requirements.

b. Observations and Findings

b.1 Policies and Procedures for the Corrective Action Program

Section 16 of the Doosan QAM describes the corrective action process for Doosan and delineates the responsibilities and controls used to assure that conditions adverse to quality are promptly identified and corrected and that the cause of the condition is determined and corrective action taken to preclude recurrence. Verification of completion of corrective action implementation and trend analysis of nonconformances and corrective actions are also defined in Section 16.

QCP-1602 defines responsibilities and procedures for handling nonconformances identified by the customer. The procedure describes the process for verifying the validity of the deficiency, evaluating the cause of the deficiency, and documenting the actions to be taken to prevent recurrence.

b.2 Implementation of the Corrective Action Program

The NRC inspectors noted that QCP-1602 adequately identified sources of quality and product safety-related problems that result in the generation of a CAR. The NRC inspectors verified that QCP-1602 provided adequate guidance for the review of corrective actions to determine if they were effective in precluding the recurrence of the deficiencies. However, the NRC inspectors found that QCP-1602 did not provide instructions for evaluating the applicability of 10 CFR Part 21 in the corrective action process and that Exhibit 1 of QCP-1602 presented a sample CAR form that did not include a space for a 10 CFR Part 21 determination. The NRC inspectors found the lack of procedural guidance for the evaluation of the applicability of 10 CFR Part 21 in the corrective action process to be inconsistent with Section 5.4 of PQAP-1602, "Reporting of 'Defects' and 'Failures to Comply Pursuant to 10 CFR 21,'" which defines the various control systems in place within Doosan to identify, control, and resolve quality problems. According to PQAP-1602, these systems include activities such as design reviews; source, receipt, and process inspections; product examinations; tests; NCRs; internal and external audits; corrective action reports; and trend analysis. The NRC inspectors identified this issue as Nonconformance 99901373/2008-201-06.

The NRC inspectors reviewed five of the 14 CARs issued for the six U.S. components being manufactured at Doosan. The NRC inspectors noted that each CAR contains a detailed description of the deficiency, includes the appropriate review and signoff and, when applicable, verified that each corrective action is assigned to an organization responsible for its completion. The NRC inspectors observed that 4 of the 14 CARs were generated as a result of NCRs and

had been evaluated for the applicability of 10 CFR Part 21 requirements. However, the NRC inspectors identified that the remaining 10 CARs generated to address deficiencies for U.S. components were not evaluated for the applicability of 10 CFR Part 21. The NRC inspectors identified this issue as another example of Nonconformance 99901373/2008-201-06.

c. Conclusions

Except for the examples identified as part of Nonconformance 99901373/2008-201-06, the NRC inspectors concluded that the Doosan corrective action program requirements are consistent with the regulatory requirements of Criterion XVI of Appendix B to 10 CFR Part 50. Based on the CARs reviewed, the NRC inspectors determined that the Doosan QAM and associated corrective action procedures were being effectively implemented.

7. Entrance and Exit Meetings

On May 26, 2008, the NRC and KINS inspectors presented the scope of their respective inspections during an entrance meeting with Sang Jin Kim, Doosan Vice President of Quality Assurance; Suk Kwan Kim, General Manager of Quality Assurance; and other Doosan personnel.

On May 29, 2008, the NRC and KINS inspectors presented the results of their respective inspections during an exit meeting with Sang Jin Kim, Doosan Vice President of Quality Assurance; Suk Kwan Kim, General Manager of Quality Assurance; and other Doosan personnel.

See Attachment 1 for a list of attendees for the entrance and exit meetings.

ATTACHMENT 1

List of Attendees: (1) Entrance Meeting on May 26, 2008, (2) Exit Meeting on May 29, 2008

<u>(1)</u>	<u>(2)</u>	<u>Name</u>	<u>Department/Organization</u>
X	X	Glenn Tracy	NRC
X	X	Kerri Kavanagh	NRC
X	X	Richard McIntyre	NRC
X	X	Sabrina Cleavenger	NRC
X	X	Sung Ho Yang	KINS
X	X	Hyo-Jun Kim	KINS
X	X	Myung-Mo Jung	KINS
X	X	Jae-Hun Lee	KINS
X	X	Suk-Won Kim	KINS
X	X	Hee Jun Chang	NDE Dept. General Manager, Doosan
X	X	Sang-Youn Bang	RV Design Team/General Manager, Doosan
X	X	Se Won Park	NQC Dept. General Manager, Doosan
X		Hwa Gyu Park	SG Design Team/General Manager, Doosan
X		Kee Hak Lee	Nuclear BG Production VP, Doosan
X	X	Seok Bin Park	VP Nuclear Design, Doosan
X		Jung-Woo Park	QA Senior Manager, Doosan
X	X	John Maeng	Site QA Rep, WEC
X		Kyoung-Sik Choi	QA Manager, Doosan
X		Bog Sig Kim	RV Design Manager, Doosan
X		Gwang Yil Kim	NME Team, Doosan
X		Yong Chul Kim	Nuclear QC, Doosan
X		Won Man Lee	Nuclear QC, Doosan
X		Jeong Sun Kim	QA Team Manager, Doosan
X	X	Min Kyou Choi	QA Team Manager, Doosan
X		Tae Woo Kim	EVP for Nuclear BG, Doosan
X	X	Sang Jin Kim	VP of QA, Doosan
X	X	Suk Kwan Kim	QA Team/ General Manager, Doosan
X		Sung Won Kim	NME Team/ General Manager, Doosan
X	X	In Ho Jeong	AP 1000 PM, Doosan
X		Soo Young Park	Overseas Project Management, Doosan
X		Byung Il Son	Nuclear Shop, Doosan
X		Byeng Kwan Kim	Nuclear Production Control, Doosan
	X	Chang Ro Lee	Overseas Project Management VP, Doosan
	X	Yong Yeoul Shin	LS Dept. / General Manager, Doosan
	X	Richard Phelps	APS Nuclear Assurance Dept.
	X	Jung Y.M.	KHNP Chief Manager

Attachment 2

1. PERSONS CONTACTED

Sang Jin Kim, Vice President of Quality Assurance, Doosan
Suk Kwan Kim, General Manager of Quality Assurance, Doosan
Jung Woo Park, Senior Manager of Quality Assurance, Doosan
Tae-Woo Kim, Executive Vice President, Nuclear Power Plant, Doosan
Jeong Sun Kim, Quality Assurance Team Manager, Doosan
Soo Young Park, General Manager of Nuclear Overseas Project Management, Doosan
In Ho Jeong, General Manager, AP1000 PM, Doosan
Won Man Lee, Manager, Nuclear Power Plant Quality Control Dept., Doosan
Kee Hak Lee, Vice President, Nuclear Power Plant Production, Doosan
Min-Kyou Choi, Manager, Quality Assurance, Doosan
Se Wan Park, General Manager, Nuclear Power Plant Quality Control Dept., Doosan
Seok Bin Park, Vice President Nuclear Power Plant Design, Doosan
Ki Young Son, Manager, Nuclear Overseas Project Management, Doosan
Richard Phelps, Arizona Public Service Nuclear Assurance Department
John Maeng, Site Quality Assurance Representative, Westinghouse Electric Corporation
John Roberts, Resident Engineer, Westinghouse Electric Corporation
David Reynolds, Authorized Nuclear Inspector, Hartford Steam Boiler Global Standards
Yong Kyu Kim, Senior Manager, Reactor Design Team, Doosan
Won Man Lee, Manager, Nuclear Power Plant Quality Control Department, Doosan
Gyoung Back Ko, Staff R&PD Engineer, Nuclear Power Plant Manufacturing Engineering Team
Joo Youl Hong, Senior Manager, Quality Assurance, Non-Destructive Examination Department

The following inspectors from the Korea Institute of Nuclear Safety held an inspection at Doosan from May 26–29, 2008:

Sung Ho Yang, Quality Regulation Department Manager, KINS
Suk-Won Kim, Quality Regulation Department Manager, KINS
Myung-Mo Jung, Quality Regulation Department Manager, KINS
Jae-Hun Lee, Quality Regulation Department Manager, KINS
Hyo-Jun Kim, Quality Regulation Department, KINS

2. INSPECTION PROCEDURES USED

Inspection Procedure 43002, "Routine Inspections of Nuclear Vendors"

Inspection Procedure 36100, "Inspection of 10 CFR Part 21 and 50.55(e) Programs for Reporting Defects and Nonconformance"

3. LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

There were no previous NRC inspections performed at Doosan's facility in Changwon, Korea, prior to this inspection.

<u>Item Number</u>	<u>Status</u>	<u>Type</u>	<u>Description</u>
99901373/2008-201-01	Opened	Violation	10 CFR Part 21
99901373/2008-201-01	Opened	Nonconformance	Criterion III
99901373/2008-201-02	Opened	Nonconformance	Criterion VII
99901373/2008-201-03	Opened	Nonconformance	Criterion VII
99901373/2008-201-04	Opened	Nonconformance	Criterion VII
99901373/2008-201-05	Opened	Nonconformance	Criterion XV
99901373/2008-201-06	Opened	Nonconformance	Criterion XVI