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NED-84-131

March 13, 1984

Director of Nuclear Reactor Regulation
Attention: Mr. John F. Stolz, Chief
Operating Reactors Branch No. 4
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

NRC DOCKET 50-366
OPERATING LICENSE, NPF-5
EDWIN I. HATCH NUCLEAR PLANT UNIT 2
VENT HEADER CRACK

Gentlemen:

On February 6, 1984, representatives of Georgia Power Company (GPC), the BWR Regulatory Response Group, and General Electric Company (GE) met with the NRC staff to discuss the cracked vent header at Plant Hatch Unit 2, which was discovered on February 3, 1984. At that meeting, GPC officials discussed a most probable cause of the cracking and stated that further metallurgical tests and evaluations would be conducted. Accordingly, GE has provided us a report (attached hereto) on the metallographic examination of metal samples taken from the cracked vent header.

We conclude that the vent header cracking was a brittle fracture, caused at cryogenic temperature, resulting from the injection of cold nitrogen into the torus and impingement on the vent header.

Please let us know if you require additional information.

Very truly yours,

L. T. Gucwa

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Enclosure

xc: J. T. Beckham, Jr.
H. C. Nix, Jr.
J. P. O'Reilly (NRC- Region II)
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NUCLEAR ENERGY ENGINEERING DIVISION
GENERAL ELECTRIC COMPANY • 175 CURTNER AVENUE • SAN JOSE, CALIFORNIA 95125

February 24, 1984

T.V. Greene, Deputy General Manager
Edwin I. Hatch Nuclear Plant
Georgia Power Company
P.O. Box 439
Baxley, Georgia 31513

SUBJECT: Status Report: Metallographic Examination of Metal Samples
of Vent Header Hatch-2

REFERENCE: Status Report: Letter Delwiche to Greene, Feb. 10, 1984.

This letter is a summary report of the materials testing performed to date at GE - Vallecitos Nuclear Center on samples removed from the cracked regions of the Hatch-2 Torus Vent header.

Work Plan

The work plan that GE is following is outlined in **Figure 1**. The plan consists of three tasks; materials verification testing, fracture mechanics evaluation, and failure analyses. The goal of the test program is the identification of the cause of failure.

Summary of Previously Reported Information

Scanning Electron Microscope (SEM) examination of the vent header sample transmitted to GE on February 6, 1984 has shown the cracking of The Plant Hatch Unit 2 torus vent header was caused by a "quasi-cleavage" brittle fracture. The fracture surface is characteristic of a single loading event fracture at a temperature below the Nil ductility transition temperature of the A516 gr 70 material. Recently performed tests continue to support these early conclusions.

Status - Material Verification

The material specified for the vent header was ASTM-A516 Grade 70, with the following requirements:

<u>Chemistry</u>	o .27 max carbon
	o .85/1.20 manganese
	o .035 max phosphorus
	o .04 max sulfur
	o .15/.30 silicon

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Mech. Properties Tensile 70/90 ksi
Yeild. min 38 ksi

The test certification chemistry and mech. properties values for the heat of material used in the vent header are tabulated below. For the purpose of comparison the independent laboratory* verification of the chemistry and mechanical property values is also listed in the table.

	<u>U.S.S Corp Test CERT</u>	<u>Anamet Verification</u>
<u>Chemistry</u>	0.23 carbon	0.26 carbon
	1.11 manganese	1.07 manganese
	.005 phosphorus	.010 phosphorus
	.022 sulfur	.023 sulfur
	.22 silicon	.21 silicon

Mech. Properties

Tensile 81.3 ksi	Tensile 77.4 ksi
Yield 60.8 ksi	Yield 53.2 ksi
% Elongation 22.0	% Elongation 29.7

Charpy V-notch impact toughness values were determined for the material per ASTM E-23 on subsize (5 X 10 X 55 mm) specimens over a range of temperatures from +40°F to -80°F. The Nil ductility transition temperature was found to be approximately -50°F.

- * Anamet Laboratories - Berkeley California
Chemistry was determined by the emission spec. method, except for carbon which was determined by a LECO combustion method.

The microstructure and grain size was normal for this material and as expected for a fine grain material normalized at 1616°F as stated on the test certification.

These data verify, (A) That the material used in the Hatch-2 Torus Vent header meets the requirements of the ASTM-A516 gr. 70 specification, and (B) That the material is as identified in the U.S.S. Corp. Test certification.

Status - Failure Examination

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Initiation

Macroscopic examination of the fracture surfaces and observation of the geometric features associated with the suspected point of fracture initiation suggest initiation occurred at the 12 O'clock (Top Center) position of the pipe on the inner surface of the pipe at the notch-like discontinuity of the fusion line of the butt weld.

Cause of Fracture

Optical metallographic examination of three fracture samples has shown the vent pipe failure to be due to **transcrystalline brittle fracture** characteristic of crack propagation at temperatures below the NDT temperature (ie. -60°F). The fracture occurred along a single microplane, without plastic deformation. "Micro-branching", fatigue striations, and other features characteristic of a possible cyclic mechanism were not found.

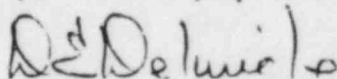
SEM Fractography

Some delay has been experienced in the completion of The Scanning Electron Microscope study due to a malfunction of the machine. As an alternate course of action replicas are being prepared of the fracture faces for study on an alternate machine an uncontrolled (radiation protection) area. Completion expected by Tuesday Feb. 28th.

Conclusion

Materials Testing on the Hatch Unit 2 Torus Vent header material has shown that the cracking was due to a brittle fracture as can be caused at cryogenic temperatures resulting from cold nitrogen injection into the torus and impingement on the vent header. The properties of the header material has been found to be normal and within specification of ASTM-A516 gr 70.

If you have any questions, please contact me.



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cc: S. Koski
Plant Hatch

/cea

FIGURE 1 - WORK PLAN

