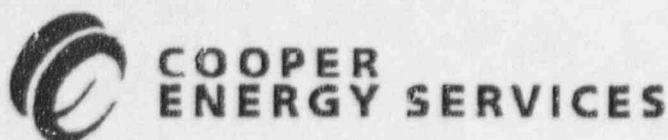


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Grove City, PA 16127-1898  
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May 23, 1997

Our Ref: QCG-10389

Document Control Desk  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Subject: 10 CFR 21 Notification, Cooper-Bessemer  
KSV Emergency Diesel Generator Power Piston Failure

Dear Sir:

In accordance with the requirements of the Nuclear Regulatory Commission Title 10, Chapter 1, Code of Federal Regulations, Part 21, Cooper Energy Services (CES), a division of Cooper Cameron Corporation, hereby notifies the Commission of a potential manufacturing defect of the Cooper-Bessemer KSV Emergency Diesel Generators (EDG's).

On January 27, 1997 Commonwealth Edison Company (CECo), Zion Station identified a significant drop in crankcase lube oil level. Subsequent investigation revealed that a crack had developed in the cylinder liner wall allowing jacket water to enter the combustion chamber. Jacket water in the combustion chamber is incompressible and caused a hydraulic lock, which resulted in a fracture in an area of the piston crown relieving the hydraulic lock. Upon review of the failed piston it was noted that the piston crown thickness in the area of failure was below drawing specifications.

While the EDG continued to operate, the potential long term effect of the above could be dilution of the crankcase oil with jacket water, accompanied by a reduction in lubrication, ultimately resulting in seizure of critical assemblies.

This event resulted in two distinct investigations, the liner failure causing the event and the piston crown thickness below specification. This notification is specific to the potential piston deficiency.

KSV Power Piston Potential Deficiency:

Cooper-Bessemer part numbers KSV-5-A, KSV-5-A#1, KSV-5-3A#1 (commercial, non-safety) and KSV-5-A#2, KSV-5-2A, KSV-5-2A#1 (safety-related) supplied by CES are affected.

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PDR ADDCK 05000295  
S PDR



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The potential defect concerns the thickness of the piston crown in the valve cutout area (see attachment) that provides clearance for the intake and exhaust valves. The nominal design thickness for this area is .438. The failed piston at CECo had an area that tapered down to a minimum thickness of .040.

#### Discussion:

Finite Element Analysis performed by CES subsequent to the failure has indicated an acceptable minimum thickness in the valve cutout area of .100. The analysis also indicated that a .040 thick piston should not fail in normal operation, but the factor of safety is below normally accepted values. Examination of pistons in CES stores noted many in the .25-.31 range and one as low as .070.

The root cause of the deficient condition was an incorrect foundry pattern.

#### User Recommendations:

Users are advised to perform the following:

Using Ultrasonic or similar measuring equipment, the crown thickness at the valve cutout should be verified to be .100 minimum. For pistons currently installed in engines this can be done during normal maintenance activities when the pistons become accessible. Immediate verification is not considered necessary based on the following:

- The piston failure was caused by an extraordinary event (hydraulic lock).
- No other reported failures of this type in the KSV operating history.
- Consideration of logged time for each piston. 600 hours of piston operation corresponds to  $10 \times 10^6$  stress cycles and thus is unlikely to fail under normal loading. Many installed pistons will have significantly more hours of operation.
- The limited inspection performed on CES in stores pistons indicates that the mean thickness is well above the .100 minimum thickness. Ultrasonic inspection performed by CECo on 74 pistons (in stores and in use) resulted in none below the .100 minimum.

Users with spare pistons in stores should verify the subject thickness prior to installation.

#### Corrective Action:

The following activities are being undertaken by CES:

- Revision of the foundry pattern to correct crown thickness.

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- Inclusion of specific verification of crown thickness in the valve cutout area during the production process.
- Inclusion of specific verification of crown thickness in the valve cutout area during the refurbishment process of used pistons.

Affected Sites:

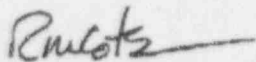
All pistons in Cooper-Bessemer KSV EDG's at the following sites are affected.

Arizona Public Service- Palo Verde  
Commonwealth Edison - Braidwood  
Commonwealth Edison - Byron  
Commonwealth Edison - Zion  
Entergy Operations - Waterford III  
Houston Lighting and Power - STP  
Nebraska Public Power District - Cooper Nuclear Station  
Niagara Mohawk - NMP2  
Pennsylvania Power and Light - SSES

Please contact Andrew Steffan at 412-458-3455 or John Horne at 412-458-3543, if you have any questions.

Sincerely,

COOPER CAMERON CORPORATION



R. M. Cote  
Vice President and General Manager

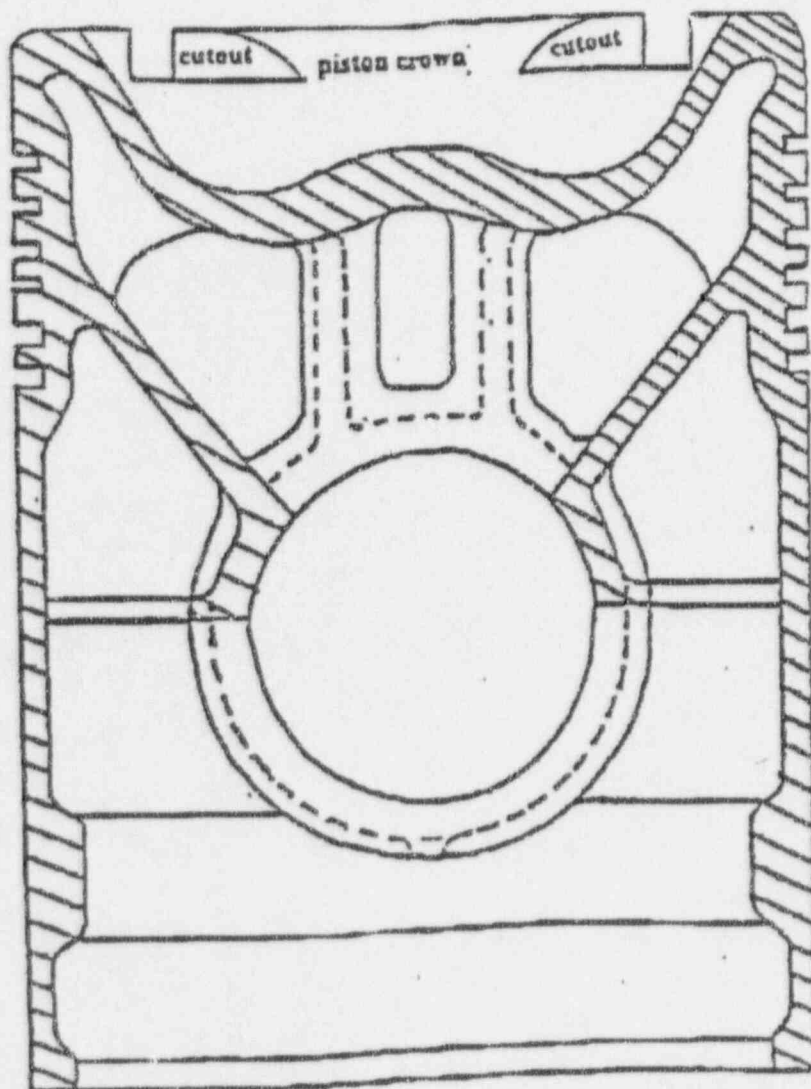
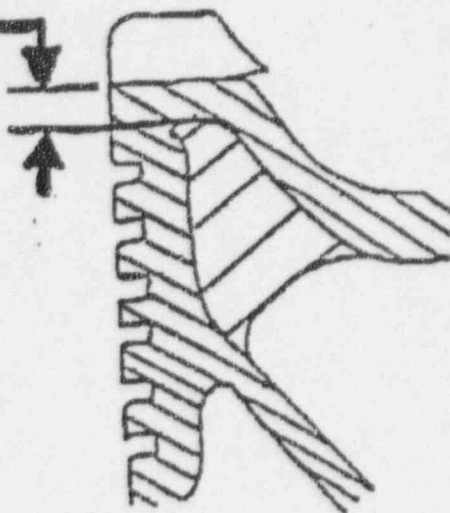
Attachment

:kll

cc: D. T. Blizzard - CES/GC  
J. M. Horne - CES/GC  
T. W. Kearns - CES/GC  
W. H. A. Lambert  
A. P. Steffan - CES/GC  
G. S. Mishler - CES/GC  
P. J. Shimek - CES/GC  
File: K5fa40

ATTACHMENT TO QCG-10389

Minimum crown  
thickness is measured  
in cutouts



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Copies to: (List revised 5/29/97)

Mr. Walter Haass  
U.S. Nuclear Regulatory Commission  
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Washington, DC 20555

Houston Lighting and Power Co.  
South Texas Project Electric  
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Wadsworth, TX 77483  
Attn: General Manager  
Nuclear Assurance & Licensing

Mr. James Kenny  
Licensing Group Supervisor  
Pennsylvania Power and Light  
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Ms. Violet D'Angelo  
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Mr. Michael Kneble  
EnTergy Associates  
Louisiana Power and Light  
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Tech Staff Electrical Group  
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Mr. Roman Estrada  
Nebraska Public Power District  
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Mr. Terry O'Brien  
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Mr. David Zink  
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Nine Mile Road - Unit 2  
P. O. Box 63  
Lycoming, NY 13093

Ms. Kathleen Russo  
Niagara Mohawk Power Corp.  
Nine Mile Road - Unit 2  
P. O. Box 63  
Lycoming, NY 13093

Arizona Public Service  
P. O. Box 52034 Mail Station 6325  
Phoenix, AZ 85072-2034  
Attn: Department Leader  
Nuclear Materials Management

Ms. Angela Krainik  
Manager, Nuclear Regulatory Affairs  
Arizona Public Service  
P. O. Box 52034 Mail Station 7636  
Phoenix, AZ 85072-2034

Mr. Terry Vandevorst  
Commonwealth Edison  
Zion Generating Station  
101 Shiloh Blvd.  
Zion, IL 60099

Mr. Arthur G. Killinger  
MPR Associates, Inc.  
320 King Street  
Alexandria, VA 22314-3238

Entergy Operations Inc.  
P.O. Box 31995  
Jackson, MS 39286-1995  
Attn: Mr. Joe Pennington  
Supervisor of Material Requirements



## GENERAL INFORMATION or OTHER

EVENT NUMBER: 32416

LICENSEE: COOPER ENERGY SERVICES  
CITY: GROVE CITY REGION: 1  
COUNTY: STATE: PA  
LICENSE#: AGREEMENT: N  
DOCKET:

NOTIFICATION DATE: 05/30/97  
NOTIFICATION TIME: 14:53 [ET]  
EVENT DATE: 05/30/97  
EVENT TIME: 00:00 [EDT]  
LAST UPDATE DATE: 05/30/97

## NOTIFICATIONS

LAURIE PELUSO, REG 1 RDO

JOHN PELLET, REG 4 RDO  
JOHN JACOBSON, REG 3 RDO  
CHARLES HOSEY, REG 2 RDO  
VERN HODGE, RVIB NRR

NRC NOTIFIED BY: COTE (FAX)  
HQ OPS OFFICER: CHAUNCEY GOULD

EMERGENCY CLASS: NOT APPLICABLE  
10 CFR SECTION:  
CCCC 21.21 UNSPECIFIED PARAGRAPH  
NINF INFORMATION ONLY

## EVENT TEXT

- PART 21 - POTENTIAL MANUFACTURING DEFECT IN COOPER-BESSEMER KSV EDGs -

COOPER ENERGY SERVICES MADE A 10 CFR PART 21 NOTIFICATION FOR THEIR COOPER-BESSEMER KSV EMERGENCY DIESEL GENERATORS DUE TO A POTENTIAL MANUFACTURING DEFECT. THE POTENTIAL DEFECT CONCERNS THE THICKNESS OF THE PISTON CROWN IN THE VALVE CUTOUT AREA THAT PROVIDES CLEARANCE FOR THE INTAKE AND EXHAUST VALVES. THE NOMINAL DESIGN THICKNESS OF THIS AREA IS 0.438, BUT A FAILED PISTON HAD AN AREA THAT TAPERED DOWN TO A MINIMUM THICKNESS OF 0.040.

FINITE ELEMENT ANALYSIS PERFORMED SUBSEQUENT TO THE FAILURE HAS INDICATED AN ACCEPTABLE MINIMUM THICKNESS IN THE VALVE CUTOUT AREA OF 0.100. THE ANALYSIS ALSO INDICATED THAT A 0.040 THICK PISTON SHOULD NOT FAIL IN NORMAL OPERATION, BUT THE FACTOR OF SAFETY IS BELOW NORMALLY ACCEPTED VALUES. EXAMINATION OF PISTONS IN COOPER ENERGY SERVICES STORES NOTED MANY IN THE 0.25 TO 0.31 RANGE AND ONE AS LOW AS 0.070. THE ROOT CAUSE OF THE DEFICIENT CONDITION WAS AN INCORRECT FOUNDRY PATTERN.

THE FOLLOWING PLANTS ARE AFFECTED: PALO VERDE, BRAIDWOOD, BYRON, ZION, WATERFORD, SOUTH TEXAS, COOPER, NINE MILE POINT UNIT 2, AND SUSQUEHANNA.