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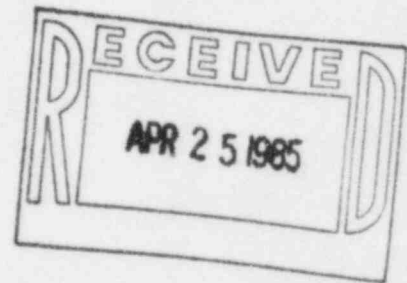
AREA CODE 713 838-6631

April 23, 1985
RBG- 20,787
File Nos. G9.5, G9.25.1.1

Mr. Robert D. Martin, Regional Administrator
U. S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 1000
Arlington, Texas 76011

Dear Mr. Martin:

River Bend Station Unit 1
Docket No. 50-458
Final Report/DR-277



On March 22, 1985, GSU notified Region IV that it had determined DR-277 concerning Category II flux containing zinc chloride used for Category I terminations to be reportable under 10CFR50.55(e)(3). The attachment to this letter is GSU's final 30-day written report pursuant to 10CFR50.55(e)(3) with regard to this deficiency.

Sincerely,

J. E. Booker
Manager-Engineering,
Nuclear Fuels & Licensing
River Bend Nuclear Group

ME
JEB/PJD/lp

Attachment

cc: Director of Inspection & Enforcement
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

NRC Resident Inspector-Site

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ATTACHMENT

April 23, 1985
RBG- 20,787

DR-277/Zinc Chloride in
Solder Flux

Background and Description of the Problem

The deficiency concerns Category II flux, AMCO C-flux that was used for soldering QA Category I connectors as identified in Nonconformance and Disposition Report (N&D) No. 7862. This soldering procedure violates Specification No. 248.000, with respect to the use of Category II material on a Category I installation. Further investigation was made by means of N&D No. 7862 dated October 29, 1984, and RBS project-unique testing determined that zinc chloride in the flux might have caused corrosion on the connectors and reduced their electrical effectiveness. A random sampling of 12 connectors was sent to the Material Evaluation Laboratory, Baton Rouge, Louisiana, to analyze corrosive effects due to the use of solder fluxes containing zinc chloride. The laboratory analysis report concludes the following:

1. The presence of zinc chloride in flux residues is verified, and all sampled connectors were found with flux residue.
2. The zinc chloride residues are deliquescent and corrosive when there is moisture. Copper wires are the most vulnerable (especially small conductors and multiple-stranded conductors).
3. Corrosion may cause physical damage; therefore, the potential failure modes may be electrical or mechanical.
4. It does not appear to be feasible to clean the connectors nondestructively.
5. The silver tips of the connectors do not seem to present a potential problem; but solder will be affected by corrosion.
6. It appears that there are two methods for corrective action; remove and replace the connectors or environmentally seal the conductors to prevent entry of moisture.

Some of the areas where solder flux was used are listed below:

1. Tinning of strands where conductors are connected to compression-type terminal blocks.
2. Making shield terminations for 5-kV and 15-kV power cables.

3. Coaxial cable connectors at reactor primary containment penetrations.
4. Field run coaxial cables connectors.
5. Tinning of strands for ground grid connections and other miscellaneous connections.

Electrical Installation Specification No. 248.000 references Construction Standard Instructions (CSIs) 9.0.19 and 9.0.20 for use in the installation of connectors. These CSIs allowed the use of non-acid flux in soldering applications. The flux chosen for use by Construction contained zinc chloride; however, while not an acid itself, it is considered an acid-corrosive flux, since it becomes corrosive to the copper conductors when exposed to moisture. This corrosive behavior of the zinc chloride based flux was not anticipated.

Safety Implication

Among the soldered connectors, a major area of concern is coaxial cable connectors at the reactor penetrations. Coaxial cables prefixed 1NMS are reactor neutron monitoring sensor cables. These coaxial cables include cables for control rod position. These system cables are integral parts of systems which function to maintain reactor safe operation as well as for normal reactor reactor process control. Cables prefixed 1RMS are containment area radiation monitoring sensor cables. Losing these cables by connector corrosion results in losing the means of monitoring containment radiation activity. Loss of these systems limits information to the plant operator, with respect to control rod position and ambient radiation levels, thus impairing the safe operation of the plant.

Corrective Action

The subject solder connectors have been identified and will be reworked in accordance with N&D 7862 using proper solder and soldering procedures, which do not result in corrosive action.

CSIs 9.0.19 and 9.0.20 were revised to allow the use of only rosin base flux if required to facilitate installation of electrical connectors.