Sulzer Pumps (US) Inc.

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U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk,
Washington, D.C. 20555-0001

6/2/2010

Subject: "Reply to a Notice of Nonconformance"

The purpose of this memorandum is to document actions taken by Sulzer Pumps (US) pursuant to the Nuclear Regulatory Commission (NRC) notice of nonconformances 99901361/2010/201-02, 99901361/2010/201-03, 99901361/2010/201-04, 99901361/2010/201-05 and 99901361/2010/201-06.

NRC Notice of Nonconformance 99901361/2010/201-02:

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.

Sulzer Response:

Reason for the nonconformance:
Sulzer Engineering classified the shafts including Pumpshaft (1), Lineshaft (3) and Headshaft (1) as safety related on the Design Bill of Material for the first three pumps designed and shipped to Farley (ref. s/n 08C02145, 08C02146, 08C02139). However, Sulzer did not specifically classify the shaft coating with respect to requiring commercial grade dedication (CGD). The purchase order(s) controlling the shaft coating activities did not include CGD activities.

The fourth (and subsequent) pumps Design Bill of Materials classified shaft coating as safety related. Dimensional verifications were documented as part of the Commercial Grade Dedication (CGD) process; however, dedication activities still lacked process control verifications, which were identified during the root cause determination following the coating failure on Pump s/n 08C02145.

Corrective Steps that have been taken and the results achieved:
Corrective Actions to Prevent Recurrence include engineering evaluation details for a change to a different coating system and subsequent Commercial Grade Dedication (CGD) Activities (see Forms S0402-7), which are currently being implemented on shaft coatings.

Two separate Commercial Grade Dedication (CGD) activities are required to support shaft coating: 1) Dedication of a specific coating batch (see attached Form S0402-7), and 2) Dedication of shaft coating during production application of the coating on the shaft (see attached Form S0402-7).

Corrective Steps that will be taken to avoid non-compliances:
Two separate Commercial Grade Dedication (CGD) activities identified in Item 2) above will be implemented on future shaft coating activities to preclude recurrence of the non-compliance.

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Date when full compliance will be achieved:
Implementation of the updated Commercial Grade Dedication (CGD) plans was accepted by Southern Company (Farley) Engineering on May 18, 2010. This action is complete.

NRC Notice of Nonconformance 99901361/2010/201-03:

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.

Sulzer Response to Nonconformance 1:

Reason for the nonconformance:
The specification (FM-S-05-001) requirement for pump rotors to be designed with critical speeds at least 25 percent above normal rated speed was missed by Sulzer during the design of the pump(s). The original Johnston Pump design since approximately 1991 was duplicated with respect to the critical speed design. Sulzer concludes the existing design with respect to critical speed was maintained with "no change" and documented on the Design Bill of Material (and associated drawings).

The current pump design does not meet the specification requirement for pump rotors to be designed with critical speeds at least 25 percent above normal rated speed. The as-built configuration supports pump operability and the pump(s) are capable of performing their intended design function. The current configuration would affect long term reliability whereas component wear (bearings, impeller / bowl wear parts) would exhibit mechanical performance degradation (vibration) sooner than otherwise predicted.

Corrective Steps that have been taken and the results achieved:
Sulzer has updated a combined rotor / structural lateral rotordynamic analysis model for the Farley Service Water pumps (Unit 1 and 2) to provide solutions for required shaft critical margins and column structural natural frequencies. Results of the analysis include the following recommendations:

a. Columns will be configured with a change from 3 columns (each at 10 foot lengths, including bearing spans), to 4 columns (each at 90 inch lengths, including bearing spans). This configuration has design integrity for lateral rotordynamic behavior.
b. Combined static and dynamic shaft displacement will be less than 80% of available bearing clearance.
c. As a result of the shortened bearing spans, increased shaft diameter and updated bearing clearances, rotor natural frequencies will be above 30Hz with 1x design clearances, and above 25Hz with 2x design clearances, which will provide a frequency separation margin of 52% and 27%. This meets Southern Company Specification requirements.
d. The upper column will be modified to add 10 ribs to establish approximately 15% separation margin between a structural natural frequency and 0.5X excitation.

Corrective Steps that will be taken to avoid non-compliances:
The non-compliance documented above (Item 1) is considered unique to the Farley specific project. Actions identified in Item 2 above will prevent recurrence.

Date when full compliance will be achieved:
The Sulzer analysis documents (lateral analysis, seismic analysis) along with updated drawings require final review/approvals. Approval is expected by August 1, 2010.

NRC Notice of Nonconformance 99901361/2010/201-03: (cont'd)

Sulzer Response to Nonconformance 2:

Reason for the nonconformance:
The original Johnston pump design with respect to impeller wear ring interference fit tolerances dates back to the mid-1970s. When the recent customer purchase order was issued in 2006, specified updates were implemented; however, the impeller-to-wear ring fit tolerances were not changed. The Sulzer specifications identified above (reference: Document E 10.13) would not have applied to the Johnston Pump in the mid-1970s; however, when the replacement pump design was being documented in 2006, had the original interference fit tolerances been identified, a change would have been implemented.

Corrective Steps that have been taken and the results achieved:
Sulzer has updated the design of the impeller to wear ring interference fit tolerances to meet 0.002" to 0.006" (interference) for current ongoing work for the Farley pumps (repairs and design updates). This change assures acceptable hoop stress for the installed impeller wear rings while considering seasonal temperature swings (thermal effects) for the lake (pumpage, heat sink).

Corrective Steps that will be taken to avoid non-compliances:
The non-compliance documented above (Item 1) is considered unique to the Farley specific project. Actions identified in Item 2 above will prevent recurrence.

Date when full compliance will be achieved:
This action is considered complete.

NRC Notice of Nonconformance 99901361/2010/201-04:

Contrary to the above as of March 26, 2010:

1. Sulzer's corrective program does not provide as 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.

Sulzer Response:

Reason for the nonconformance:
Insufficient process details ensuring timely processing of for corrective measures of conditions adverse to quality.

Corrective Steps that have been taken and the results achieved:
Sulzer procedure for controlling Corrective and Preventive Actions CHQ-028 was reviewed and revised to specify processing times, 10 CFR Part 21 evaluations, enhanced follow up requirements and a better defined system for extending due dates if necessary.

Corrective Steps that will be taken to avoid non-compliances:
Semi annual reviews of the CAR process with results reported to management.

Date when full compliance will be achieved:
Implementation date was 4/13/2010 when training was conducted (session # 2010-025) for Sulzer personnel.

NRC Notice of Nonconformance 99901361/2010/201-05:

Contrary to the above as of March 26, 2010:

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

Sulzer Response:

Reason for the nonconformance:
Lack of procedural controls for performance of commercial-grade surveys.

Corrective Steps that have been taken and the results achieved:
Reviewed existing commercial supplier audits and reconciled to commercial grade surveys.

Corrective Steps that will be taken to avoid non-compliances:
Developed procedure CHQ-031 (R0) for conducting commercial-grade surveys.

Date when full compliance will be achieved:
Implementation date was 4/13/2010 when training was conducted (session # 2010-025) for Sulzer personnel.

NRC Notice of Nonconformance 99901361/2010/201-06:

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.

Sulzer Response:

Reason for the nonconformance:
Sulzer had not performed a commercial-grade survey verifying critical characteristics including material traceability.

Corrective Steps that have been taken and the results achieved:
Sulzer has updated the Commercial Grade Dedication (CGD) for material verification associated with the elastomer (rubber) portion of the bearing. Additionally, Sulzer has performed a commercial-grade survey.

Corrective Steps that will be taken to avoid non-compliances:
Sulzer will conduct commercial-grade surveys in accordance procedure CHQ-031 and continue during receipt inspection of bearings, to perform a visual inspection and a hardness check for verification of durometer characteristics.

Date when full compliance will be achieved:
Implementation date was 4/13/2010 when training was conducted (session # 2010-025) for Sulzer personnel.

Sulzer Pumps (US) would like to thank the NRC investigators for their professionalism and thoroughness during their inspection which was conducted on March 23-26, 2010. We appreciated their input enabling us to make programmatic improvements.

Should you have questions please don't hesitate to contact us as necessary.

Respectfully,
Tommy Craig
Quality Assurance Manager
Sulzer Pumps (US)
Office: (423) 296-1935
Cell: (423) 883-5948
Fax: (423) 892-8217
e-mail:tommy.craig@sulzer.com

cc: Roy Horner,
Jason Foster,
Art Washburn,
Director, Division of Engineering
Office of Nuclear Reactor Regulation

Attachment:
Form S0402-7 (Test Specimen 4 pgs)
Form S0402-7 (Pumpshaft Coating-Application 5 pgs)
CHQ-028 (R1)
CHQ-031 (R0)
Training Report 2010-025

SULZER PUMPS (US) INC.
SULZER NUCLEAR SERVICE CENTER
CHATTANOOGA, TENNESSEE

COMMERCIAL GRADE DEDICATION (CGD) CHECKSHEET

(Reference Procedure CHQ-007)

SALES ORDER 100031377 **DWG / PART NO. (AND REV)** N/A

MATERIAL P.O. NO. 4500158749 **P.O. ITEM NO.** 10 **QTY** 3 (bond caps)

COMPONENT Test Specimen **CUSTOMER P.O. NO.** QP090838

CHE-032 PAGE (and rev) 200V.1 (R0)

Prepared By / Date: _____ **Engineering Approval / Date:** _____ **QA Approval / Date:** _____

INSPECTION INSTRUCTION	RECORD ACTUAL DATA (IF REQ'D)	M&TE	INSPECTOR SIGNATURE	INSPECTION DATE
•RECORD HT # / SN# (as applicable): _____		x		
•MATERIAL OF CONSTRUCTION:				
REQUIRED: Sulzer Metco SA Coating Chemistry: Tungsten carbide - WC (84-88%), Co (8-12%), Cr (2-6%), (percent by weight) Bond Cap Base Material – ASTM A582-416 (commercial - provided by Sulzer)				
•METHOD OF INSPECTION:				
COATING POWDER BATCH # (RECORD):		x		
METALLURGIST:	x	x	x	x
Supplier C of C:	x	x		
TESTING LAB (P.O.): Chemistry by Sample: See above for requirements Hardness, Vickers HV 1,000 min w/300g load (by Sample) Bond strength, 5,000 psi min (by Sample)	x	x		
Testing Lab C of C include Batch #	x	x		
OTHER:	x	x	x	x
•HARDNESS: REQUIRED: N/A	x	x	x	x
•RECORD DIMENSIONS:				
Dimensions from (X) — Drawing: — Catalog: — P.O.: x — Other:				
Bond Cap 1 length — Bare:_____Coated:_____ Record Coating Thickness (Required: 0.008-0.039)				
Bond Cap 2 length — Bare:_____Coated:_____ Record Coating Thickness (Required: 0.008-0.039)				
Bond Cap 3 length — Bare:_____Coated:_____ Record Coating Thickness (Required: 0.008-0.039)				

- **"X" NON-APPLICABLE ITEMS**

LIST NCRs BELOW: FINAL QA REVIEW: _____ DATE: _____

SULZER PUMPS (US) INC.
SULZER NUCLEAR SERVICE CENTER
CHATTANOOGA, TENNESSEE
COMMERCIAL GRADE DEDICATION (CGD) CHECKSHEET
(Reference Procedure CHQ-007)

SALES ORDER 100031377 **DWG / PART NO. (AND REV)** N/A

MATERIAL P.O. NO. 4500158749 **P.O. ITEM NO.** 10 **QTY** 3 (bond caps)

COMPONENT Test Specimen **CUSTOMER P.O. NO.** QP090838

CHE-032 PAGE (and rev) 200V.1 (R0)

•VISUAL INSPECTIONS:				
Marking:	x	x		
Surface Finish:	x	x	x	x
Overall Appearance:	x	x		

COMMERCIAL GRADE DEDICATION PLAN / TECHNICAL JUSTIFICATION

Engineering Basis:

Subject: Technical Evaluation for Commercial Grade Dedication (CGD)
Sume SA Coating on Shaft Journals

History:
The Farley SW pumps were updated in the early 1990s to change shaft bearing journal coating from Metco #4 to Chrome Oxide. The recent coating failure identified several factors resulting in the coating failure including misapplication. Review of the specifications identified the coating exhibits a relatively high porosity and low bond strength as compared to other coatings commercially available. Chrome Oxide is deposited by Plasma thermal spray coating.

Alternative Coating System:
Sulzer Metco has developed several coating systems applied by High Velocity Oxy-Fuel (HVOF) process. Sulzer Metco engineering reviewed the Farley application and identified the Sume Pump SA coating system as an appropriate alternative for hardfacing the shaft bearing journals.

The coating (Sume Pump SA) will not exhibit galvanic potential with the current shaft material (416 SS) or alternate materials (410 SS) approved for use. Sume Pump SA coating exhibits excellent anti-galling behavior, high ductility and toughness and resistance to particle abrasion. Sume Pump SA coating is rated for a service temperature as high as 1,025°F (acceptable for the Farley SW pump service).

Bearing materials of construction (current, Duramax Marine – rubber) and (alternate, Greene Tweed – AR-1) are suitable for contact with Sume Pump SA coating as applied to the shaft bearing journals.

Application of Sume Pump SA coating to the pump shaft bearing journals will not impact seismic qualification or rotordynamic stability for the current pump design or proposed updates. There is no impact to fit, form or function.

- **"X" NON-APPLICABLE ITEMS**

LIST NCRs BELOW: FINAL QA REVIEW: DATE:

SULZER PUMPS (US) INC.
SULZER NUCLEAR SERVICE CENTER
CHATTANOOGA, TENNESSEE
COMMERCIAL GRADE DEDICATION (CGD) CHECKSHEET
(Reference Procedure CHQ-007)

SALES ORDER 100031377 **DWG / PART NO. (AND REV)** N/A

MATERIAL P.O. NO. 4500158749 **P.O. ITEM NO.** 10 **QTY** 3 (bond caps)

COMPONENT Test Specimen **CUSTOMER P.O. NO.** QP090838

CHE-032 PAGE (and rev) 200V.1 (R0)

Sulzer engineering has reviewed coating qualification and application practices by Sulzer Metco and associated work performed for major industries including aircraft and turbine parts. Sulzer engineering concludes coatings can be dedicated by confirming coating chemistry, bond strength and micro hardness as presented below.

Coating Chemistry:
Coating chemistry will be confirmed by testing coating powder (preferred if coating manufacturer will provide coating powder sample). An alternative approach would be to generate a sample of the coating by removing coating which has been applied.

Sume Pump SA coating chemistry (nominal value and ranges, % by weight):
Tungsten Carbide, WC, 86 (84-88)
Cobalt, Co, 10 (8-12)
Chrome, Cr, 4 (2-6).

Bond Strength:
Bond Strength is acceptable when tested by ASTM C633 methods on a specimen sample (1" diameter face). A coated face (with specified coating thickness range) and a bare specimen face are glued together and separated in tension. Acceptable bond strength would meet the minimum bond strength of 5,000 psi, while exhibiting a failure of the glue or cohesive failure of coating between layers. A failed bond strength test would include a separation of the coating from the base material at a bond strength less than 5,000 psi.

Micro-Hardness:
Coating micro-hardness is performed per the guidelines of ASTM E384 on a coating specimen cross-section. Testing on the cross-section coating surface eliminates influence of the base material affecting actual hardness test results. Hardness is measured by performing a Vickers Test with an acceptance of 1,000 HV with 300 gram force load (gf).

Test Implementation per Coating Batch:
Coating chemistry (of powder), and bond strength and micro-hardness will be confirmed on sample specimens per batch as described above. This testing protocol confirms the coating chemistry is acceptable and coating application is acceptable (including proprietary gun settings and associated controls). Coating batch dedication activities (including powder chemistry, bond strength and micro-hardness) will be completed prior to implementation of production runs.

- **"X" NON-APPLICABLE ITEMS**

LIST NCRs BELOW: FINAL QA REVIEW: DATE:

SULZER PUMPS (US) INC.
SULZER NUCLEAR SERVICE CENTER
CHATTANOOGA, TENNESSEE
COMMERCIAL GRADE DEDICATION (CGD) CHECKSHEET
(Reference Procedure CHQ-007)

SALES ORDER 100031377 **DWG / PART NO. (AND REV)** N/A

MATERIAL P.O. NO. 4500158749 **P.O. ITEM NO.** 10 **QTY** 3 (bond caps)

COMPONENT Test Specimen **CUSTOMER P.O. NO.** QP090838

CHE-032 PAGE (and rev) 200V.1 (R0)

Test Implementation During Production Runs:
A Production Run is a group of shafts being coated together in the same time period from the same purchase order. Each shaft will include three specimen samples (1" diameter face) connected to the part. A representative sample per production run (1 shaft) will be tested to verify bond strength, which confirms correct application of coating for the shafts in the production run. A failed test is cause for rejection of the specific shaft associated with the tested specimen. Additional bond strength testing to confirm acceptance of each of the other shafts in the production run will be required as a result of an initial failed test.

The Supplier's work orders will be submitted for Sulzer QA review to establish desired witness or hold points.

Critical setup of shaft for coating and proprietary coating parameters will be confirmed by a second co-worker prior to application of coating on each shaft, and document on the Supplier's Work Order.

- **"X" NON-APPLICABLE ITEMS**

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SULZER PUMPS (US) INC.
SULZER NUCLEAR SERVICE CENTER
CHATTANOOGA, TENNESSEE
COMMERCIAL GRADE DEDICATION (CGD) CHECKSHEET
(Reference Procedure CHQ-007)

SALES ORDER 100031377 **DWG / PART NO. (AND REV)** 504202574001 B-504202574 rev. -

MATERIAL P.O. NO. 4500162335 **P.O. ITEM NO.** 30 **QTY** 1

COMPONENT Pumpshaft Coating – Application Repaired Pumpshaft **CUSTOMER P.O. NO.** QP090838

CHE-032 PAGE (and rev) 200V.1 (R0)

Prepared By / Date: _____ **Engineering Approval / Date:** _____ **QA Approval / Date:** _____

INSPECTION INSTRUCTION	RECORD ACTUAL DATA (IF REQ'D)	M&TE	INSPECTOR SIGNATURE	INSPECTION DATE
•**RECORD HT # / SN#** (as applicable): _____		x		
•**MATERIAL OF CONSTRUCTION:**				
REQUIRED: Sulzer Metco SA Coating Chemistry: Tungsten carbide - WC (84-88%), Co (8-12%), Cr (2-6%), (percent by weight) Shaft Base Material – ASTM A582-416 (Provided by Sulzer as Safety Related)				
•**METHOD OF INSPECTION:**				
COATING POWDER BATCH # (RECORD):		x		
METALLURGIST:	x	x	x	x
TESTING LAB: (P.O.) Bond strength, 5,000 psi min (by Sample) from Shaft HT/SN: _____	x	x		
SUPPLIER C OF C (Coating - include powder Batch #):	x	x		
OTHER:	x	x	x	x
•**HARDNESS:** REQUIRED: _____	x	x	x	x
•**RECORD DIMENSIONS:**				
Dimensions from (X) — Drawing: x — Catalog: — P.O.: — Other:				
TOP BOWL, TOP BEARING JOURNAL	x	x	x	x
Test Button 1 Shaft HT# / SN#: _____ Job#: _____ Button Overall Thickness: Bare_____Coated_____ Record Coating Thickness (Required: 0.008-0.039)				
Test Button 2 Shaft HT# / SN#: _____ Job#: _____ Button Overall Thickness: Bare_____Coated_____ Record Coating Thickness (Required: 0.008-0.039)				

- **"X" NON-APPLICABLE ITEMS**

LIST NCRs BELOW: FINAL QA REVIEW: _____ DATE: _____

SULZER PUMPS (US) INC.
SULZER NUCLEAR SERVICE CENTER
CHATTANOOGA, TENNESSEE

COMMERCIAL GRADE DEDICATION (CGD) CHECKSHEET

(Reference Procedure CHQ-007)

SALES ORDER 100031377 **DWG / PART NO. (AND REV)** 504202574001 B-504202574 rev. -

MATERIAL P.O. NO. 4500162335 **P.O. ITEM NO.** 30 **QTY** 1

COMPONENT Pumpshaft Coating – Application Repaired Pumpshaft **CUSTOMER P.O. NO.** QP090838

CHE-032 PAGE (and rev) 200V.1 (R0)

Test Button 3	Shaft HT# / SN#: _____ Job#:_____ Button Overall Thickness: Bare_____Coated_____ Record Coating Thickness (Required: 0.008-0.039)				
OD (Prep for Coating)	To Be Determined at removal of old coatings - Not to exceed 3.1095 Min.				
OD (Finish Coating)	3.1875/3.1865				
Length (Coating)	13.000 +0.125 / -0.000				
Coating Location (from shaft top end)	8.875 +0.000 / -0.062				
TOP BOWL, BOTTOM BEARING JOURNAL		x	x	x	x
OD (Prep for Coating)	To Be Determined at removal of old coatings - Not to exceed 3.1095 Min.				
OD (Finish Coating)	3.1875/3.1865				
Length (Coating)	13.000 +0.125 / -0.000				
Coating Location (from shaft bottom end)	36.500 +0.000 / -0.062				
BOTTOM BOWL BEARING JOURNAL		x	x	x	x
OD (Prep for Coating)	To Be Determined at removal of old coatings - Not to exceed 3.1095 Min.				
OD (Finish Coating)	3.1875/3.1865				
Length (Coating)	10.000 +0.125 / -0.000				
Coating Location (from shaft end)	19.188 +0.000 / -0.062				

- **"X" NON-APPLICABLE ITEMS**

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SULZER PUMPS (US) INC.
SULZER NUCLEAR SERVICE CENTER
CHATTANOOGA, TENNESSEE
COMMERCIAL GRADE DEDICATION (CGD) CHECKSHEET
(Reference Procedure CHQ-007)

SALES ORDER 100031377 **DWG / PART NO. (AND REV)** 504202574001 B-504202574 rev. -

MATERIAL P.O. NO. 4500162335 **P.O. ITEM NO.** 30 **QTY** 1

COMPONENT Pumpshaft Coating – Application Repaired Pumpshaft **CUSTOMER P.O. NO.** QP090838

CHE-032 PAGE (and rev) 200V.1 (R0)

SUCTION BELL BEARING JOURNAL		x	x	x	x
OD (Prep for Coating)	To Be Determined at removal of old coatings - Not to exceed 3.1095 Min.				
OD (Finish Coating)	3.1875/3.1865				
Length (Coating)	9.500 +0.125 / -0.000				
Coating Location (from shaft bottom end)	0.190 +0.000 / -0.06				
•VISUAL INSPECTIONS:					
	Marking:	x	x		
	Surface Finish:	x			
	Overall Appearance:	x	x		

COMMERCIAL GRADE DEDICATION PLAN / TECHNICAL JUSTIFICATION

Engineering Basis:

Subject: Technical Evaluation for Commercial Grade Dedication (CGD) Sume SA Coating on Shaft Journals

History:
The Farley SW pumps were updated in the early 1990s to change shaft bearing journal coating from Metco #4 to Chrome Oxide. The recent coating failure identified several factors resulting in the coating failure including misapplication. Review of the specifications identified the coating exhibits a relatively high porosity and low bond strength as compared to other coatings commercially available. Chrome Oxide is deposited by Plasma thermal spray coating.

Alternative Coating System:
Sulzer Metco has developed several coating systems applied by High Velocity Oxy-Fuel (HVOF) process. Sulzer Metco engineering reviewed the Farley application and identified the Sume Pump SA coating system as an appropriate alternative for hardfacing the shaft bearing journals.

The coating (Sume Pump SA) will not exhibit galvanic potential with the current shaft material (416 SS) or alternate materials (410 SS) approved for use. Sume Pump SA coating exhibits excellent anti-galling behavior, high ductility and toughness and resistance to particle abrasion. Sume Pump

- **"X" NON-APPLICABLE ITEMS**

LIST NCRs BELOW: FINAL QA REVIEW: DATE:

SULZER PUMPS (US) INC.
SULZER NUCLEAR SERVICE CENTER
CHATTANOOGA, TENNESSEE
COMMERCIAL GRADE DEDICATION (CGD) CHECKSHEET
(Reference Procedure CHQ-007)

SALES ORDER 100031377 **DWG / PART NO. (AND REV)** 504202574001 B-504202574 rev. -

MATERIAL P.O. NO. 4500162335 **P.O. ITEM NO.** 30 **QTY** 1

COMPONENT Pumpshaft Coating – Application Repaired Pumpshaft **CUSTOMER P.O. NO.** QP090838

CHE-032 PAGE (and rev) 200V.1 (R0)

SA coating is rated for a service temperature as high as 1,025°F (acceptable for the Farley SW pump service).

Bearing materials of construction (current, Duramax Marine – rubber) and (alternate, Greene Tweed – AR-1) are suitable for contact with Sume Pump SA coating as applied to the shaft bearing journals.

Application of Sume Pump SA coating to the pump shaft bearing journals will not impact seismic qualification or rotordynamic stability for the current pump design or proposed updates. There is no impact to fit, form or function.

Sulzer engineering has reviewed coating qualification and application practices by Sulzer Metco and associated work performed for major industries including aircraft and turbine parts. Sulzer engineering concludes coatings can be dedicated by confirming coating chemistry, bond strength and micro hardness as presented below.

Coating Chemistry:
Coating chemistry will be confirmed by testing coating powder (preferred if coating manufacturer will provide coating powder sample). An alternative approach would be to generate a sample of the coating by removing coating which has been applied.

Sume Pump SA coating chemistry (nominal value and ranges, % by weight):
Tungsten Carbide, WC, 86 (84-88)
Cobalt, Co, 10 (8-12)
Chrome, Cr, 4 (2-6).

Bond Strength:
Bond Strength is acceptable when tested by ASTM C633 methods on a specimen sample (1" diameter face). A coated face (with specified coating thickness range) and a bare specimen face are glued together and separated in tension. Acceptable bond strength would meet the minimum bond strength of 5,000 psi, while exhibiting a failure of the glue or cohesive failure of coating between layers. A failed bond strength test would include a separation of the coating from the base material at a bond strength less than 5,000 psi.

Micro-Hardness:
Coating micro-hardness is performed per the guidelines of ASTM E384 on a coating specimen cross-section. Testing on the cross-section coating surface eliminates influence of the base material affecting actual hardness test results. Hardness is measured by performing a Vickers Test with an acceptance of 1,000 HV with 300 gram force load (gf).

- **"X" NON-APPLICABLE ITEMS**

LIST NCRs BELOW: FINAL QA REVIEW: DATE:

SULZER PUMPS (US) INC.
SULZER NUCLEAR SERVICE CENTER
CHATTANOOGA, TENNESSEE
COMMERCIAL GRADE DEDICATION (CGD) CHECKSHEET
(Reference Procedure CHQ-007)

SALES ORDER 100031377 **DWG / PART NO. (AND REV)** 504202574001 B-504202574 rev. -

MATERIAL P.O. NO. 4500162335 **P.O. ITEM NO.** 30 **QTY** 1

COMPONENT Pumpshaft Coating – Application Repaired Pumpshaft **CUSTOMER P.O. NO.** QP090838

CHE-032 PAGE (and rev) 200V.1 (R0)

Test Implementation per Coating Batch:
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Test Implementation During Production Runs:
A Production Run is a group of shafts being coated together in the same time period from the same purchase order. Each shaft will include three specimen samples (1" diameter face) connected to the part. A representative sample per production run (1 shaft) will be tested to verify bond strength, which confirms correct application of coating for the shafts in the production run. A failed test is cause for rejection of the specific shaft associated with the tested specimen. Additional bond strength testing to confirm acceptance of each of the other shafts in the production run will be required as a result of an initial failed test.

The Supplier's work orders will be submitted for Sulzer QA review to establish desired witness or hold points.

Critical setup of shaft for coating and proprietary coating parameters will be confirmed by a second co-worker prior to application of coating on each shaft, and document on the Supplier's Work Order.

Repair of Shafting:
The repair of shafting previously coated will be as follows:
The existing coating will be removed from the bearing journals.
The bearing journal will be prepared for the Sume Pump SA.
The bearing journal will be coated for a thickness range to not exceed 0.039".

- **"X" NON-APPLICABLE ITEMS**

LIST NCRs BELOW: FINAL QA REVIEW: _____ DATE: _____

CORRECTIVE AND PREVENTIVE ACTION

03/24/10
Prepared By

03/24/10
Quality Assurance Manager

1.0 PURPOSE:

1.1 To provide guidance and supplemental process controls for initiating, documenting, analyzing and evaluating conditions adverse to quality.

1.2 Also for developing and implementing changes that prevent reoccurrence of conditions adverse to quality.

2.0 SCOPE

2.1 The Corrective Action Request process is to be implemented in a timely manner as follows:

2.1.1 Standard response times shall be 30 - 45 days minimum.

2.1.2 An initial evaluation for Substantial Safety Hazards subject to10CFR21 applicability shall be performed and documented on form S0199 as the first action taken to correct the nonconforming condition. The Quality Assurance Manager shall be notified as required by CHQ-001 (latest revision).

3.0 RESPONSIBILITY:

3.1 The Quality Assurance Manager is responsible for effective implementation of the requirements of this procedure which include but is not limited to:

3.1.1 Corrective Action log.

3.1.2 Ensures that Corrective Actions Requests (CAR) are issued, implemented in a timely manner,

3.1.3 Performance of follow up for verification of effectiveness.

3.1.4 Use of available data for assistance with evaluation efforts include (but are not limited to):

3.1.4.1 NCR reports, Corrective Action Requests, Audit results (Internal or Management Audits), Customer Complaints.

4.0 CORRECTIVE ACTON REPORT ISSUANCE:

4.1 *The following are guidelines for when Corrective Action Requests (CAR) may be issued but is not intended to restrict the issuance of Corrective Action Requests.*

4.1.1 Corrective Action Requests may be issued anytime conditions adverse to quality are identified.

4.1.2 Repeatable conditions adverse to quality identified through the nonconformance process.

4.1.3 Inadequate or nonexistent policies, practices, or controls that may result in product or conditions adverse to quality.

4.1.4 Customer warranty issues.

4.1.5 Suppliers with repeatable nonconformances.

4.1.6 Corrective Action Requests shall be issued in a timely manner ensuring effective measures are implemented which prevent recurrence.

4.2 If the significance of a condition is determined to be a reportable condition under 10CFR21, proper notification shall be made.

5.0 PROCEDURE:

5.1 Quality Assurance initiates a Corrective Action Request, S0199 which includes the following as applicable.

5.1.1 CAR Number.

5.1.2 Issue Date.

5.1.3 NCR Number if applicable.

5.1.4 Reply due date.

5.1.5 Follow up date

5.1.6 Date Closed.

5.2 Internal Corrective Action Requests

5.2.1 A Root Cause evaluation of the condition shall be performed by the department manager assigned the CAR.

5.2.2 The investigation shall include an evaluation sufficient to establish a root cause.

5.2.3 The evaluation process may include the use of industry evaluation tools such as (but not limited to):

5.2.3.1 Cause and Effect Problem Detection and Lessons Learned data sheets. Additional attachments may be used as necessary.

5.2.4 Utilization of other problem solving tools such as charts, graphs, trending data, etc. is acceptable.

5.3 Responder signs and dates the CAR and enters the date that the action is or will be completed and/or action to prevent reoccurrence will be completed.

5.4 The Quality Assurance Manager shall review the submitted CAR for acceptance.

5.5 The Quality Assurance Manager completes the CAR if acceptable as-is. Follow up is performed as required for verification the actions taken effectively prevent recurrence.

5.6 When a response is overdue the responsible department manager assigned the CAR notifies the Quality Assurance Manager in writing requesting an extension with a completion date. Requested extension dates for completion shall be documented on the CAR log and maintained with the CAR.

5.7 Follow up verifications found ineffective or inconclusive, the CAR shall remain open until satisfactory actions are implemented and verified.

5.8 Corrective Action Requests are maintained by the Quality Assurance Manager

6.0 SUPPLIER CORRECTIVE ACTION:

6.1 Corrective Action Requests issued to suppliers are required to respond in an established time frame and shall include appropriate responses to effectively prevent recurrence to conditions adverse to products or services supplied to the SNSC. Cause and Effect data sheets do not apply to suppliers.

CONDUCTING COMMERCIAL GRADE SURVEYS

04/28/2010
Prepared By

04/28/2010
Quality Assurance Manager

1.0 PURPOSE

1.1 This procedure establishes supplemental guidance and controls for performing commercial grade surveys ensuring compliance to specified requirements and EPRI 5652 Method 2.

2.0 RESPONSIBILITY

2.1 The Quality Assurance Manager shall be responsible for implementation of the procedure and Lead Auditor selection.

2.2 The Quality Assurance Manager and Engineering Manager shall develop and approve initial characteristics to be verified during commercial grade surveys

2.3 The Engineering Manager shall be responsible for establishing critical characteristics including issuance of CGD for S0402.

3.0 PLANNING

3.1 The Lead Auditor prior to performing a survey shall select a survey team and prepare a survey plan to include the following as applicable:

3.1.1 Survey scope

3.1.2 Applicable requirements

3.1.3 Survey Team

3.1.4 Activities to be Surveyed

3.1.5 Applicable documents

3.1.6 Schedule

3.1.7 Checklist and other information relevant to the Survey.

3.2 The Lead Auditor shall direct auditors during the performance of Survey.

3.3 The Lead Auditor shall determine the acceptability of the amount of objective evidence reported by auditors.

3.4 Surveys shall be performed by auditors independent of any direct responsibility for performance of activities, which they survey.

3.5 Audit personnel shall have sufficient authority and organizational freedom to perform a meaningful and effective survey.

3.6 A pre- survey conference shall be included as part of initial planning.

3.7 Auditors shall examine objective evidence to the depth necessary to determine if Checklist elements are being implemented effectively.

3.8 Deficiencies identified during a survey are documented and reported to the Lead Auditor.

3.9 Deficiencies found during the performance of a survey shall be communicated to the organization or department as soon as practical.

3.10 Deficiencies discovered and resolved to the satisfaction of the Lead Auditor during the survey require no further action.

4.0 SURVEY CLOSING

4.1 At the conclusion of a survey, a post- survey conference shall be held by the audit team with management of the audited organization, to present survey results and clarify misunderstandings.

5.0 SURVEY REPORT

5.1 The Lead Auditor shall prepare a Report listing the results of the survey. The Lead Auditor shall prepare a report indicative of results requiring a written response. The Report shall be signed by the Lead Auditor and issued and it shall include the following information, as appropriate:

5.1.1 Description of the survey scope.

5.1.2 Identification of the auditors.

5.1.3 Identification of persons contacted during audit activities.

5.1.4 Summary of survey results, including a statement on the effectiveness of the quality assurance program elements, which were surveyed.

5.1.5 Description of each reported adverse condition in sufficient detail to enable corrective action(s) to be taken by the audited organization.

6.0 FOLLOW-UP

6.1 Verification of implementation and completion of corrective actions shall be performed by a Lead Auditor, where determined necessary. Follow-up verification will be conducted and documented on the Survey Report by the Lead Auditor.

7.0 RECORDS

7.1 Quality Assurance shall maintain copies of survey records in the Quality Assurance Files. Records shall include:

7.1.1 Survey plans

7.1.2 Survey checklists

7.1.3 Survey reports

7.1.4 Written replies

7.1.5 Record of completion of corrective actions.

7.1.6 Lead Auditor qualifications

SULZER

FORM S0783-0

SULZER PUMPS (US) INC.
SULZER NUCLEAR SERVICE CENTER
CHATTANOOGA, TENNESSEE
TRAINING SESSION REPORT

Procedure Revisions

04/13/2010
Date

Training Session Number 2010 025

Reference Material:

Revised procedures as shown on page 3 of Stationized Procedure Index Revision 11 dated 4/9/2010

Comments:

Conducted By: T. Craig — QA Mgr.

Signature ~ See Notes 1 & 2 on line below — Title

Note 1: Signature is affirmation all required attendee signatures & dates are included and the training log is updated.
Note 2: Self Study training must be confirmed by the instructor who conducts an interview to insure competency and a complete understanding of the subject material has been established.

Duration of Session: Self-Study Hours — Self-Study Minutes

Name	Attendees Title	Signature & Date
Alva, James	Quality Control Inspector	4/23/10
Amy, Raymond	Project Engineer	Raymond Amy 4/13/10
Brandon, Warren	Nuclear Service Center Manager	4/23/10
Brown, Ronnie	Project Engineer	4/13/10
Bullock, Gary	Machinist	4.14.10
Cordell, Randy	Assemblyman	4-14-10
Cook, Gordon	Buyer	Gordon A. Cook Jr. 4-13-10
Craig, Tommy	Quality Assurance Manager	4/13/2010
Crisp, Russell	Project Engineer	4-13-10

Crouch, John	Welder	John Crouch
Davis, Bobby	Welder	Bobby Davis 4-13-10
Denton, Aaron	Machinist	Aaron Denton 4-14-10
Duryee, Julie	Project Engineer	Julie Duryee 4/13/10
Dykes, Jeremy	Quality Control Inspector	4/14/10
Edison, Sharon	Buyer	04.15.2010
~~Emery, Terry~~ K/H 4/23/10	~~Welder~~ K/H 4/23/10	N/A
Evans, John	Quality Assurance Engineer	*Medical leave - CBBrop 4/22/10 JD Evans 05/24/10
Ferguson, Bobby	Quality Control Inspector	B. Ferguson 4-14-10
Foss, Tim	Quality Control Inspector	4.14.10
Foster, Jason	Operations Manager	4/23/10
Gabhart, Colin	Project Engineer	4/23/10
Greene, Mark	Project Engineer	Mark Greene 4/13/10
Grimm, Josh	Quality Assurance Engineer	4/13/10
Goins, Kenneth	Machinist	Ken Goins 4-26-10
Harper, Chris	Quality Assurance Engineer	4/23/10
Headrick, Kenneth	General Foreman	4/23/10
House, Steve	Assemblyman	Steve House 4-14-10
Huffaker, Earl	Project Engineer	Earl Huffaker 4/13/10
James, Jonathan	Quality Control Supervisor	4/14/10
James, Steve	Welder (Lead)	4-14-10
Johnson, Robert	Quality Assurance Engineer	RT Johnson 4/13/10
Kiah, Morris	Quality Control Inspector	~~M. Kiah~~ 04-14-10
Kilgore, Carl	Machinist	Carl H. Kilgore 4-14-010
Layne, Mike	Machinist	4-14-10
Martin, Mark	Machinist	Mark L Martin 4/14/10
Matuszak, Tom	Buyer	Tom Matyszak 4/23/10
McKibben, Tim	Machinist (Lead)	Tim McKibben
MATHERSON, JOE	TRUCK DRIVER	Joe Matherson 4-14-10

Middleton, Donnie	Welder	Donnie Middleton 4/14/10
Nichols, Blake	Machinist	4/14/10
Peckinpaugh, Israel	Machinist	4-14-10
Phillips, Callie	Buyer	4/15/10
Pressley, Jesse	Quality Assurance Engineer	4/13/2010
Reeves, Charlie	Quality Control Inspector	4/24/10
Reeves, Nathan	Shipping Clerk	4-14-10
Remillard, Jeremy	Shipping Clerk	
Richter, Stanislav	Machinist	04-14-10
Robinson, Tim	Machinist	4-26-10
Soules, Mark	Machinist	4-14-10
Tenthorey, Henri	Project Engineer	4/13/10
Vitiello, Frank	Project Manager	4-16-10
Wade, Kim	Quality Assurance Engineer	4/13/10
Wallace, Randall	Assemblyman	4/14/10
Washburn, Art	Engineering Manager	4/13/10
White, Patrick	Project Engineer	4/13/10
Wooden, David	Machinist	4-14-10

INDEX OF IMPLEMENTING PROCEDURES (STATIONIZED)

	PROCEDURE	TYPE	PROCEDURE TITLE	DATE	REV.
	CHA-001	ADMIN	Job Classifications	03-20-08	0
**	CHE-001	ENGR	Design Control and Reconciliation (CEP-001, -003, -019)	01-13-10	2
**	CHE-002	ENGR	Drawings	02-05-09	3
**	CHE-003	ENGR	Design Reconciliation	01-13-10	1
	CHE-004	ENGR	Seismic Analyses (CEP-017)	01-13-10	2
**	CHE-005	ENGR	Control of Computer Software	10-20-06	0
**	CHE-006	ENGR	Order Review, Acceptance and Order Entry	01-13-10	1
**	CHE-007	ENGR	Bill of Material Preparation, Review and Approval (CEP-018)	02-05-09	2
**	CHE-008	ENGR	Hydrostatic Testing (CEP-004)	01-29-09	2
**	CHE-008	ENGR	Hydrostatic Testing (CEP-004)	01-13-10	3
**	CHE-009	ENGR	Work Orders: Preparation and Control (MNS-01)	01-29-09	3
**	CHE-010	ENGR	Qualifications of Registered Professional Engineers (CEP-010)	08-01-06	0
	CHE-011	ENGR	Reverse Engineering (CEP-034)	10-04-06	1
	CHE-012	ENGR	Shaft Straightening (CEP-030, MSS-12)	02-05-09	1
	CHE-014	ENGR	Impeller, Volute and Bowl Hydraulic Passage Cleaning (JCP-4)	02-05-09	2
	CHE-015	ENGR	Assembly of Components with Interference Fits	02-05-09	1
	CHE-016	ENGR	Disassembly (CEP-012)	04-02-07	1
	CHE-017	ENGR	Assembly / Reassembly (CEP-023)	10-18-07	2
	CHE-020	ENGR	Cleaning of Nuclear Components (CEP-008, CEP-028, QNS-04)	04-02-07	1
	CHE-021	ENGR	Technical Bulletins	03-22-07	0
	CHE-022	ENGR	Surface Preparation and Application of Protective Coatings (CEP-025)	08-01-06	0
	CHE-023	ENGR	Packaging and Shipping (ANSI N45.2.2-1978) – CEP-026	04-02-07	1
	CHE-024	ENGR	Technical Manual (CEP-031)	08-01-06	0
	CHE-025	ENGR	Balancing Procedure for Components and Rotors (MSS-03, CEP-006)	02-05-09	3
	CHE-026	ENGR	Uniform Part Marking	08-01-07	0
**	CHE-030	ENGR	Torquing of Threaded Fasteners (CEP-032)	10-17-07	2
**	CHE-031	ENGR	Fastener and Torque Value Standard	08-01-06	0
	CHE-032	ENGR	Nuclear Parts Commercial Dedication Program Classification and Critical Characteristic Worksheets	08-15-08	2

INDEX OF IMPLEMENTING PROCEDURES (STATIONIZED)

	PROCEDURE	TYPE	PROCEDURE TITLE	DATE	REV.
	CHQ-001	QA	Compliance with 10CFR Part 21 (ANS-01)	03-24-10	2
	CHQ-002	QA	Straightness Inspection of Shafts	01-29-09	2
	CHQ-003	QA	Visual Acceptance Standards for Machined Surfaces (H30.19)	01-29-09	2
**	CHQ-004	QA	Receipt Inspection (IBS-06)	02-15-10	2
**	CHQ-005	QA	Qualification and Certification or Nondestructive Examination Personnel (JCP-3)	10-06-08	3
**	CHQ-006	QA	Purchase Orders: Preparation, Issuance and Control (JCP-1, PNS-03)	12-21-09	3
	CHQ-007	QA	Commercial Grade Dedication Program (QNS-14, -16)	01-29-09	4
**	CHQ-009	QA	Quality Assurance Records (QNS-06, JCP-24)	08-01-06	0
**	CHQ-012	QA	Qualification & Certification of Inspection & Test Personnel (QNS-02, JCP-13)	01-1610	1
	CHQ-015	QA	Conducting Audits (JCP-9)	01-16-10	1
	CHQ-016	QA	Material Traceability (JCP-21)	01-16-10	2
**	CHQ-018	QA	Calibration (JCP-5)	01-13-10	3
	CHQ-019	QA	Calibration of Measuring & Test Equipment (JCP-23)	08-01-06	0
	CHQ-020	QA	Procedure Distribution and Control	01-16-10	1
**	CHQ-021	QA	Control of Nonconforming Items or Activities	03-24-10	2
**	CHQ-022	NDE	Liquid Penetrant Examination	04-04-07	0
**	CHQ-022	NDE	Liquid Penetrant Examination	09-08-09	1
**	CHQ-023	NDE	Magnetic Particle Examination	04-04-07	0
**	CHQ-023	NDE	Magnetic Particle Examination	01-13-10	2
	CHQ-024	NDE	Ultrasonic Thickness Measurement	07-16-08	1
	CHQ-024	NDE	Ultrasonic Thickness Measurement	09-08-09	2
**	CHQ-025	NDE	Visual Examination Procedure	04-02-07	0
**	CHQ-028	QA	Corrective and Preventative Action	03-24-10	1
**	CHQ-029	NDE	Ultrasonic Examination Procedure (Flaw Detection)	07-16-08	1
**	CHQ-029	NDE	Ultrasonic Examination Procedure (Flaw Detection)	09-08-09	2
	CHQ-030	QA	Final Shipping Inspections	12-15-08	0
	CHQ-031	QA	Conducting Commercial Grade Surveys	03-24-10	0

**** DENOTES ASME SECTION III CODE PROCEDURES**

INDEX OF IMPLEMENTING PROCEDURES (STATIONIZED)

PROCEDURE	TYPE	PROCEDURE TITLE	DATE	REV.

Revision Summary:

Procedure	Revision	Description of Revision
CHE-001	2	Update to Class 1 requirements
CHE-003	1	Update to Class 1 requirements
CHE-004	2	Update to Class 1 requirements
CHE-006	1	Update to Class 1 requirements
CHE-008	3	Update to Class 1 requirements
CHE-013	0	Deleted
CHQ-001	2	General update
CHQ-004	2	General update
CHQ-012	1	General update
CHQ-015	1	General update
CHQ-016	2	General update
CHQ-018	3	General update
CHQ-020	1	General update
CHQ-021	2	General update
CHQ-022	1	Update to Class 1 requirements
CHQ-023	2	Update to Class 1 requirements
CHQ-024	2	Update to Class 1 requirements
CHQ-028	1	General update
CHQ-029	2	Update to Class 1 requirements
CHQ-031	0	Conducting Commercial Grade Surveys

APPROVALS:

Engineering Manager / Date

QA Manager / Date