

May 3, 2010

Warren Brandon, Manager  
Nuclear Service Center  
Sulzer Pumps (US) Inc.  
4126 Caine Lane  
Chattanooga, TN 37421

SUBJECT: NRC INSPECTION REPORT NO. 99901361/2010-201, NOTICE OF VIOLATION  
AND NOTICE OF NONCONFORMANCE

Dear Mr. Brandon:

From March 23 to March 26, 2010, the U.S. Nuclear Regulatory Commission (NRC) conducted an inspection at the Sulzer Pumps (Sulzer) facility in Chattanooga, Tennessee. The enclosed report presents the results of this inspection.

This was a limited scope inspection, which focused on assessing Sulzer's dedication and manufacturing processes that may have contributed to the Service Water Pump 2E failure at the Farley Nuclear Power Plant. This inspection also reviewed the adequacy of Sulzer's corrective actions and nonconformance programs, audits and design control. This NRC inspection report does not constitute NRC endorsement of Sulzer's overall quality assurance (QA) or 10 CFR Part 21 programs.

Based on the results of this inspection, the NRC has determined that one Severity Level IV violation of NRC requirements occurred. The violation is cited in the enclosed Notice of Violation (Notice) and the circumstances surrounding it is described in detail in the subject inspection report. The violation is being cited in the Notice because NRC inspectors identified that Sulzer failed to meet the requirements set forth in 10 CFR Part 21 for an adequate procedure to evaluate deviations and failures to comply.

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

During this inspection, NRC inspectors also found that implementation of your QA program failed to meet certain NRC requirements contractually imposed on you by your customers. The NRC inspectors noted five deficiencies for: 1) inadequate classification of a safety-related service; 2) failure to evaluate a requirement specified by the licensee in the procurement document; 3) inadequate timeliness of corrective actions; 4) inadequate commercial-grade dedication surveys; and 5) inadequate verification of a critical characteristic during the dedication process. The specific findings and references to the pertinent requirements are identified in the enclosures to this letter.

These nonconformances are cited in the enclosed NON, and the circumstances that surround them are described in the enclosed report. Please provide a written explanation or statement within 30 days of this letter in accordance with the instructions specified in the enclosed Notice of Nonconformance. We will consider extending the response time if you show good cause for us to do so.

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

Sincerely,

*/RA/*

Patrick Hiland, Director  
Division of Engineering  
Office of Nuclear Reactor Regulation

Docket No.: 99901361

Enclosures:   1. Notice of Violation  
                  2. Notice of Nonconformance  
                  3. Inspection Report 99901361/2010-201  
                  4. Attachment

These nonconformances are cited in the enclosed NON, and the circumstances that surround them are described in the enclosed report. Please provide a written explanation or statement within 30 days of this letter in accordance with the instructions specified in the enclosed Notice of Nonconformance. We will consider extending the response time if you show good cause for us to do so.

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Sincerely,

*/RA/*

Patrick Hiland, Director  
Division of Engineering  
Office of Nuclear Reactor Regulation

Docket No.: 99901361

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## NOTICE OF VIOLATION

Sulzer Pumps (US) Inc.  
4126 Caine Lane  
Chattanooga, TN 37421

Docket Number 99901361  
Inspection Report No. 99901361/2010-201

Based on the results of a Nuclear Regulatory Commission (NRC) inspection conducted March 23 to March 26, of activities performed at Sulzer Pumps (Sulzer), one violation of NRC requirements was identified. In accordance with the NRC Enforcement Policy, the violation is listed below:

- A. 10 CFR Part 21, Section 21.21(a)(1), "Notification of failure to comply or existence of a defect and its evaluation," states in part that, "each individual, corporation, partnership, or other entity subject to 10 CFR Part 21 shall adopt appropriate procedures to evaluate deviations and failures to comply associated with substantial safety hazards as soon as practicable and, except as provided in paragraph (a)(2) of this section, 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."

10 CFR Part 21, Section 21.21(b), states that, "If the deviation or failure to comply is discovered by a supplier of basic components, or services associated with basic components, and the supplier determines that it does not have the capability to perform the evaluation to determine if a defect exists, then the supplier must inform the purchasers or affected licensees within five working days of this determination so that the purchasers or affected licensees may evaluate the deviation or failure to comply, pursuant to § 21.21(a)."

10 CFR Part 21, Section 21.51, "Maintenance and inspection of records" sets forth requirements for the maintenance of records related to 10 CFR Part 21 evaluations and notifications.

Contrary to the above, as of March 26, 2010;

Sulzer Pumps (US) Inc. procedure CHQ-001, "Compliance with 10CFR Part 21," Revision 1, dated July 10, 2007, did not provide adequate guidance to meet the requirements of 10 CFR Part 21. Specifically:

1. CHQ-001 did not provide guidance to inform the purchasers or affected licensees when Sulzer makes the determination that they do not have the capability to perform the evaluation to determine if a defect exists.
2. CHQ-001 did not reflect the time frames of 10 CFR 21.51 for maintenance and retention of Part 21 records.

This issue has been identified as Violation 99901361/2010-201-01.

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

**ENCLOSURE**

Pursuant to the provisions of 10 CFR 2.201, "Notice of Violation," you are required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555-0001, with a copy to the Director, Division of Engineering, Office of Nuclear Reactor Regulation, 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 addresses the required response. Where good cause is shown, consideration will be given to extending the response time.

If you contest this enforcement action, you should also provide a copy of your response, with the basis for your denial, to the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001.

Because your response will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's Agency-wide 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.

Dated this 3<sup>rd</sup> day of May 2010

## NOTICE OF NONCONFORMANCE

Sulzer Pumps (US) Inc.  
4126 Caine Lane  
Chattanooga, TN 37421

Docket Number 99901361  
Inspection Report No. 99901361/2010-201

Based on the results of a Nuclear Regulatory Commission (NRC) inspection conducted March 23 to March 26, of activities performed at Sulzer Pumps (Sulzer), certain activities were not conducted in accordance with NRC requirements, which were contractually imposed upon Sulzer by NRC licensees.

- A. Criterion II, "Quality Assurance Program," of Appendix B to 10 CFR Part 50 states, in part, "The applicant shall identify the structures, systems, and components to be covered by the quality assurance program and the major organizations participating in the program, together with the designated functions of these organizations. The quality assurance program shall provide control over activities affecting the quality of the identified structures, systems, and components, to an extent consistent with their importance to safety."

Sulzer Nuclear Service Center Quality Assurance Manual, Revision 4, dated January 13, 2010, Section 3-A titled, "Design Control," paragraph 5.0, "Design Process," states in part that, "The Engineering Manager shall prescribe and document the design activities to the level of detail necessary to permit the design process to be performed to permit verification the design meets requirements."

Sulzer's Document No. CHE-032, Revision 2, dated September 8, 2008, "Nuclear Parts Commercial Grade Dedication Program Classification and Critical Characteristics Worksheets," paragraph 2.0, "Purpose," states in part that, "Engineering defines the following for pump parts and equipment in nuclear safety related service: Determine if component is a commercial grade item and/or basic component,..."

Contrary to the above as of March 26, 2010:

1. Sulzer failed to evaluate and classify the coating process performed on a safety-related component (shaft) in Farley's Service Water pumps.

This issue has been identified as Nonconformance 99901361/2010-201-02.

- B. Criterion III, "Design Control" of Appendix B to 10 CFR Part 50, states in part that, "Measures shall be established to assure that applicable regulatory requirements..., for those structures, systems, and components to which this appendix applies are correctly translated into specification, drawings, procedures, and instructions. Design changes...shall be subject to design control measures commensurate with those applied to the original design..."

Sulzer's Nuclear Service Center Quality Assurance Manual, Revision 4, dated January 13, 2010, Section 3-A titled, "Design Control," paragraph 4.0, "Design Input," states in part that, "The Customer Design Specification shall be reviewed for design basis and input in sufficient detail to form the basis for construction in accordance with the Code.

**ENCLOSURE 2**

Design inputs include, but are not limited to: Design bases, performance requirements, regulatory requirements, codes and standards. Changes from approved design inputs, including the reason for revision, shall be identified, approved, documented and controlled.

Specification Number FM-S-05-001, Version 1.0, Specification for Replacement Service Water Pumps for Joseph M. Farley Nuclear Plant – Unit No. 1 and 2,” Paragraph 3.6.2.1, states in part that, “Pump rotors shall be designed with critical speeds at least 25 percent above normal rated speed.”

Sulzer’s Engineering Department Manual, Document Number E 10.13, Revision Number 10, dated November 2004, “Fits Tolerances & Clearances (Imperial dimensioning),” provides minimum and maximum diametrical fit tolerances for wear rings of a specified size.

Contrary to the above, as of March 26, 2010:

Sulzer failed to provide evaluations for deviations from the approved design inputs, through design change control measures or approvals and control of associated documentation for the change. Specifically:

1. The requirement for pump rotors to be designed with critical speeds at least 25 percent above normal rated speed as specified in Specification Number FM-S-05-001 for the replacement service water pumps for Joseph M. Farley Nuclear Plant, Units No. 1 and 2 had no design change control measures or approvals documenting the change.
2. The minimum and maximum diametrical fit tolerances for the wear rings on Sulzer’s design drawings differed from the specifications in Document Number E 10.13, with no associated design change control measures or approvals documenting the change.

This issue has been identified as Nonconformance 99901361/2010-201-03.

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

Sulzer’s Nuclear Service Center Quality Assurance Manual, Revision 4, dated January 13, 2010, Section 16-A titled, “Corrective Action,” Revision 1, dated January 13, 2010, states in part that, “The responsible person shall determine the cause of the unsatisfactory condition and the action necessary to preclude recurrence of the condition. The cause, corrective action and schedule for implementation of the corrective action(s) shall be recorded on the CAR and the Quality Assurance Manager approval obtained.”

Contrary to the above as of March 26, 2010:

1. Sulzer's corrective action program does not provide a systematic method for the review and follow up of corrective actions to determine if they are being completed in a timely fashion and are effective in precluding recurrence of the deficiencies.

This issue has been identified as Nonconformance 99901361/2010-201-04.

- D. Criterion VII, "Control of Purchased Material, Equipment, and Services," of Appendix B to 10 CFR Part 50 states in part, "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."

Sulzer's Procedure CHQ-007, Revision 4, dated January 29, 2009, Section 3.0 titled, "Responsibilities," paragraph 3.2.6.b, "Method 2 – Commercial Grade Survey," states in part, "When Method 2 is utilized, then Supplier Programmatic Elements/Critical Characteristics for materials and special processes as established by Engineering, shall be documented and verified during the Commercial Grade Survey."

Contrary to the above as of March 26, 2010:

1. Sulzer performed audits instead of commercial-grade surveys for several commercial-grade suppliers.

This issue has been identified as Nonconformance 99901361/2010-201-05.

- E. Criterion III, "Design Control" of Appendix B to 10 CFR Part 50, states in part that, "Measures shall be established to assure that applicable regulatory requirements..., for those structures, systems, and components to which this appendix applies are correctly translated into specifications, drawings, procedures, and instructions. These measures shall include provisions to assure that appropriate quality standards are specified and included in design documents and that deviations from such standards are controlled."

Sulzer's Nuclear Service Center Quality Assurance Manual, Revision 4, dated January 13, 2010, Section 3-A titled, "Design Control," paragraph 5.0, "Design Process," states in part that, "The Engineering Manager shall prescribe and document the design activities to the level of detail necessary to permit the design process to be performed to permit verification the design meets requirements."

Sulzer's Procedure CHQ-007, Revision 4, dated January 29, 2009, "Commercial Grade Dedication Program," Section 5.0, "Dedication Process," paragraph 5.1.6., states in part, "QA/QC shall perform receipt inspection of vendor supplied material, parts and documentation and perform specified inspections per Form S0402."

Contrary to the above as of March 26, 2010:

1. Sulzer failed to adequately verify by survey or receipt inspection, the rubber material (a critical characteristic) used in bearings made by commercial-grade supplier Duramax Marine, during the dedication process.

This issue has been identified as Nonconformance 99901361/2010-201-06.

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 Director, Division of Engineering, within 30 days of the date of the letter transmitting this Notice of Nonconformance. This reply should be clearly marked as a "Reply to a Notice of Nonconformance" and should include for each noncompliance: (1) the reason for the noncompliance, or if contested, the basis for disputing the noncompliance; (2) the corrective steps that have been taken and the results achieved; (3) the corrective steps that will be taken to avoid non-compliances; and (4) the date when your corrective action will be completed. Where good cause is shown, consideration will be given to extending the response time.

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

Dated this 3<sup>rd</sup> day of May 2010

U.S. NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR REACTOR REGULATION  
DIVISION OF ENGINEERING  
VENDOR INSPECTION REPORT

Docket No.: 99901361

Report No.: 99901361/2010-201

Vendor: Sulzer Pumps (US) Inc.  
4126 Caine Lane  
Chattanooga, TN 37461

Vendor Contact: Tommy Craig  
Quality Assurance Manager  
Phone: (423) 296-1935

Nuclear Industry: Sulzer Pumps (US) Inc. is a pump manufacturer with focus on specialized centrifugal pumps and agitators/mixers for several markets, including the nuclear power generation market.

Inspection Dates: March 23 - March 26

Inspection Team Leader: Carla Roquecruz, NRR/DE

Inspectors: Paul Prescott, NRR/DE  
Jonathan Ortega-Luciano, NRR/DE  
Cale Young, Region II/DRP (Observer)

Approved by: Dale Thatcher, Chief  
Quality & Vendor Branch  
Division of Engineering  
Office of Nuclear Reactor Regulation

**ENCLOSURE 3**

## **EXECUTIVE SUMMARY**

Sulzer Pumps (US) Inc.  
99901361/2010-201

The purpose of this inspection was to assess Sulzer Pumps (US) Inc. (Sulzer's) dedication and manufacturing processes that may have contributed to the Farley Nuclear Power Plant's Service Water Pump 2E failure. In addition, the inspectors reviewed selected portions of Sulzer's quality assurance (QA) and 10 CFR Part 21 (Part 21) programs. The inspection was conducted at Sulzer's facility in Chattanooga, Tennessee.

The NRC inspection bases were:

- Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to Part 50 of Title 10 of the *Code of Federal Regulations*; and
- 10 CFR Part 21, "Reporting of Defects and Noncompliance."

The last NRC inspection conducted at Sulzer's facility in Chattanooga, Tennessee occurred in September 2006. During that inspection, the NRC staff did not identify any violations or nonconformances.

### **10 CFR Part 21 Program**

The inspectors identified one violation of Part 21. Violation 99901361/2010-201-01 was cited for one example of failure to adopt an appropriate procedure to ensure effective identification and evaluation of deviations and failures to comply associated with a substantial safety hazard. The second example was cited for failure to establish proper Part 21 record retention requirements. With the exception of the violation noted above, the inspectors concluded that Sulzer's Part 21 program was consistent with regulatory requirements.

### **Quality Assurance Program**

The inspectors identified one Nonconformance of Appendix B to 10 CFR Part 50. Nonconformance 99901361/2010-201-02 was cited for failure to adequately categorize a process performed in a safety-related component as a safety-related activity. With the exception of the Nonconformance noted above, the inspectors concluded that Sulzer's QA Program and implementation were consistent with the regulatory requirements of Criterion II of Appendix B to 10 CFR Part 50.

### **Design Control**

The inspectors identified one Nonconformance of Appendix B to 10 CFR Part 50. Nonconformance 99901361/2010-201-03 was cited with two examples noted, for failure to provide evaluations for deviations from the approved design inputs and control of associated documentation for the change. With the exception of the Nonconformance noted above, the inspectors concluded that Sulzer's design control process requirements and implementation were consistent with the regulatory requirements of Criterion III of Appendix B to 10 CFR Part 50.

### Corrective Action

The inspectors identified one nonconformance of Appendix B to 10 CFR Part 50. Nonconformance 99901361/2010-201-04 was cited for timeliness of corrective action. With the exception of the above nonconformance, the inspectors determined that Sulzer's corrective action program and implementation met the requirements of Criterion XVI of Appendix B to 10 CFR Part 50.

### Commercial-Grade Dedication

The inspectors identified two Nonconformances of Appendix B to 10 CFR Part 50. Nonconformance 99901361/2010-201-05 was cited for failure to perform commercial-grade surveys instead of audits for several commercial-grade suppliers. Nonconformance 99901361/2010-201-06 was cited for failure to adequately verify the material supplied by a commercial-grade supplier not previously surveyed, during the dedication process. With the exception of the nonconformances mentioned above, the inspectors determined that Sulzer's commercial-grade dedication process and implementation was in compliance with regulatory requirements and industry guidance.

### Audits

Based on the review of Sulzer's process for performing audits, implementing procedures, and recent audit reports, the inspectors concluded that Sulzer process met the requirements of Criterion XVIII of Appendix B to 10 CFR Part 50. No findings of significance were identified.

## **REPORT DETAILS**

### 1. 10 CFR Part 21 Program

#### a. Inspection Scope

The inspectors reviewed Sulzer's Quality Assurance Manual (QAM), Revision 4, dated January 13, 2010, and procedures that govern the Part 21 program to determine compliance with 10 CFR Part 21. Specifically, the inspectors focused on Procedure CHQ-001, "Compliance with 10CFR Part 21," Revision 1, dated July 10, 2007, and Procedure CHQ-021, "Control of Nonconforming Items or Activities," Revision 1, dated January 29, 2009.

The inspectors discussed the Part 21 process with Sulzer's Quality Assurance (QA) Manager to evaluate the vendor's Part 21 program and reviewed a sample of completed Part 21 evaluations.

#### b. Observations and Findings

The inspectors verified that Sulzer's procedure CHQ-001 met the requirements of Part 21. The inspectors noted that procedure CHQ-001 outlined the process Sulzer used for the reporting of defects and noncompliance, as well as the responsibilities of employees, managers, and the QA Manager with respect to Part 21.

The inspectors noted that CHQ-001, Section 2.0, "Responsibility," provides instructions for any worker who obtained information indicating that a safety-related component could contain a condition that could cause the component to fail to perform its intended function, to promptly report the condition to the QA Manager. Also, under the QA Manager's responsibilities, the procedure states in part that, "The Manager of Sulzer has delegated the responsibility of handling all 10 CFR Part 21 reports, evaluations, and notifications to the Quality Assurance Manager." The QA Manager is responsible to ensure that all conditions are evaluated and reported in accordance with procedure CHQ-001.

During the review of the CHQ-001, specifically under section 5.0, "Evaluation," the inspectors noted that the procedure did not contain adequate guidance to meet the regulatory requirements of 10 CFR Part 21.21. Specifically, CHQ-001 did not provide for measures to inform purchasers or affected licensees within 5 days of Sulzer's determination that it does not have the capability to perform the Part 21 evaluation. This issue is identified as an example of Violation 99901361/2010-201-01.

The inspectors noted that maintenance of Part 21 records is addressed in Sulzer's procedure CHQ-001, Section 8, "Record Maintenance." This section requires the QA Manager to keep the required Part 21 records for a period of at least one year or 10 years if the record was associated with a Part 21 violation, including a record of basic component purchasers. 10 CFR 21.51, "Maintenance and Inspection of Records," establishes the following time-frames for retention of Part 21 records:

- Retain evaluations of all deviations and failures to comply for a minimum of five years after the date of the evaluation;
- Suppliers of basic components must retain any notifications sent to purchasers and affected licensees for a minimum of five years after the date of the notification; and
- Suppliers of basic components must retain a record of the purchasers of basic components for 10 years after delivery of the basic component or service associated with a basic component.

Contrary to the requirements of the regulation, Sulzer's CHQ-001 procedure requirements differed from those established in Part 21. This issue is identified as another example of Violation 99901361/2010-201-01.

c. Conclusions

The inspectors identified one violation of Part 21. Violation 99901361/2010-201-01 was cited for one example of failure to adopt an appropriate procedure to ensure effective identification and evaluation of deviations and failures to comply associated with a substantial safety hazard. The second example of violation 99901361/2010-201-01 was cited for failure to establish proper Part 21 record retention requirements. With the exception of the violation noted above, the inspectors concluded that Sulzer's Part 21 program was consistent with regulatory requirements.

2. Quality Assurance Program

a. Inspection Scope

The inspectors reviewed Sulzer's QA policies and implementing procedures that covered the classification of pump parts, equipment and services as safety-related or commercial-grade, to verify compliance with the requirements of Criterion II, "Quality Assurance Program," of Appendix B to 10 CFR Part 50 as applied to the Farley Nuclear Power Plant (Farley) procurement of service water (SW) pumps. Specifically, the inspectors reviewed the procurement documents, bill of material (BOM), dedication packages and drawings for Farley's SW pumps 2D and 2E. In addition, the inspectors held discussions with the engineering manager, the QA manager, other Sulzer QA personnel and the QA manager for a sub-supplier that provided a service for the SW pumps. The procedures, documents, and records reviewed within the scope of the inspection in this area included:

- Document No. CHE-032, Revision 2, dated September 8, 2008, "Nuclear Parts Commercial Grade Dedication Program Classification and Critical Characteristics Worksheets;"
- Procedure CHQ-007, Revision 4, dated January 29, 2009, "Commercial Grade Dedication Program;"

- Form SO802-0, "Job Specific Bill of Material," Revision 7, Job Number 08C02145;
- List of Sulzer Supplied Parts Referenced to sectional dwg. E-08C02145 Revision F, Job Number 08C02145, Johnston Model 27CC – 2 Stage Pump;
- Sulzer Purchase Order (PO) 08407839 to Dubose National Energy Service Inc., for Bar Round 2¼" Diameter, 36¾" long, material A582 – 416A, dated March 16, 2006;
- Sulzer PO 08407902 to Engineered Coatings & Machining (ECM), for head shaft, 2¼" Diameter bar stock 36¾" long to be coated 9.25" (+/-1/16") long with chrome oxide 0.020-0.022" thick, 16⅛" (+/-1/8") from one end, dated April 10, 2006; and
- Sulzer PO 08407976 to ECM, for line shaft, 2 3/16" diameter bar stock 120½" (+1/-0) to be coated 7-5/8" (+/-1/16") long with chrome oxide 0.020-0.022" thick, 8¾" (+/-1/8") from one end.

b. Observations and Findings

The inspectors reviewed the BOM and procurement documents for the shaft in Farley's SW pump 2E and noted that the head shaft, line shaft and pump shaft were classified as safety-related. According to Sulzer's PO, the shaft bearing journals for the SW pumps are comprised as follows: a machined surface of the shaft base material, a chromium oxide layer, and a phenolic sealer. The inspectors noted that Sulzer used the coating services of commercial-grade supplier, ECM in Birmingham, Alabama, to apply the shaft bearing journals coating for Farley's SW pumps. Through discussions with Sulzer personnel, the inspectors learned that for the first three SW pumps sent to Farley, Sulzer considered this coating service as a commercial-grade activity. Sulzer did not verify or dedicate the coating services provided by ECM for the chromium oxide coating applied to the shafts.

The inspectors noted, during the review of the documentation related to the procurement of the Farley's SW pumps, that Sulzer did not perform an evaluation to determine that this coating process was not essential to the function of these pumps. No failure mode and effects analysis was performed for the shaft bearing journals coating, as a result, no documented evidence could be found to support Sulzer's conclusion that this coating process was not a safety-related activity. This issue was identified as Nonconformance 99901361/2010-201-02.

c. Conclusion

The inspectors identified one nonconformance of Appendix B to 10 CFR Part 50. Nonconformance 99901361/2010-02 was cited for failure to adequately categorize a process performed on a safety-related component as a safety-related activity. With the exception of the above nonconformance, the inspectors determined that Sulzer's QA program was consistent with regulatory requirements.

3. Design Control

a. Inspection Scope

The inspectors reviewed Sulzer's QA policies and implementing procedures that governed the design control process to verify compliance with the requirements of Criterion III, "Design Control," of Appendix B to 10 CFR Part 50 as applied to the Farley replacement SW pumps. The inspectors held discussions with the Engineering Manager on the design changes implemented for the Farley SW pumps. Specifically, the inspectors reviewed the documents governing the implementation of Sulzer's design control measures related to the development of component specifications and the pump calculations that supported the procurement controls for selected safety significant components of the pump. The inspectors also reviewed PO documents associated with the Farley SW pumps to verify that the licensee's design specifications were properly translated into design documents. The procedures, documents and records reviewed within the scope of the inspection in this area included:

- Specification Number FM-S-05-001, Version 1.0, Specification for Replacement Service Water Pumps for Joseph M. Farley Nuclear Plant – Unit No. 1 and 2;"
- Form SO802-0, "Job Specific Bill of Material," Revision 7, Job Number 08C02145;
- Document Number E12.51183 for Order No. 08C02145/49, E068-1089, "Design Report – ASME Pressure Vessel Calculation Unit 2-27CC 2-Stage;"
- Document Number E12.5.1186 for Order No. 08C02145/49, "Seismic Stress Analysis for Unit 2 – 27CC 2-Stage Pumps;"
- Document No. CHE-006, Revision 0, "Order Review, Acceptance and Entry;" and
- Engineering Department Manual Document Number E 10.13, "Fits, Tolerances & Clearances (Imperial Dimensioning)."

b. Observations and Findings

The inspectors reviewed all of the major design changes implemented for the Farley SW pumps. The changes were adequately identified in the licensee's PO specification and for the most part, translated into the vendor's BOM. Licensee POs for pumps or components are reviewed by Sulzer using CHE-006. Engineering is responsible for coordination of activities with other internal organizations. The BOM will identify all necessary parts and associated drawings. The final BOM is maintained as a quality record. It is a job specific engineering document that controls design, inspection and manufacturing requirements necessary to ensure PO requirements are met.

Sulzer's design process is controlled by CHE-001. The two main products engineering develops from the licensee's PO, subsequent to completion of the BOM are a design

report and seismic analysis document. The majority of design changes for the Farley SW pumps were related to material changes. The impact on the original pump design was evaluated for Code compliance and seismic impact analysis, as detailed in the respective documents above. However, the inspectors requested the design evaluation for not meeting the licensee's specified PO requirement that the pump rotors shall be designed with critical speeds at least 25 percent above normal rated speed. Seismic Report E12.5.1186 did not document the deviation from the critical speed calculation. In discussions with the engineering manager, he stated that nonconformance reports (NCRs) were generated to document this issue for both units. The disposition of NCR 1672, related to the Unit 2 pumps, had been approved by the licensee. The Unit 1 NCRs were still under review, but all of the pumps except for one are of the same design. The condition was determined not to affect the operability of the Unit 2 pumps; however, long term reliability would be impacted. The licensee and Sulzer have agreed to replace or modify the pumps with a number of design changes to address this issue as well as other potential reliability issues related to the pumps. Assurance of near-term operability was provided by the licensee's pump monitoring compensatory measures.

The pump procurement specification in Specification Number FM-S-05-001, paragraph 3.6.2.1, stated a requirement that the pump rotors shall be designed with critical speeds at least 25 percent above normal rated speed. This requirement was not explicitly called out in the PO; however, the PO invokes the specification. The PO required a certificate of conformance (CofC) certifying compliance to the specifications and requirements of the PO. The specification also required certification that the pumps are designed in accordance with the specification.

The specification requirement only addresses rotor critical speed but did not address the natural frequency of the pump structure or assembly. This distinction is important because it is possible to have pump vibration problems that are not caused by the critical speed of the rotor. The requirement in the specification for rotor critical speed margin is largely a carryover from the original specification for the SW pumps. However, industry guidance recommends that new pump design should be analyzed by the manufacturer to address structural natural frequency separation from operation speed as well as rotor critical speed margin.

There is no specific requirement in the specification to have the vendor submit results of the rotor critical speed analysis to the licensee for review. Thus vendor noncompliance was not easily detectable by normal contract administration.

Structural natural frequency of the pump assembly was actually analyzed by the pump vendor as part of the stress seismic analysis reports. As described in these reports, the frequency separation from running speed was analyzed to be 12.75 percent. These reports were reviewed by licensee personnel and were found to be acceptable from a seismic qualification standpoint. However, these personnel would not normally be aware of the intent to maintain larger margins for purposes unrelated to seismic qualification.

The inspectors determined that Sulzer had not performed an analysis or adequately identified to the licensee that the pump rotors were not designed with critical speeds at

least 25 percent above normal rated speed. This issue was identified as one example of Nonconformance 99901361/2010-201-03.

The inspectors reviewed Sulzer's design control and procurement processes to ensure an adequate technical review was performed of the change of the wear ring material and clearances from what was originally specified in the licensee's specifications. Sulzer selected hardened grade 410 stainless steel for the wear rings. The wear rings were installed with shrink fits which may have been an excessive mismatch between the mounting and the mounted parts.

The first stage and second stage impellers have a bottom and top set of stainless steel rings. The bottom rings that are attached to the impeller are called the wear ring. The wear ring of each impeller is interference fit with the bottom side of the impeller. The top stainless steel rings that are attached to the impeller are called the balance rings. The balance ring of each impeller is interference fit with the top side of the impeller.

Sulzer's document E 10.13, states the minimum and maximum diametrical fit for the wear ring interference fit range to meet Sulzer design standards to produce acceptable stress for the parts. The drawings for both of the rings had a greater tolerance range. The greater allowance in tolerance range could result in allowing for excessive wear ring stress. This was identified as a second example of Nonconformance 99901361/2010-201-03.

c. Conclusion

The inspectors identified one nonconformance of Appendix B to 10 CFR Part 50. Nonconformance 99901361/2010-03, had two examples of inadequate design control. One example of was cited for a failure to perform a technical justification to support that the pump rotors were not designed with critical speeds at least 25 percent above normal rated speed. The other example was cited for a failure to meet the wear ring interference fit range specified of the vendor's design standards. With the exception of the above nonconformances, the inspectors determined that Sulzer's design control process was consistent with regulatory requirements.

4. Corrective Actions

a. Inspection Scope

The inspectors reviewed Sulzer's QAM, Revision 4, dated January 13, 2010, and implementing policies and procedures that govern the corrective action process to ensure the procedures provided adequate guidance consistent with the requirements of Appendix B to 10 CFR Part 50 and Part 21. The inspectors also evaluated a sample of corrective action reports (CARs) and nonconformance reports (NCRs) and to verify compliance with the program requirements and adequate implementation of those requirements.

b. Observations and Findings

The inspectors reviewed Sections 15-A, "Nonconformance Control," and 16-A, "Corrective Action," of Sulzer's QAM, which describes the nonconformance and corrective action processes. These sections describe the process for identifying, documenting, segregating, evaluating, and handling nonconformances

Procedure CHQ-021, "Control of Nonconforming Items or Activities," Revision 1, dated January 29, 2009, assigned responsibilities for identification, documentation, and disposition of nonconforming items, services and program activities. The procedure described the process for identifying, evaluating, reporting, and correcting nonconformances. The process for identifying and documenting nonconformances was initiated when Form S0561-1, "Sulzer Nuclear Service Center Non-Conformance Report (NCR)," was prepared by QA or Quality Control personnel when a nonconformance was recognized. In addition, the inspectors discussed the nonconformance process with the vendor, including the establishment and roles of the Material Review Board (MRB) responsible for reviewing all potential nonconformances generated against the program. The MRB is comprised of the QA Manager and Engineering Manager at a minimum. The inspectors noted that each NCR contains a detailed description of the concern and at least one proposed corrective action associated with the identified deficiency. The inspectors verified that the NCRs included the appropriate review and signoff and, when applicable, verified that each corrective action is assigned to an organization lead responsible for its completion.

The inspectors discussed the Corrective Action Program (CAP) with the vendor as defined in Section 16-A of the QAM.

The inspectors reviewed a sample of corrective actions and noted that most of the corrective actions had been completed in a timely manner; however, some took an extended period of time to be completed. The inspectors discussed this with the vendor and determined that the QAM or associated CAP procedures did not describe a process for ensuring timely closure of corrective actions. As described by the vendor, if the due date for a corrective action is near, the QA manager will contact the responsible person with a reminder to complete the work. At that time, if necessary, a new due date is established for closure of the corrective action. Although the QA manager maintained a list of all corrective actions, the Sulzer's program did not provide a systematic method for the review of corrective actions to determine if they are being completed in a timely fashion and are effective in precluding recurrence of the deficiencies. The inspectors identified this issue as Nonconformance 99901361/2010-201-04.

c. Conclusions

The inspectors identified one nonconformance of Appendix B to 10 CFR Part 50. Nonconformance 99901361/2010-04 was cited for timeliness of corrective action program. With the exception of the above nonconformance, the inspectors determined that Sulzer's corrective action process was consistent with regulatory requirements.

5. Commercial-Grade Dedication Process

a. Inspection Scope

The Inspectors reviewed Sulzer's QA Manual, Revision 4, dated January 13, 2010, and the implementation process for commercial-grade dedication activities. The inspectors also reviewed the following Sulzer dedication procedures and instructions: Chattanooga Quality Procedure CHQ-007, "Commercial Grade Dedication Program," Revision 4, dated January 29, 2009; Chattanooga Engineering Document No. CHE-032, "Nuclear Parts Commercial Dedication Plan Classification and Critical Characteristic Worksheets", Revision 2, dated September 8, 2008; and the Commercial Grade Dedication Checksheet S0402, Revision 5.

The inspectors reviewed the quality and work procedures governing the implementation of commercial-grade dedication activities, and a sample of completed dedication packages. The inspectors interviewed Sulzer personnel and conducted a tour of Sulzer's facility.

b. Observations and Findings

The inspectors noted that Sulzer's procedure CHQ-007 outlined the dedication process from the procurement of commercial material to the preparation of the Commercial Grade Dedication (CGD) Checksheet (Form S0402) that contained the critical characteristics to be verified and the acceptance of CGD items. CHQ-007 stated that commercial-grade items will be inspected/tested based on critical attributes and characteristics as defined by Sulzer Engineering. Sulzer's CHE-032 contains the safety classification, component function, credible failure mode(s) and critical characteristics for all their pump parts and equipment. If Sulzer identified an item as commercial-grade, but the customer requested the item as safety-related, then Sulzer engineering used the process described in procedure CHQ-007 to create a CHE-032 worksheet and perform the dedication. CHE-032 stated that parts may require CGD as dictated by the customer, even though Sulzer has determined the part failure would not prevent the parent item from performing as intended. The part specific worksheet in CHE-032 included critical characteristics for dedication, as applicable.

The inspectors noted that during the early stages of the dedication process, Sulzer engineering utilized the CHE-032 checksheet for the specific pump part or equipment to prepare form S0402, which was then submitted to QA for review/approval. Form S0402 included the CHE-032 page and revision used; material PO; PO item number; customer PO number; heat or serial number; material of construction; method of inspection; hardness; dimensions; and visual inspections results.

Sulzer primarily performed Method 1, special test and inspections and Method 2, commercial-grade survey to perform CGD. These methods are included in NRC endorsed industry guidance (Electric Power Research Institute EPRI 5652.) The inspectors requested a sample of CGD surveys performed by Sulzer and the Approved Vendor List (AVL) for American Society of Mechanical Engineers (ASME), safety-related and commercial suppliers. The inspectors reviewed the CGD surveys for ECM, in

Birmingham, AL; MetalTek Int., in Chattanooga, TN; Tennessee Rand Co., in Chattanooga, TN; and Sulzer Pumps in Brookshire, TX. The inspectors noted that Sulzer's CGD surveys were limited scope audits of the commercial suppliers' QA programs. Sulzer did not perform a CGD survey focused on the critical characteristics that Sulzer intended to take credit for during the dedication process. This issue was identified as Nonconformance 99901361/2010-201-05.

Sulzer's AVL for commercial vendors contained the supplier's name, item/services provided by that vendor and what type of CGD acceptance method it used with each supplier. While reviewing CGD package for PO 10252412 from Entergy, for a marine style, cutless and rubber with bronze sleeve bearing, the inspectors noted that Sulzer purchased the bearing shell from a safety-related supplier, Metaltek Intl., and then provided this material to a commercial supplier, Duramax Marine, who then provided the finished item to Sulzer. According to Sulzer's PO 4500121088 for Duramax Marine's service, this supplier had to do all the machining and provide Sulzer with the finished item including the nitrile rubber lining used to finish the bearings.

According to Sulzer's AVL for commercial suppliers when using Duramax Marine's services Sulzer uses Method 1 to do the CGD dedication. For the dedication of the bearings, Sulzer used the CofC provided by Duramax Marine and a durometer test (hardness test) as the acceptance criteria for the rubber material used in the bearings. Through discussions with Sulzer staff, the inspectors determined that Sulzer was taking credit for Duramax Marine CofC for the rubber material in the bearings and then testing only the hardness; however, Duramax Marine was never surveyed by Sulzer to take credit for this critical characteristic during the dedication process for these bearings. This issue was identified as Nonconformance 99901361/2010-201-06.

c. Conclusion

The inspectors identified two nonconformances to 10 CFR Part 50, Appendix B. Nonconformance, 99901361/2010-201-05, was cited for Sulzer failing to perform commercial-grade surveys instead of audits for several commercial-grade suppliers. Nonconformance 99901361/2010-201-06 was cited for failure to adequately verify the material supplied by a commercial-grade supplier not previously surveyed, during the dedication process. With the exception of the above nonconformances, the inspectors determined that Sulzer's commercial-grade dedication program was consistent with regulatory requirements.

6. Audits

a. Inspection Scope

The inspectors reviewed Sulzer's QAM, Section 18-A, "Audits," Revision 1, Section 7-B, "Supplier Evaluation and Selection," Revision 2, and Section 2-E, "Qualification of Audit Personnel," Revision 2, all dated January 13, 2010 and implementing procedures that govern the process for internal and external audits. The inspectors evaluated a sample of external audit reports and corrective actions implemented by Sulzer for findings identified during audits.

b. Observations and Findings

1. External Audits

The inspectors noted that Section 18-A, "Audits," of Sulzer's QAM provided a description of the process and requirements for performing external audits. This section contained specific requirements such as, audit plans, checklists, and information required in the audit report. The inspectors noted that forms S1322 "Audit Plan," S1324 "Audit Checklist" and S1323 "Audit Report," were of sufficient detail to provide an adequate scope for a supplier audit.

Section 7-B, "Supplier Evaluation and Selection," described the process for conducting periodic audits/commercial-grade surveys of suppliers to evaluate the effectiveness of their quality program and of their ability to supply materials in accordance with specified requirements. This section stated that suppliers surveyed or audited by a subcontractor that met the requirements in section 7-B may be placed on the AVL.

The inspectors reviewed a sample of external supplier audits from Sulzer's AVL. The inspectors verified that Sulzer's recent audits of the following suppliers met the requirements of Criterion XVIII of Appendix B to 10 CFR Part 50.

- Dubose Nat. Energy Svc. Inc., in Clinton, North Carolina, which supplied Ferrous & Non Ferrous materials;
- John Crane Inc., in Morton Grove, Illinois, which supplied seal glands and parts; and
- PRL Industries, Inc., in Cornwall, Pennsylvania, which supplied Ferrous and Non Ferrous castings, testing and machining.

The inspectors' review of external audits did not identify any findings of significance.

c. Conclusion

Based on the review of Sulzer's process for performing audits, implementing procedures, and recent audit reports, the inspectors concluded that Sulzer is implementing external audit process in compliance with regulatory requirements and industry guidance. No findings of significance were identified.

7. Exit Meeting

On March 26, 2010, the inspectors presented the inspection scope and findings during an exit meeting with Sulzer's Manager, Warren Brandon, other Sulzer personnel and personnel from Southern Nuclear Operation Company. In addition, inspectors from NRC's Region II office were present during part of the inspection and exit meeting.

**ATTACHMENT**

1. PERSONS CONTACTED

W. Brandon, Manager, Sulzer Nuclear Service Center  
T Craig, Quality Systems Manager, Sulzer Nuclear Service Center  
A. Washburn, Engineering Manager, Sulzer Nuclear Service Center  
L. Carson, Nuclear Product Manager, Sulzer Nuclear Service Center  
J. Grimm, Quality Assurance Engineer, Sulzer Nuclear Service Center  
J. Foster, Operations Manager, Sulzer Nuclear Service Center

2. INSPECTION PROCEDURES USED

IP 36100, "Inspection of 10 CFR Parts 21 and 50.55(e) Programs for Reporting Defects and Noncompliance"  
IP 43001, "Reactive Inspection of Nuclear Vendors"

3. LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

The last NRC inspection conducted at Sulzer Pumps facility in Chattanooga, Tennessee occurred in September 2006. During that inspection, the NRC staff did not identify any violations or nonconformances.

<u>Item Number</u>	<u>Status</u>	<u>Type</u>	<u>Description</u>
99901361/2010-201-01	Opened	NOV	Part 21
99901361/2010-201-02	Opened	NON	Criterion II
99901361/2010-201-03	Opened	NON	Criterion III
99901361/2010-201-04	Opened	NON	Criterion XVI
99901361/2010-201-05	Opened	NON	Criterion VII
99901361/2010-201-06	Opened	NON	Criterion III

4. LIST OF ACRONYMS USED

US	United States
NRC	Nuclear Regulatory Commission
Sulzer	Sulzer Pumps (US) Inc.
QA	Quality Assurance
Notice	Notice of Violation
ADAMS	Agency-wide Documents Access and Management System
Part 21	10 CFR Part 21
QAM	Quality Assurance Manual
SW	Service Water
BOM	Bill of Material
ECM	Engineered Coatings & Machining
PO	Purchase Order
NCR	Nonconformance Report
CofC	Certificate of Conformance

CAR	Corrective Action Report
MRB	Material Review Board
CGD	Commercial-Grade Dedication
AVL	Approved Vendors List
Farley	Farley Nuclear Power Plant
EPRI	Electric Power Research Institute