

APPENDIX C

U.S. NUCLEAR REGULATORY COMMISSION  
REGION IV

NRC Inspection Report: 50-267/88-23

Operating License: DPR-34

Docket: 50-267

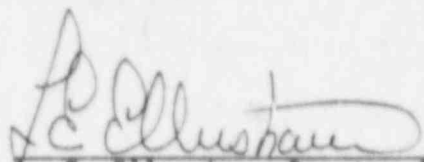
Licensee: Public Service Company of Colorado (PSC)  
2420 W. 26th Avenue, Suite 15c  
Denver, Colorado 80211

Facility Name: Fort St. Vrain Nuclear Generating Station (FSV)

Inspection At: General Atomics International Services Corporation (GA),  
San Diego, California

Inspection Conducted: September 12-16, 1988

Inspector:

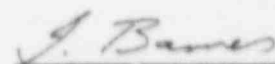
  
L. E. Ellershaw, Reactor Inspector, Materials  
and Quality Programs Section, Division of  
Reactor Safety

10/3/88  
Date

Accompanying

Personnel: F. B. Litton, Materials Engineer, NRR

Approved:

  
J. Barnes, Chief, Materials and Quality  
Programs Section, Division of Reactor Safety

10/3/88  
Date

Inspection Summary

Inspection Conducted September 12-16, 1988 (Report 50-267/88-23)

Areas Inspected: Reactive, announced inspection of activities related to refurbishment of reactor Helium Circulator S/N C-2101 resulting from previous inspection findings identified at FSV.

Results: Within the area inspected, one violation (failure to appropriately control special processes, paragraph 2.b) and one deviation (failure to perform committed fluorescent penetrant inspection on completed fasteners, paragraph 2.a) were identified.

DETAILS

1. Persons Contacted

GA

- \*D. Alberstein, Manager, FSV Services
- E. V. Bak, Staff Manufacturing Engineer
- \*G. P. Connors, Manager, Reactor Quality Assurance (QA)
- \*F. C. Dahms, Manager, Engineering Resources
- \*J. Lindgren, Research Staff Engineer
- \*R. F. Maxwell, Manager, QA
- M. K. Nichols, Circulator Project Manager

PSC

- #P. L. Craun, Site Manager, Nuclear Engineering Division (NED)
- #M. Deniston, Superintendent, Operations
- #J. M. Gramling, Supervisor, Nuclear Licensing - Operations
- #M. H. Holmes, Nuclear Licensing Manager
- #F. J. Novachek, Nuclear Support Manager
- \*G. L. Redmond, Circulator Program Manager
- #A. Wong, Licensing Supervisor
- #D. Warembourg, Manager, NED

\*Denotes those persons attending the exit interview on September 16, 1988.

#Denotes those persons participating in the exit interview by means of a telephone conference call on September 16, 1988.

2. Previous Inspection Findings (92701)

- a. (Closed) Open Item (267/8815-05): This item pertained to PSC requiring only a certificate of conformance from GA in regard to many of the detailed QA requirements for fastener procurement committed to by paragraph 6.0 of Attachment 1 to PSC Letter P-88019 to the NRC dated January 22, 1988. This resulted in the NRC inspector being unable to specifically verify implementation of these commitments during an NRC inspection of the fastener procurement process conducted at FSV and documented in NRC Inspection Report 50-267/88-15.

The NRC inspector reviewed PSC's Purchase Order (P.O.) N8157 dated August 13, 1987, through Supplement 2, to GA Technologies, Inc. (currently known as General Atomics International Services Corporation) for the labor and materials to repair "D" Helium Circulator S/N C-2101. This review was performed to assure that the QA requirements committed to in the above letter (P-88019) had been delineated in this PO. It was confirmed that these commitments were

addressed in the PO, with most being incorporated by Supplement 1 dated April 11, 1988.

To verify that GA had, in turn, passed on the applicable requirements to their suppliers, the NRC inspector reviewed the following POs for the specified items:

- (1) PO 094552 to SPS Technologies dated November 5, 1987, for 94 each, 3/4-inch X 1.925 long bolts, of A-286, P/N 90-C2101-300-45 which was subsequently changed to P/N 90-C2101-300-105. After receipt, GA modified some of the bolts by drilling a 1/8-inch hole through the bolt making them P/N 90-C2101-300-52 which was subsequently changed to P/N 90-C2101-300-104.

It was noted that GA's PO imposed the following requirements which were consistent with PSC's PO: Appendix B to 10 CFR Part 50, 10 CFR Part 21, ultrasonic examination (UT) in accordance with Article 5 in Section V of the ASME Code, fluorescent penetrant examination (PT) in accordance with Article 6 in Section V of the ASME Code, GA's QA personnel to witness UT and PT, and all fasteners to be from the same heat.

The bolts were receipt inspected by GA which included a 100 percent visual examination (VT), a sampled dimensional inspection, and a sampled hardness verification. In addition, GA tested two bolts for mechanical properties and for chemical analysis. The NRC inspector reviewed this data and the certified material test reports (CMTRs) from Carpenter Technology Corporation, the material manufacturer. The PT report from SPS Technologies and the Certificate of Processing from General Inspection Laboratories, Inc., who performed the UT, were also reviewed. The PT and UT procedures which were identified as having been used were on file at GA and had been reviewed and approved as meeting the applicable Articles of Section V of the ASME Code. SPS Technologies was approved in accordance with GA's QA Manual, Second Edition, Quality Procedure No. 4, Revision A, Amendment 1 dated October 6, 1987.

- (2) PO 094569 dated December 2, 1987, to A&G Engineering. The NRC inspector reviewed the following three items:
  - (a) One hundred and four each 1/4-20 UNC-2A X 5/8-inch long hex head bolts of Inconel X-700, GA P/N 90-C2101-300-46 which was subsequently changed to P/N 90-C2101-300-100 A/C.
  - (b) Thirty-eight each 1/4-20 UNC-2A X 1 1/2-inch long socket head cap screws of Inconel X-750, GA P/N 90-C2101-300-44 which was subsequently changed to P/N 90-C2101-300-99 A/C.

- (c) One hundred and sixteen each 1/4-28 UNF X 3/4-inch long socket head cap screws of Inconel X-750, GA P/N 90-C2101-460-10 which was subsequently changed to P/N 90-C2101-460-13/H.

The GA PO imposed the following requirements: Appendix B to 10 CFR Part 50, 10 CFR Part 21, material to be ASTM B-637 except stress rupture testing is waived, perform the specified modified heat treatment for Inconel X-750 and provide the furnace charts, PT per Article 6 in Section V of the ASME Code, thoroughly clean in alcohol, and the material must be of domestic manufacture.

The above items were receipt inspected by GA on February 17, 1988, with each item being documented on a separate Receiving Inspection Plan (RIP). The receiving inspection consisted of 100 percent VT, and a sampled dimensional check and hardness check. GA also performed a chemistry analysis and mechanical property tests on two samples from each item. The NRC inspector reviewed this data, the CMTRs from Carpenter Technology Corporation (the material manufacturer) and A&G Engineering, the furnace charts and heat treat certifications from Precision Heat Treating Company, and the PT reports from Hadd Company Inspection Laboratory. The documentation attested to all of the applicable requirements above. The supplier was approved in accordance with the GA QA Manual noted above.

- (3) PO 059475 dated September 4, 1986, to A&G Engineering for 12 each bearing bolts, 3/4-10 UNC 2A X 10 3/4, 410 stainless steel material, GA P/N 90-C2101-546. The quality requirements were invoked on the PO by use of numbers which pertained to specific standard quality clauses that are identified in GA's Document No. QDI4-1. A comparison of the numbers noted in the PO with the clauses in the document revealed that all of the applicable requirements were identified.

GA performed a receipt inspection that was documented on RIP 059475-1 dated April 7, 1987, which showed that VT and dimensional inspection was performed along with a review of the received documentation.

The NRC inspector reviewed the documentation which included A&G Engineering's CMTR and PT report, and furnace charts and heat treat certification from Precision Heat Treating Company. The CMTR acknowledged that 10 CFR Part 21 was applicable and provided the material identity, chemical analysis, mechanical properties, and hardness values. In addition, the heat treatment times and temperatures were stated as "Hardening at 1800°F 1 hour, oil quenched per MIL-6875 except temper at 1150°F ±25° for 1 hour, Air Cool." The NRC inspector questioned GA as to why the heat treatment was noted as apparently being

different from what was required by MIL-6875. It was explained that technical requirements are noted on the applicable part drawings. GA provided the NRC inspector with a copy of the drawing for this part and it was identified that Note 3 specified the tempering temperature noted above. It was also noted that the CMTR attested to the parts having been manufactured under ASME Quality System Certificate No. 455.

A&G Engineering was approved in accordance with the GA QA manual.

- (4) PO 094568 dated January 29, 1988, to Production Tools, Inc. for 36 each spring plungers, Inconel X-750, GA P/N 90-C2101-316-2. The PO stated that the body plungers and plugs were to be AMS 5667 material and the springs to be AMS 5698 or 5699 material. The use of domestic material was required and 10 CFR Part 21 was imposed. The applicable standard quality clauses were invoked along with Appendix B to 10 CFR Part 50, and the parts were designated QA Level 1 (safety-related). The PO referenced a Vlier Engineering part number for the spring plungers which indicated that Production Tools, Inc. was to place the order with Vlier Engineering.

GA performed a receipt inspection of the parts which was documented on RIP 094568-1 dated April 22, 1988. This included a documentation review and a VT and dimensional inspection. GA also performed a chemistry analysis on one body, one plunger, one spring, and one set screw. They also performed a spring rate test on one spring plunger. It should be noted that GA identified the copper content of the plunger as being above the maximum allowed. The analysis identified the copper content as being 0.57 percent while AMS 5667 and 2269 allow a maximum of 0.53 percent. It was also identified that the silicon content of the spring was 0.61 percent whereas AMS 5698 and 2269 allow a maximum of 0.5 percent. Both conditions were written on Nonconformance Report (NR) 12058 which was dispositioned "use-as-is."

The NRC inspector reviewed the documentation provided by the vendors. A certificate of conformance from Vlier Engineering dated April 8, 1988, attested to the fact that the 36 parts were in accordance with their attached drawing which addressed dimensions, plunger forces, and materials. A CMTR dated September 30, 1987, from Howmet Turbine Components Corporation provided the material identity, chemical analysis, mechanical test results, and the material hardness in the solution annealed and precipitation heat treated conditions. Furnace charts were not available, thus the actual times and temperatures could not be established. AMS 5667, however, shows the equalization (solution annealing) heat treatment to consist of being heated to 1625°F ±25°, holding at heat for 24 hours ±0.5, and cooling in air. The precipitation heat treatment is shown as being

heated to 1300°F ±25°, holding at heat for 20 hours ±1, and cooling in air to room temperature.

A certification of compliance dated March 11, 1988, from Titan Spring Company shows Inconel 750/AMS 5699 and a heat treatment of 900°F for 1 hour. Another document titled "Certification of Shipment" shows the material specification AMS 5699 and Inconel X-750, chemical analysis, wire wrap test, and as shipped tensile properties. This document was superimposed over a shipping invoice dated July 16, 1986, which shows that the material was sold to Titan Spring Company. The sellers name was not legible.

The NRC inspector questioned GA regarding the 900°F heat treatment, in that it did not relate to any of the various types of heat treatments addressed in AMS 5699. GA could not provide a response without first contacting Titan Spring Company. Subsequent to the inspection, the NRC inspector telephoned GA to find out what information had been obtained regarding the heat treatment. GA responded by stating that Titan Spring Company had sent GA a corrected Certification of Compliance in which the 900°F was no longer shown as being the heat treatment temperature. Instead, new data was entered showing a precipitation heat treatment of 1200°F for 4 hours.

In any event, the heat treatment information provided with respect to the components of the spring plungers does not meet the requirements specified in Section 5.2 of Attachment 1 to P-88019. Section 5.2 requires that fasteners made from Inconel X-750 be solution annealed at 2025°F ±25°F, held for 1 to 2 hours and cooled within 5 minutes to 800°F or less and then cooled to room temperature as quickly as possible. This is to be followed by a precipitation hardening at 1300°F ±25°F for 20 hours +2, -0 hours, and air cooled.

This information has been presented in view of the fact that a deviation had been identified (267/8815-04) during the NRC inspection at FSV in which it was established that PSC had failed to comply with the commitments made in Attachment 1 to P-88019 relative to PSC failing to obtain chemical and mechanical CMTRs and heat treat furnace charts for the spring plungers.

It was further noted, during the inspection at GA, that another commitment in Attachment 1 to P-88019 had not been complied with: i.e., there was no documentation attesting to the performance of the required fluorescent penetrant inspection of the completed fasteners (spring plungers). This failure to comply with the commitments is an apparent deviation.  
(267/8823-02)

- b. (Closed) Unresolved Item (267/8815-07): This item pertained to the information provided to the NRC inspector during the FSV inspection in which he was informed that GA had not prepared a welding procedure specification (WPS) for the repair welding of the upper strut to scroll plate welds in the S/N C-2101 helium circulator.

The NRC inspector reviewed the applicable drawings, shop travelers, and NRs associated with the repair welding of the struts and scroll of Helium Circulator S/N C-2101.

Note 10 in Drawing 90-C2101-431, Weldment, Steam Ducting, states that all welding procedures and welders shall be qualified to the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.

Section IX of the ASME Code describes the requirements for and the relationship between a procedure qualification record (PQR) and a WPS. The PQR is a record of variables recorded during the welding of a test coupon, and as a minimum, all essential variables for each welding process used shall be documented. PQRs may be revised by having additional information recorded at a later date provided the information can be substantiated as having been part of the original qualification condition by laboratory record or similar data. The WPS must reference the supporting PQR. The WPS may be in any format as long as every essential and nonessential variable for the welding process is included or referenced. Changes to nonessential variables may be made provided such changes are documented by either an amendment to the WPS or by use of a new WPS. Changes to essential variables require requalification of the WPS by either a new PQR or an additional PQR.

The NRC inspector reviewed NR 11857 dated October 8, 1987. This NR addressed two nonconforming conditions: (1) a crack in the scroll originating at bolt hole No. 9 and extending 0.400 inches on one side of the hole, and on the other side, extending 0.350 inches to the radius and continuing up the wall for a distance of 1.400 inches, and a 0.250 inches crack like indication on one side of bolt hole No. 10; and (2) cracks in the welds in the same general area of all 16 struts.

The disposition stated to repair by grinding out the defects and then weld repair the areas. The NR identified a shop traveler which was to be used for each condition. Conditions (1) and (2) were to be repaired by following the operations delineated in shop traveler PCs 41064 and 41029, respectively. A review of both shop travelers revealed that each one referenced a WPS to be used.

Shop traveler PC 41064 for the scroll repairs, operation 20 states, "Clean, preheat & weld repair scroll area per WPS-C2101-431-801." This operation was signed off by both production and Quality Control on February 1, 1988. The NRC inspector reviewed WPS C2101-431-801

which was dated November 2, 1987. The WPS addressed the manual gas tungsten arc welding process (GTAW). There was no reference to a PQR. However, PQR C-2101-431-801 dated November 2, 1987, was provided to the NRC inspector as being the qualification for the WPS. All of the applicable essential variables were addressed in the PQR. Review of the WPS revealed, however, that one essential variable and seven nonessential variables were not addressed.

Shop traveler PC 41029 for the strut repairs, operation 20 states, "Clean, preheat & weld repair struts per WPS-C2101-431-802." This operation was signed off by production and QC on February 4 and 9, 1988, respectively. There was no evidence of a WPS by that number; however, the shop traveler which was used to perform the sample strut weld repair for qualification purposes was numbered C-2101-431-802. Operation 10 of this traveler states, "Weld per welding procedure specification W-27 and WPS-C2101-431." This operation was completed on January 12, 1988. There was some apparent confusion in that there was no evidence of the existence of WPS C-2101-431. WPS W-27 dated July 20, 1978, was established for manual GTAW, and was qualified by PQR W-27 on July 20, 1978. The WPS was requalified by PQR C-2101-431-802 dated March 19, 1980, in which several essential and nonessential variables were changed on the PQR, but not on the WPS. PQR C-2101-431-802 was subsequently revised on August 4, 1988. However, conflicts still existed between the essential and nonessential variables listed in the WPS and PQR. The NRC inspector was informed that the variables noted in the PQR dated August 4, 1988, were actually those used in the repair welding. If this were the case, a new WPS should have been initiated to address the changes. In any event, this failure to properly qualify and/or document the qualification of the WPS is an apparent violation of Criterion IX of Appendix B to 10 CFR Part 50 and GA's approved QA program. (267/8823-01)

It should be noted that, prior to the exit interview, GA presented the NRC inspector with two new WPSs with attached PQRs for the weld repairs made to the scroll and struts. The NRC inspector did not review these documents for adequacy.

c. Other Observations Noted in Inspection Report 50-267/88-15

During the NRC inspection at PSC, it was noted with respect to the commitments in Attachment 1 to P-88019, that PSC's applicable procedure did not address: (1) committed chamfering of the edge of the C-2101-431 counter bolts (paragraph 5.5 of Attachment 1 to P-88019), and (2) committed cleaning of bolt holes to remove previous thread lubricants (paragraph 5.6 of Attachment 1 to P-88019).

During the inspection at GA, the NRC inspector requested the applicable procedure(s) which addressed these items. GA informed the NRC inspector that these actions were not proceduralized; however, they were included in the appropriate operations of the shop



travelers with circulator C-2101. The NRC inspector reviewed 1 travelers to verify that these commitments were included. Order PC C-2101-300 was initiated on December 10, 1987. Operation addresses the machining, reaming, back spotfacing and grinding all (15) 13/16-inch diameter holes to  $0.070 \pm 0.010$  X 4" and remove all burrs. This operation is for the C-2101-431 counter bores and was signed off complete on March 1, 1988. Regarding the removal/cleaning of old lubricants, the other nine travelers all referenced this type of cleaning operation with quite specific instructions.

The NRC inspector verified, by this review, that the specified commitments had been performed.

3. Exit interview

An exit interview was conducted on September 16, 1988, with the GA and licensee personnel denoted in paragraph 1. During this interview, the NRC inspector reviewed the scope and findings of the inspection.