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HL-1572
001433

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

PLANT HATCH - UNIT 1
NRC DOCKET 50-321
OPERATING LICENSE DPR-57
UNIT 1 IGSCC WELD REPAIRS

Gentlemen:

On January 22, 1991, Georgia Power Company (GPC) received an NRC Safety Evaluation Report (SER) on our inspections and repairs performed during the Spring 1990 Unit 1 refueling/maintenance outage. The SER concluded that the work met the guidelines of Generic Letter (GL) 88-01, with the exception of those weld overlay repairs that had a low ferrite content in the first layer. The SER requested GPC evaluate these affected overlay repairs and, if necessary, upgrade them during the next refueling/maintenance outage.

The weld overlay repairs were designed for GPC by Structural Integrity Associates (SIA). GPC's submittal, dated June 29, 1990, to the NRC contained the SIA report, "Flaw Evaluation and Weld Overlay Designs for Plant E. I. Hatch Unit 1 Spring 1990 Refueling Outage." GPC has retained the services of SIA to evaluate the affected weld repairs, and has determined the subject welds do not require any further upgrading to qualify as full structural or standard weld overlays. Details of this evaluation are contained in the enclosure.

If you have questions regarding this matter, please contact our office any time.

Sincerely,

J. T. Beckham, Jr.

GKM/cr
001433

Enclosure: Evaluation of Low Delta Ferrite in First Layers of Weld Overlays on the Hatch Unit 1 Recircualtion System

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cc: Georgia Power Company
Mr. H. L. Sumner, General Manager - Nuclear Plant
Mr. J. D. Heidt, Manager Engineering and Licensing - Hatch
NORMS

U.S. Nuclear Regulatory Commission, Washington, D.C.
Mr. K. Jabbour, Licensing Project Manager - Hatch

U.S. Nuclear Regulatory Commission, Region II
Mr. S. D. Ebneter, Regional Administrator
Mr. L. D. Wert, Senior Resident Inspector - Hatch

ENCLOSURE

PLANT HATCH - UNIT 1
NRC DOCKET 50-321
OPERATING LICENSE DRP-57
EVALUATION OF LOW DELTA FERRITE IN FIRST LAYERS
OF WELD OVERLAYS ON THE HATCH UNIT 1 RECIRCULATION SYSTEM

On January 22, 1991, the NRC issued their NRC Safety Evaluation Report (SER) on GPC's intergranular stress corrosion cracking (IGSCC) inspections and repairs performed during the Spring 1990 Unit 1 refueling/maintenance outage (Reference 1). The SER concluded the work met the guidelines of Generic Letter (GL) 88-01, with the exception of the weld overlay repairs that had a low ferrite content in the first layer. The SER requested GPC evaluate these affected overlay repairs and, if necessary, upgrade them during the next refueling/maintenance outage. The NRC's principal concern appears to be the potential for reduced IGSCC resistance of the first layer in the affected welds due to dilution of the weld metal with the higher carbon base metal.

Structural Integrity Associates (SIA) reviewed the delta ferrite data provided by GPC during the 1990 outage and determined three welds are potentially affected by the low delta ferrite (ferrite number [FN]) concern. The three welds with delta ferrite readings in the first layer lower than 7.5 FN are 28A7, 28A14, and 28B14. These welds are included in Table 1 with the reported first layer delta ferrite readings, the average of the eight readings, the design overlay thickness, the first layer thickness, the as-built thickness, and the underlying carbon content of the base metal, where available. The first layer delta ferrite contents of the remainder of the welds which received weld overlay repairs during the 1990 outage are also presented for completeness. Each of the welds with low first layer delta ferrite readings is discussed below.

Weld 28A7 contains three of eight readings below 7.5 (6.0, 7.3, 7.3). The other five readings are sufficiently high that the average of all eight readings is 8.4. The as-built weld overlay repair is of sufficient thickness (0.75") that the design thickness (0.49") is met without requiring credit for the first layer thickness (0.15").

The first layer delta ferrite data for weld 28A14 shows two of eight readings less than 7.5 (both are 7.3). The average delta ferrite considering all eight readings in this weld is 7.8. The as-built thickness is not sufficient to "discard" the first layer in meeting the design thickness (design: 0.52", as-built: 0.595", first layer: 0.17").

The data for the first weld overlay layer for weld 28B14 contain three of eight readings less than 7.5 (all three readings are 7.0). The average delta ferrite, considering all eight readings, is 8.3. The first layer thickness was not reported, but we assume that the first layer thickness cannot be discarded from the as-built thickness in meeting the required design thickness (design: 0.52", as-built: 0.6").

EVALUATION OF LOW DELTA FERRITE IN FIRST LAYERS
OF WELD OVERLAYS ON THE HATCH UNIT 1 RECIRCULATION SYSTEM

The highest carbon level in the underlying base metal at each of these overlay locations is reported as 0.059% in the certified material test reports (CMTRs). The weld metal has a reported carbon level of 0.019%. A dilution rate for the first welded layer by the base metal was determined by physical examination and chemical analysis of the diluted first layer of welded coupons made using the same procedures as were used in weld overlay application. Using this dilution rate, the first layer of applied weld overlays was calculated to contain a carbon content of approximately 0.032%. Such a carbon level meets the NUREG-0313 criterion for IGSCC-resistant austenitic stainless steel base metal, even if no ferrite is present.

SIA has concluded, and GPC concurs, that the low individual delta ferrite readings on the three weld overlay repairs discussed above are not a concern with regard to the acceptability and IGSCC resistance of the first welded layer. This conclusion is based upon the above arguments which are summarized below:

1. The low readings are not extremely low (one reading of 6, three readings of 7.0, and four readings of 7.3).

2. The average delta ferrite is greater than 7.5 in the first layer of all three weld repairs.

3. The underlying base material is not extremely high in carbon content (0.059%).

4. The calculated carbon content in the diluted first weld material is 0.032%, based upon chemical analysis of a mock-up weld prepared using the same weld parameters as were used in the overlay application. A carbon content of 0.032% is sufficiently low to qualify base metal as IGSCC resistant in accordance with NUREG-0313, independent of delta ferrite content. For the 0.032% carbon content, the weld material is predicted to be IGSCC resistant (as shown in Figure 1 from Reference 2), even with 6 FN delta ferrite, which is the lowest reported single reading from any of the measurements in Table 1.

5. There is some surplus material over minimum required design thickness in each repair, although only in one case is this sufficient to permit discarding of the entire first layer.

6. The as-welded first layers are fairly thick (0.15" or greater). Consequently, dilution effects are not expected to be significant, as noted in the physical examination of the mock-up first layer.

EVALUATION OF LOW DELTA FERRITE IN FIRST LAYERS
OF WELD OVERLAYS ON THE HATCH UNIT 1 RECIRCULATION SYSTEM

Therefore, GPC believes that the weld overlays in question are acceptable and do not require any further upgrading to qualify as NUREG-0313 standard weld overlays.

References:

1. Letter from Kahtan Jabbour (NRC) to W. G. Hairston III, (GPC), "Edwin I. Hatch Nuclear Plant, Unit 1, Safety Evaluation of Intergranular Stress Corrosion Cracking Inspection and Repairs", dated January 22, 1991.

2. ASTM Special Technical Publication 756 "Stainless Steel Castings", November, 1980.

Table 1
Summary of 1990 First Layer Delta Ferrite Data

Weld	Delta Ferrite Readings (8)	Average	Design (in.)	As-built (in.)	1st Layer (in.)	Base (%)
28A2	9.8, 9.8, 10.2, 10.1,	10.1	0.46	0.5		.055
	10.1, 11.5, 10.5, 9.0					
28A4	12.4, 10.9, 12.4, 11.1	11.3	0.45	0.48		.059
	11.5, 11, 10.9, 9.8					
28A6	13.6, 12.4, 12.4, 11.8	11.4	0.44	0.54		.059
	9.8, 9.8, 10.1, 11.0					
28A7	6, 7.3, 8.5, 7.3,	8.4	0.49	0.75	0.15	.059
	8.8, 9.8, 7.5, 11.8					
28A8	10, 9.5, 9, 9.5	9.1	0.43	0.465		.055
	9.25, 8.5, 8.5, 8.5					
28A14	7.3, 8.3, 7.9, 7.5	7.8	0.52	0.595	0.17	.059
	7.5, 8.5, 7.9, 7.3					
28B8	12.8, 12, 11, 11,	11.9	0.44	0.57		.059
	11.8, 11.8, 12, 12.4					
28B9	8.4, 9.5, 9.5, 9.0,	9.3	0.44	0.545		.055
	9.0, 11.0, 9.0, 8.9					
28B10	12.4, 9.2, 11.8, 14.3	11.6	0.44	0.48		.069
	11.5, 10.5, 9.8, 13.4					
28B13	9.5,8.5,10.4,9.8	10.3	0.52	0.59		.058
	9.9, 9.5, 12.1, 12.3					
28B14	9.6, 9.2, 10.2, 8.5	8.3	0.52	0.6		.059
	8.0, 7.0, 7.0, 7.0					
28B15	7.9, 8.5, 11, 8.5	8.9	0.52	0.62		.059
	8.5, 9.2, 8.5, 9.2					