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United States Nuclear Regulatory Commission
Office of Inspection and Enforcement
Region II-Suite 3100
101 Marietta Street
Atlanta, Georgia 30303

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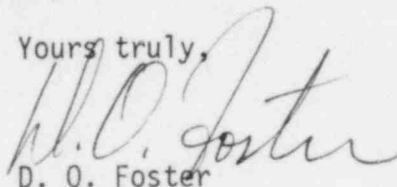
Reference: Vogtle Electric Generating Plant - Units 1 and 2,
50-424, 50-425; Defective Weld Wire; Letter
to J. P. O'Reilly dated 11/1/83 (GN-272)

Gentlemen:

Georgia Power Company has completed its engineering evaluation of the above referenced concern and has concluded that neither a significant deficiency nor a substantial safety hazard exists. This concern is therefore not reportable pursuant to the requirements of 10 CFR 50.55(e) or 10 CFR 21. A summary of the engineering evaluation is attached for your information.

This letter contains no proprietary information and may be placed in the NRC Public Document Room upon receipt.

Yours truly,



D. O. Foster

DOF/REF/cc

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EVALUATION FOR A SUBSTANTIAL SAFETY HAZARD
EVALUATION FOR A SIGNIFICANT DEFICIENCY
DEFECTIVE WELD WIRE

Initial Report:

On June 9, 1983, Mr. C. W. Hayes of Georgia Power Company reported a potential deficiency to the NRC concerning hot cracks in welding test specimens. Georgia Power Company subsequently informed the NRC that an interim report could be expected by October 14, 1983.

Background Information:

Georgia Power Company performed welder qualification tests at the construction site. Specimens were prepared to qualify welders for welding P1 carbon steel to P8 stainless steel by the Gas Tungsten Arc Welding process (GTAW) using 309L weld wire. Subsequent to the welding of the specimen, hot cracks were observed in a major percentage of the specimens. This definition of hot cracks refers to cracks associated with the welding of stainless steels. The formation of these cracks directly relates to the amount of delta ferrite present at the end of the welding process. The Type 309L weld wire used for welding the specimens came from heat number 05766 and was manufactured by Teledyne McKay. A preliminary evaluation indicated the possibility that this wire could be defective.

Engineering Evaluation:

Weld specimens were prepared at the Plant Vogtle site which accurately represented the welder performance qualification specimens which had failed. A full metallurgical laboratory evaluation of these specimens was conducted by Bechtel Power Corporation (BPC). A report was issued covering the results of this evaluation, "Hot Cracking of 309L Weld Metal, Bechtel Technical Report No. 0783-08-FA," dated July 1983.

As a result of this investigation, it was concluded that the hot cracking of the welder performance qualification test specimens was caused by the following factors:

- (1) The chemical composition of the base materials and the support heat of Type 309L weld wire used to prepare the specimens were within specification limits. However, the as-deposited weld metal exhibited a combined content of phosphorus and sulfur (P/S) which was toward the high end of the specification limits. Heat 05766 of the Type 309L weld wire was found to be acceptable, within specification requirements, and without deficiencies.
- (2) The ferrite content of the as-received weld wire was within specification requirements; but the as-deposited weld metal in some specimens exhibited a low delta ferrite content.
- (3) It is postulated that welder technique, including wide weave passes and high interpass temperature, resulted in high heat input during welding.

All of the above contributed to the hot cracking in the dissimilar metal welds with welder technique being the most significant factor. The interrelationship between two of the three factors above, the combined P/S content and the ferrite content, has a direct effect on the propensity toward hot cracking of the as-deposited weld metal. A high P/S content and/or a low ferrite content in the as-deposited weld metal increases the probability of hot cracking. However, this result is not assured. Other factors such as the level of weld joint restraint may also serve as a minor contributing factor.

Welder technique may exacerbate the relationship between the first two items because of its potential effect on both P/S content and delta ferrite content of the as-deposited weld metal. The properties of the weld wire may be well within specification limits; but if, as postulated in this instance, the welder technique is such that insufficient weld wire is deposited in the joint and/or excess melting of the base materials occurs, then the result may be excessive weld metal dilution. Excessive weld metal dilution usually results in a higher combined content of P/S and a lower delta ferrite content in the weld metal, when compared to the weld wire composition. Either of these effects increases the propensity toward hot cracking in the as-deposited weld metal. The welding technique required by the welding procedure of record was found to be unsatisfactory. A revision of the welding procedure has been requested of the responsible supplier, Pullman Power Products (PPP). The welding procedure revision will reduce the heat input by restricting welder weaving during a weld pass. It should be noted that the procedures used by Pullman Power Products were considered unsatisfactory, not deficient. As noted below, none of the production welds were found to have hot cracks. An unusual set of conditions is necessary for these hot cracks to appear. The new procedures will control some of these conditions and will make it more difficult for hot cracks to form. Laboratory weldability studies confirm that the requested revisions will eliminate the potential for hot cracking in the as-deposited weld metal in welds completed with heat 05766 Type 309L weld wire.

Dissimilar metal welds in safety-related systems at the Vogtle Electric Generating Plant are also required to pass an NDE inspection. This inspection should ensure the detection and repair of any unacceptable welds. At the construction site, radiographic film for the production welds for dissimilar metal welds was reviewed. None of the welds contained defects attributable to the hot cracking problem.

Conclusion:

In summary, the weld wire manufactured by Teledyne McKay met the specifications; therefore weld wire is not considered to be defective. The welding procedures used by Pullman Power, while unsatisfactory, are not deficient or defective. The production welds at the construction site have been reviewed and there are no defects attributable to the hot cracking problem. Therefore it has been concluded that a substantial safety hazard and/or a significant deficiency does not exist.

Corrective Action:

All applicable PPP welding procedures will be reviewed by Bechtel Power Corporation for appropriate modifications to minimize the potential for high heat input and excessive weld metal dilution during GTAW welding of P1 carbon steel to P8 stainless steel using type 309L weld wire.