AEOD TECHNICAL REVIEW REPORT*

UNITS: Calvert Cliffs Units 1 and 2
DOCKET NOS.: 50-317 and 50-318
LICENSEE: Baltimore Gas and Electric Co.
NSSS/AE: Combustion Engineering/Bechtel

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SUBJECT: EVENTS INVOVLING FIRES OR OTHER RELATED ABNORMALITIES IN MOTOR CONTROL CENTERS WITH ALUMINUM BUS BARS

REFERENCES:
1. U.S. NRC, IE Morning Report for Region I, Docket No. 50-318, dated May 2, 1984.
2. U.S. NRC, IE Inspection Report Nos. 50-317/84-07 and 50-318/84-08, Docket Nos. 50-317 and 50-318, dated May 2, 1984.

SUMMARY

This Technical Review Report provides information concerning a potential degradation or failure mechanism for motor control centers. The initial concern regarding this area was that the degradation or failure mechanism identified in this report could result in fires or other related abnormalities in motor control centers and/or associated electical equipment. In addition, this mechanism appears to have common cause implications and could result in simultaneous degradation or failure of redundant motor control centers and/or associated electrical equipment. The referenced reports and the abstracts for 31 licensee event reports were used as the sources of information for this report. This report concludes that the concerns stated above are generally not applicable to nuclear stations, although they may be applicable to certain stations. In view of this, the report suggests that further AEOD actions relating to this issue are not warranted at this time. However, should additional events similar to those described in the referenced reports be identified, it is suggested that further actions for this issue be taken at that time.

* This document supports ongoing AEOD and NRC activities and does not represent the position or requirements of the responsible NRC program office.

DISCUSSION

Reference 1 provides information concerning an event which occurred at Calvert Cliffs Unit Number 2 on April 29, 1984. As stated in this reference, the licensee found indications of overheating of a non-safety related 480 volt motor control center (MCC). The MCC was subsequently de-energized and investigation showed that considerable melting had occurred in two of the three aluminum bus bars. The bus bars are bolted together and if loose, poor contact at the bolted connections occur, which result in increased resistance and heating at these connections. The report also notes that the involved MCC is located in a high vibration area. This being the case, it is likely that this vibration may have contributed to this event.

Reference 2 provides a description of a similar event which occurred at the Calvert Cliffs Station on March 11, 1984. As described in this reference, a fire broke out in a non safety-related 480 volt MCC which was located in the auxiliary building. The fire was quickly extinguished when the MCC was de-energized. The cause of the fire was believed to be a loose connection between the aluminum bus bar sections which caused overheating and arcing. The licensee disassembled the burned bus work and confirmed that a bolted connection was loose.

All of the buses, load centers and motor control centers at this station have aluminum bus bars. However, only the motor control centers have bolted connections between bus bar sections (bus bar sections are welded together in the other components). There are approximately twelve motor control centers for each unit with two of these being safety-related.

At this station, the licensee had established a five year preventive maintenance program to clean and inspect MCC buses and to perform insulation resistance tests. However, the steps contained in the preventive maintenance document were cryptic and did not specifically require that bolted connections be checked for tightness. To prevent recurrence of similar events the licensee stated that they would re-evaluate and modify the five year interval for performing the preventive maintenance activity (following the event which occurred on March 11, 1984 a five year interval for conducting this activity was considered too long), improve the wording in the preventive maintenance document so as to specifically state that the tightness of the bolted connections be checked, and to perform this preventive maintenance on MCCs by the end of the next refueling outage for each unit. (These outages are presently scheduled for the summers of 1984 and 1985 for Unit 2 and 1 respectively.) Also, the licensee has stated that they were considering purchasing an infrared detector to periodically monitor for bus hot spots during MCC operation.

Collectively, the two events described above illustrate a failure or degradation mechanism for motor control centers, both safety-related and non safety-related, with bolted aluminum bus bar connections. Such a mechanism may be stated as follows. In-plant vibration at the physical location of the MCC may cause the bolted connections at the bus bars to loosen. The loosening of the bolted connnections results in a relative high resistance between the connected bus bars. When normal operating electrical currents pass through these buses, this relative high resistance causes a voltage difference to

occur across the connected bus bars. In addition, heating of the bus bars occur as a result of the electrical power which is dissipated by the relative high resistance between the bolted bus bar connections. In time, this condition if unattended, tends to deteriorate to one which could result in fires as well as abnormal operation of electrical equipment associated with the MCC. Also, such a mechanism appears to have common cause implications and could result in simultaneous degradation or failure of redundant MCCs and/or associated electrical equipment.

Using the two events and the degradation or failure mechanism described above as a bases for further actions, searches were obtained from the SCSS data base systems for other similar events which may be attributed to this mechanism. This search resulted in the identification of 31 licensee event reports which describe events involving motor control centers. These events occurred during the period from January 1981 to June 1983. A review of the abstracts for these reports did not result in the identification of a single event which may be attributed to the degradation or failure mechanism identified above. In view of the lack of other identified events which illustrate this mechanism, it appears that this is not a generic concern although it may be applicable to certain stations.

FINDINGS

Based on the information presented in the discussion above, the following findings are provided:

1. The two events which occurred at the Calvert Cliffs Station and described above illustrate a degradation or failure mechanism for motor control centers. However, a review of the set of related events obtained from the SCSS indicates that in general, such a mechanism is not a concern for motor control centers at nuclear stations.

2. The identified degradation or failure mechanism does have a common cause implication in that it could result in the simultaneous degradation or failure of redundant motor control centers and/or associated electrical equipment.

CONCLUSION

Based on the above information, we believe that in general the degradation or failure mechanism identified in this report is not a concern for motor control centers at nuclear stations, although it may be a concern for motor control centers at certain stations. In view of this, we believe that further AEOD actions relating to this issue are not warranted at this time. However, should additional events similar to those described in the referenced reports be identified, it is suggested that further actions regarding this issue be assessed at that time.