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June 19, 2001

U.S. Nuclear Regulator Commission
Document Control Desk
Mail Stop 0P1-17
Washington, DC 20555

Subject: 10CFR21 Reporting of Defects and Non-Compliance -
Engine Systems, Inc. Report No. 10CFR21-0082

Woodward electronic controls with electrolytic capacitors

Dear Sir:

The enclosed report addresses a reportable notification about service life of electrolytic capacitors in Woodward controls.

A copy of the report will be mailed to all of our nuclear customers.

Please sign below, acknowledging receipt of this report, and return a copy to the attention of Document Control at the address below (or, fax to number 252/446-1134) within 10 working days after receipt.

Yours very truly,

ENGINE SYSTEMS, INC.

Susan Woolard

Susan Woolard
Document Control

Please let us know if ANY of your mailing information changes - name of recipient, name of company/facility, address, etc. Mark the changes on this acknowledgment form and send to us by mail or FAX to the number above.

RECEIVED: _____

(93)

DATE: _____

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Report No. 10CFR21-0082
Rev. 0: June 18, 2001

10CFR21 REPORTING OF DEFECTS AND NON-COMPLIANCE

COMPONENT: Woodward electronic controls with electrolytic capacitors

SYSTEM: Diesel generator and turbine control systems

CONCLUSION: Reportable in accordance with 10CFR21.

PREPARED BY: _____ DATE: 6/18/01
Engineering Manager

REVIEWED BY: Michael Nuding DATE: 6/18/01
Quality Assurance Manager

SUMMARY:

Engine Systems Inc. (ESI) has performed an investigation of a Woodward 2301A load sharing and speed control failure which occurred at Florida Power and Light – Turkey Point. In August 2000, a 2301A control (p/n 9903-337) experienced a failure of the control's power supply capacitor (device C17) which rendered the control inoperable. FP&L performed a preliminary investigation and found that Washington Public Power had also experienced a similar failure on two of their 2301A controls; one in June 1994 and another in December 1995. A summary of the capacitor failures is listed below:

Site	Device	Part No.	Date Code	Manufacture Date	Failure Date
FP&L	C17	1660-111	8804	Jan 1988	Aug 2000
WPP	C17	1660-111	8634	Aug 1986	June 1994
WPP	C17	1660-111	8634	Aug 1986	Dec 1995

FP&L had a failure analysis performed on their failed capacitor by Seal Laboratories. The analysis concludes that the most likely cause of the failure was caused by electrolyte contamination from a halogenated solvent which may have entered the capacitor during solvent cleaning of the circuit board as part of the control's manufacturing process. FP&L also provided a copy of WPP's failure analysis on one of their failed capacitors performed by HI-REL laboratories. The HI-REL analysis arrived at a similar conclusion regarding solvent contamination.

As part of our investigation, ESI contacted Woodward's capacitor supplier to obtain life expectancy and shelf life information for their electrolytic capacitors. Life expectancy can vary from a maximum of 15 years to a minimum of 5 years depending upon storage conditions, operating environment, etc.. The manufacturer recommends are 5-7 year replacement interval for conservatism; this includes time in storage plus time in service. In addition, for units in storage, the capacitor must be reformed every 18-24 months by applying system voltage.

Electrolytic capacitors are typically used in power supply filtering applications. For the 2301A, capacitor C17 is used on the output side of the control's 125V to 20V power supply. The 2301A also contains an electrolytic capacitor (device C16) on the input power side of the power supply. ESI's investigation into this issue focused primarily on the Woodward 2301A control. It should be noted; however, that Woodward also utilizes electrolytic capacitors in some of their other controls; these include the DRU (speed reference unit) and the 700 series controls.

CONCLUSION:

All three of the failed capacitors had service lives that exceeded the manufacturer's 5-7 year replacement interval. While the failure analysis reports of both Seal Laboratories and HI-REL Laboratories indicate that contamination from use of halogenated cleaning solvents may have contributed to the capacitor failures; ESI believes that the capacitors simply reached their end of life. If contamination did occur, it did not significantly affect the capacitor performance and/or life.

The purpose of this notification is not to report a defect, but is issued to alert users of a defined life for electrolytic capacitors. These capacitors are known to be used in Woodward 2301A, DRU and 700 series controls. Woodward has manufactured more than 40,000 2301A controls since its introduction in 1983 and only a limited number of capacitor failures have been report. Of the 2301A's in nuclear service, only the three (3) failures, discussed above, have been reported. No capacitor failures of the DRU and the 700 series controls in nuclear service have been reported.

COMPONENT:

Woodward electronic controls containing electrolytic capacitors. These include the 2301A load sharing & speed control, the DRU speed reference unit and the 700 series speed control.

CUSTOMERS AFFECTED:

Because of the variety of part numbers and configurations of Woodward electronic components, this notification will be sent to all ESI nuclear customers

CORRECTIVE ACTION:

ESI recommends replacing the control's electrolytic capacitors every 5-7 years from the manufacture date of the capacitor. The capacitor manufacture date is identified by a date code stamped on the capacitor (e.g. 8807 indicates the 7th week of 1988). In addition, the electrolytic capacitors of controls in storage must be reformed every 18-24 months. Reforming is accomplished by applying rated voltage to the control's input power terminals for a period of 24 hours. Controls in service normally have input power continuously applied (or as a minimum, input power is applied during periodic surveillance testing of the prime mover) and therefore, a separate reforming operation is not required.

Suspect controls can be sent to ESI for determination of electrolytic capacitor date code, capacitor replacement and periodic power-up. All future controls shipped from ESI will have the electrolytic capacitor date code identified on the front surface of the control to assist in determining replacement/refurbishment intervals. Contact ESI Customer Service for further information about returning a control.