



FirstEnergy Nuclear Operating Company

Beaver Valley Power Station  
P.O. Box 4  
Shippingport, PA 15077-0004

Lew W. Myers  
Senior Vice President

February 6, 2001  
L-01-012

724-682-5234  
Fax: 724-643-8069

U. S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, DC 20555-0001

**Subject: Beaver Valley Power Station, Unit No. 1  
Docket No. 50-334, License No. DPR-66  
10 CFR Part 21 Notification  
Socket Head Cap Screw Material Deficiency**

FirstEnergy Nuclear Operating Company hereby submits the attached report in accordance with the requirements of 10 CFR Part 21. This issue involves two conditions involving the same component, socket head cap screws used on a balancing drum in the Auxiliary Feedwater Pumps at the Beaver Valley Power Station Unit No. 1. The first issue involved receipt of replacement socket head cap screws which did not meet specified hardness requirements. The second issue involves a socket head cap screw that had been installed with a material deficiency; however, it is indeterminate as to whether the nonconforming component was provided by a supplier. This second issue is being conservatively reported under 10 CFR Part 21 because it is inconclusive whether the issue meets the reporting requirements of 10 CFR Part 21.

A copy of this 10 CFR Part 21 information was faxed to the NRC Operations Center on January 31, 2001.

Should you have any further questions regarding this matter, please contact Mr. Thomas S. Cosgrove, Regulatory Affairs Manager, at 724-682-5203.

Sincerely,

Lew W. Myers

Attachment

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cc: Mr. H. J. Miller, Regional Administrator  
United States Nuclear Regulatory Commission  
Region 1  
475 Allendale Road  
King of Prussia, PA 19406

Mr. L. J. Burkhart  
BVPS Project Manager  
United States Nuclear Regulatory Commission  
Washington, DC 20555

Mr. David M. Kern  
BVPS Senior Resident Inspector  
United States Nuclear Regulatory Commission

Mr. J. A. Hultz  
Ohio Edison Company  
76 S. Main Street  
Akron, OH 44308

INPO Records Center  
700 Galleria Parkway  
Atlanta, GA 30339-5957

Mr. L. E. Ryan  
Bureau of Radiation Protection  
Department of Environmental Protection  
RCSOB-13th Floor  
P.O. Box 8469  
Harrisburg, PA 17105-8469

Manager, Nuclear Licensing and  
Operations Support  
Virginia Electric & Power Company  
5000 Dominion Blvd.  
Innsbrook Tech. Center  
Glen Allen, VA 23060

## ATTACHMENT I

### 10 CFR Part 21 Notification, Part I Beaver Valley Power Station Unit No. 1

1) Name and Address of Individual Making Notification:

L. W. Myers, Senior Vice President  
FirstEnergy Nuclear Operating Company (FENOC)  
Beaver Valley Power Station  
P.O. Box 4  
Shippingport, PA 15077

2) Basic Component Affected:

Socket head cap screws for use on a balancing drum in the Beaver Valley Power Station Unit No. 1 Auxiliary Feedwater Pumps: 3/8" – 16UNC-3A x 3/4" LG., 410 stainless steel, IDP Material Specification 746, ANSI B18.3, Manufacturer: Ingersol-Dresser Pump Co., Part #119A2-C-198. [Note: Ingersol-Dresser Pump Co. has been acquired by Flowserve Corporation.]

3) Firms Supplying Component:

Supplier: Flowserve Corporation,  
Nuclear Pump Operations  
4816 Worth Place  
Charlotte, NC 28216

Mackson, Incorporated  
P.O. Box 12067  
2346 Southway Drive  
Rock Hill, South Carolina 29730

Fabricator: U.S. Bolt  
12895 South Main  
Houston, Texas 77035

4) Nature of Defect:

The specified maximum hardness value was exceeded for 16 of 20 cap screws supplied for use on a balancing drum located on the Auxiliary Feedwater Pump (AFP) shaft. Exceeding the hardness limit makes these cap screws susceptible to stress corrosion cracking. Therefore, the defect, if gone undetected and installed, could have caused these cap screws to fail during their operating life. A failed cap screw could jam and prevent a standby AFP from starting. Failure of one or more AFPs to start when required would result in a major degradation of essential

safety related equipment, and the required Auxiliary Feedwater System may not have been able to perform its safety related function, which would constitute a significant safety hazard. As such, the defect is reportable pursuant to 10 CFR Part 21 requirements.

5) Date on which Defect was Identified:

On 11/29/2000, FirstEnergy Nuclear Operating Company (FENOC) placed a purchase order with Flowserve Corporation for 20 screw-cap, socket head, 3/8"-16UNC-3A x 3/4" LG., 410 stainless steel, IDP Material Spec: 746, ANSI B18.3. These screws are used on Beaver Valley Power Station Unit No. 1 Auxiliary Feedwater Pumps manufactured by Ingersol-Dresser Pump Company, Part #119A2-C-198. The purchase order specified that these screws be a maximum Rockwell 22C. The purchase order invoked 10 CFR 50 Appendix B and 10 CFR 21 nuclear safety related requirements.

The above order was received in two parts of 4 screws and 16 screws manufactured in different heats. Certificates of Compliance were received from Flowserve Corporation by FENOC certifying that the material has been furnished in accordance with the requirements of the customer purchase order when the screws were delivered for each delivery. The second group of 16 screws passed receiving inspection on 12/01/2000 by FENOC Quality Control following arrival. Upon notification that appropriate cap screws had been received for installation, the lead project engineer requested that the cap screws be tested for hardness. This test was not initiated as part of any receipt inspection, but was a non-required independent verification of the item's hardness requested by the engineer. One cap screw was tested at an independent laboratory and was found to have a hardness exceeding the required maximum limit on 12/06/2000. The remaining 15 screws in the second group were then rejected because they were manufactured from the same lot. The non-conforming cap screws were not installed and were returned to the supplier. The other 4 screws were tested for hardness and determined to be acceptable.

6) Number and Location of Components:

16 of 20 cap screws supplied for use on a balancing drum located on the AFP shaft were rejected as not meeting the specified maximum hardness limit.

7) Corrective Action Taken:

The unsatisfactory cap screws were returned to the supplier. The cap screws were heat treated to make the screws comply with the maximum hardness requirement and several were returned by Flowserve. The returned screws were again independently tested for hardness with acceptable results.

The supplier stated that they have initiated corrective actions from this event.

8) Other Advice Related to Purchasers or Licensee:

FENOC initiated this purchase order specifically and solely for these cap screws as replacements to address recent concerns involving the cap screws in the operating AFPs at Beaver Valley Power Station Unit 1. Discussion with the cap screw supplier, Flowserve, indicated that these cap screws were ordered from a sub-supplier specifically to fulfill only this order received from FENOC for the Beaver Valley Power Station. Flowserve has stated that they had supplied no other purchaser with similar cap screws from this order from this sub-supplier.

## ATTACHMENT II

### 10 CFR Part 21 Notification, Part II Beaver Valley Power Station Unit No. 1

Note: This is being conservatively reported under 10 CFR Part 21 because it is inconclusive whether the issue described below meets the reporting criteria of 10 CFR Part 21. It is indeterminate as to whether the nonconforming component was provided by the supplier.

1) Name and Address of Individual Making Notification:

L. W. Myers, Senior Vice President  
FirstEnergy Nuclear Operating Company (FENOC)  
Beaver Valley Power Station  
P.O. Box 4  
Shippingport, PA 15077

2) Basic Component Affected:

Socket head cap screws for use on a balancing drum in the Beaver Valley Power Station Unit No. 1 Auxiliary Feedwater Pumps: 3/8" – 16UNC-3A x 3/4" LG., 410 stainless steel, IDP Material Specification 746, ANSI B18.3, Manufacturer: Ingersoll-Dresser Pump Co., Part #119A2-C-198. [Note: Ingersoll-Dresser Pump Co. has been acquired by Flowserve Corporation.]

3) Firms Supplying Component:

Supplier and Fabricator: Ingersoll-Dresser Pump Company [Flowserve Corporation]  
Engineered Pump Division  
942 Memorial Parkway  
Phillipsburg, NJ 08865

4) Nature of Defect:

One of the four cap screws on the collar of the hydraulic balancing drum of the steam-driven Auxiliary Feedwater Pump (AFP) 1FW-P-2 failed. The head of the screw broke off and became lodged in the area between the stuffing box extension and the balancing drum collar, preventing 1FW-P-2 from starting on 11/27/00. The root cause of the cap screw failure was material defect. Final metallurgical analysis revealed that the failure was due to intergranular failure. The defects noted in the fastener surface were attributed to the original manufacture of the cap screw. The probable cause of the failure was the propagation of manufacturing cracks under static preload, which caused tensile stress of approximately 88% of the yield stress of the cap screw. Hydrogen absorption and diffusion into regions

of high stress caused propagation of the cracks. The failure was a time delayed process.

The material defect led to the failure of one AFP cap screw which prevented the AFP from starting. Failure of one or more Auxiliary Feedwater Pumps to start when required would result in a major degradation of essential safety related equipment, and the required Auxiliary Feedwater System may not have been able to perform its safety related function, which would constitute a substantial safety hazard.

Though not attributed as part of root cause for the one cap screw failure, two related noteworthy non-compliant issues were identified with the four cap screws found on the 1FW-P-2 AFP collar. An emission spectrograph test run on a cap screw showed a chromium content of 0.148% (indicating the screw was carbon steel). The vendor Material Release for 1FW-P-2 (MR 912004) shows that the cap screws are 410 stainless steel that should have contained 12% chromium. FENOC is not able to conclude whether operating with carbon steel cap screws (in place of the required stainless steel) could have caused the AFP to fail.

The cap screws also had hardness values of 41-44 HRC (Hardness Rockwell C). The purchase specification requires 410 stainless steel with a hardness less than 22 HRC. Although carbon steel bolts are less susceptible to stress corrosion cracking than stainless steel bolts, FENOC is not able to conclude whether operating with carbon steel cap screws with a hardness of 41-44 HRC (in excess of the required hardness limit of 22 HRC) could have caused the AFP to fail.

5) Date on which Defect was Identified:

The failure of the steam-driven AFP, 1FW-P-2, to start occurred on 11/27/00. The root cause analysis, which identified the failure as a material defect in the cap screw leading to its failure jamming the AFP, was completed on 12/15/00.

6) Number and Location of Components:

Only one of the four cap screws installed in the steam-driven AFP, 1FW-P-2, contained material defects. Cap screws were initially provided as part of a new rotating assembly which was purchased in 1990 from Ingersoll-Dresser and installed into the AFP at Beaver Valley Power Station Unit No. 1 in 1991. Vendor information shows that the cap screws provided meet design requirements. There are no records showing that station personnel ever replaced these cap screws, though some plant activities periodically require these cap screws to be removed and reinstalled. The cap screws on the rotating assemblies on two motor-driven AFPs (1FW-P-3A and 1FW-P-3B) were determined to

correctly contain 410 stainless steel cap screws with no material defects. Thus, it is indeterminate exactly how and when these four noncompliant carbon steel cap screws, which included one cap screw with a material defect, were installed on 1FW-P-2 rotating assembly. Therefore, it is also indeterminate whether these cap screws were provided in the original rotating assembly purchased in 1990 from Ingersoll-Dresser.

7) Corrective Action Taken:

The unsatisfactory cap screws on 1FW-P-2 were replaced with cap screws which meet design requirements.

8) Other Advice Related to Purchasers or Licensee:

This notification is being provided for information only since it is indeterminate as to whether the supplier actually provided the nonconforming components.