



Carolina Power & Light Company

SERIAL: LAP-83-351

July 28, 1983

Mr. Darrell G. Eisenhut, Director
Division of Licensing
United States Nuclear Regulatory Commission
Washington, DC 20555

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-324
LICENSE NO. DPR-62
RESPONSE TO REQUEST FOR INFORMATION
INSPECTIONS OF BWR STAINLESS STEEL PIPING

Dear Mr. Eisenhut:

By letter dated July 21, 1983, you requested that Carolina Power & Light Company (CP&L) provide additional information concerning the issue of intergranular stress corrosion cracking (IGSCC) in stainless steel piping as it applies to the Brunswick Steam Electric Plant (BSEP) Unit No. 2. In response to this request, CP&L is providing the enclosed responses to the six items discussed in your above referenced letter. Carolina Power & Light Company believes that the results of the inspections performed to date at the Brunswick Plant support the continued operation of Brunswick-2 until the planned fall maintenance outage presently scheduled to begin in November 1983.

If you have any questions concerning the enclosed responses, please contact our staff.

Yours very truly,

P. W. Howe
Vice President
Brunswick Nuclear Project

CEH/tda (7535CEH)
Enclosure

P. W. Howe, having been first duly sworn, did depose and say that the information contained herein is true and correct to his own personal knowledge or based upon information and belief.

Marsha N. Stone
Notary (Seal)

My commission expires: 3-22-87

cc: Mr. D. O. Myers (NRC-BSEP)
Mr. J. P. O'Reilly (NRC-RII)
Mr. S. D. MacKay (NRC)

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bcc: Mr. D. L. Bensinger
Mr. E. A. Bishop (BSEP)
Mr. J. R. Bohannon
Mr. J. S. Boone (BSEP)
Mr. C. Carmichael (2)
Mr. G. S. Cashell
Mr. N. J. Chiangi
Mr. R. M. Coats
Mr. F. R. Coburn
Mr. A. B. Cutter
Mr. J. S. Dietrich
Mr. C. R. Dietz (BSEP)
Dr. T. S. Elleman
Mr. K. E. Enzor (BSEP)

Mr. S. F. Flynn
Mr. R. E. Helme (BSEP)
Mr. P. W. Howe (BSEP)
Mr. W. J. Hurford
Dr. J. D. E. Jeffries
Mr. I. A. Johnson
Mr. R. L. Mayton, Jr.
Mr. S. McManus
Mr. C. H. Moseley, Jr.
Mr. J. C. Plunkett (LIS)
Mr. J. J. Sheppard
Mr. J. Titrington (BSEP)
File: BC/A-4
File: B-X-0273

ENCLOSURE

CP&L RESPONSE TO JULY 21, 1983 NRC REQUEST FOR ADDITIONAL INFORMATION
INSPECTIONS OF BWR STAINLESS STEEL PIPING

In response to the request made on July 21, 1983 Carolina Power & Light Company (CP&L) submits the following information. Item numbers below correspond to the requests in the above referenced letter.

1. A justification for continued operation was submitted on July 15, 1983 which addressed the operation of Unit 2 until the next scheduled outage. A copy of the justification is enclosed (Attachment 2).
2. As stated in the justification for continued operation, twelve recirculation system welds were inspected on February 7 and 8, 1983. The inspections were performed by Lambert, McGill, and Thomas (LMT) under the direction of a level III inspector who had been qualified at Battelle. The technique used at Brunswick was the same used to qualify the inspector at Battelle. The technique utilized a 1.5 MHz dual element transducer master/slave system. These welds are listed in Attachment 1. The welds examined had a high susceptibility to IGSCC compared to others in the system. No indications were found. Additionally, a leak test was performed on the jet pump inlet riser piping.

It is our judgement that IGSCC in BWR piping, while undesirable from a plant reliability standpoint, does not represent a significant hazard to public health and safety. This conclusion is based on the exceptional toughness and ductility of austenitic stainless steel, and the distinct tendency for cracks which develop in this material to develop into small, detectable leaks before any significant reduction in the structural integrity of the piping occurs (leak-before-break). Numerous studies and investigations by EPRI, General Electric, the BWR Owners' Group, and the NRC support this conclusion.

3. Our current surveillance measures for monitoring drywell leakage exceed our existing Technical Specification requirements. The drywell sumps are monitored every 4 hours, and the unit will be shut down if an increase in unidentified leakage exceeds 2 gallons per minute (gpm) for a 24 hour period. A channel check of the primary containment atmospheric particulate activity monitoring system is performed every shift (8 hours) to verify operability; the frequency given in the Technical Specifications is once per 12 hours. Should the primary containment atmospheric particulate activity monitoring system become inoperable, grab samples of the containment atmosphere are obtained at least once per 8 hours.
4. The next Brunswick-2 refueling outage is presently scheduled for January 1985; however, the inspections required by Attachment A of your July 21, 1983 letter will be performed during an extended maintenance and modification outage that is scheduled to begin on approximately November 1, 1983. There are no Brunswick-2 outages scheduled between now and November 1983. If the inspections are performed during the scheduled outage, the costs are estimated at a

minimum of \$160,000 and the exposure is estimated to be at least 55 man-rem. These inspections will not be critical path and will have little impact on other outage activities.

5. a. If the inspections are performed within 30 days of August 15, 1983, it will require a 10 day outage, assuming that sufficient UT personnel are available to staff the work on a critical path basis. The direct costs are estimated at \$200,000 and the exposure is estimated to be at least 70 man-rem. Replacement power costs are estimated to be \$2,342,640 and the system power reserves during this period would decrease from an average of 2072 MW to an average of 1282 MW. Having an outage in September 1983 will severely impact our preparation for the major outage in November 1983. Resources would be diverted from the engineering, maintenance, QA, and health physics groups that would otherwise be preparing for the outage.
 - b. The effect of performing the inspections within 60 days of August 15, 1983, would be to start the major outage at that time because it would be impractical to have a 10 day outage and start a major outage only 7 days later. The start date of the major outage is based on the earliest possible time that preparation will be complete; therefore, an earlier start will result in virtually a day for day extension in the outage length. The replacement power costs are estimated to be \$3,419,600 and the system power reserves during this period would decrease from an average of 2312 MW to an average of 1522 MW. This schedule would have the severe adverse effect of beginning a major outage before preparations are complete.
 - c. Ninety days from August 15, 1983, is past the scheduled date for beginning the next Brunswick-2 outage; thus, the cost and impact is as described in Item 4 above.
6. Based on discussions with the organization that we will use to perform these inspections, there will be considerable difficulty in obtaining enough qualified personnel within 30 days of August 15, 1983, especially since the number of inspectors needed for the short outage is double that needed if the work is not critical path. Because only a few of the available personnel have qualified to IE Bulletin 83-02 as supplemented by Attachment A to the July 21, 1983 request, approximately 20 inspectors must successfully pass the demonstration test on short notice. The problem is further aggravated by the fact that most of the available personnel have already received a cumulative exposure of 2 rem or more. Because our corporate annual limit is 5 rem with a 20 percent buffer, even more personnel are needed to support a short outage.

If the inspections are done during the November 1983 outage, more time is available to qualify the inspectors, and fewer inspectors will be needed.

(7532JSDccc)

ATTACHMENT 1

LIST OF WELDS INSPECTED ON BRUNSWICK UNIT 2

<u>Weld No.</u>	<u>Description</u>
2-B32-12"-A-4	Pipe to Safe End
2-B32-12"-B-4	Pipe to Safe End
2-B32-12"-C-4	Pipe to Safe End
2-B32-12"-E-4	Pipe to Safe End
2-B32-12"-F-4	Pipe to Safe End
2-B32-12"-G-4	Pipe to Safe End
2-B32-12"-H-4	Pipe to Safe End
2-B32-12"-K-4	Pipe to Safe End
2-B32-4"-A-1	Discharge Valve Bypass
2-B32-4"-A-10	Discharge Valve Bypass
2-B32-4"-B-1	Discharge Valve Bypass
2-B32-4"-B-10	Discharge Valve Bypass

ATTACHMENT 2

RECIRCULATION SYSTEM STRESS CORROSION CRACKING
JUSTIFICATION FOR CONTINUED OPERATION

submitted July 14, 1983

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CP&L

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Carolina Power & Light Company

SERIAL: LAP-83-319

July 14, 1983

Director of Nuclear Reactor Regulation
Attention: Mr. D. B. Vassallo, Chief
Operating Reactors Branch No. 2
Division of Licensing
United States Nuclear Regulatory Commission
Washington, DC 20555

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BRUNSWICK STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-324
LICENSE NO. DPR-62
IE BULLETIN NO. 83-02
RECIRCULATION SYSTEM STRESS CORROSION CRACKING
JUSTIFICATION FOR CONTINUED OPERATION

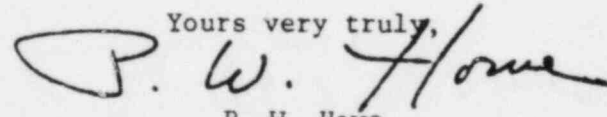
Dear Mr. Vassallo:

Carolina Power & Light Company (CP&L) received, by letter dated March 4, 1983, the NRC IE Bulletin No. 83-02, "Stress Corrosion Cracking in Large-Diameter Stainless Steel Recirculation System Piping at BWR Plants". This recent discovery of pipe cracking in BWR Recirculation System welds has raised questions concerning the safe continued operation of Brunswick Steam Electric Plant Unit No. 2 (Brunswick-2).

Brunswick-2 is presently scheduled to shutdown for an extended maintenance outage in November 1983. The ultrasonic testing inspection and a system leak test performed on Brunswick-2 in February 1983 and the relatively minor findings on Brunswick-1 indicate that there is no immediate concern on Brunswick-2 which justifies an immediate shutdown. Therefore, CP&L believes that the continued operation of Brunswick-2 until the November 1983 maintenance outage is justified. Enclosed is a discussion of the basis for CP&L's conclusions.

If you have any questions concerning this submittal, please contact our staff.

Yours very truly,



P. W. Howe
Vice President
Brunswick Nuclear Project

WRM/pgp (7421WRM)
Enclosure

cc: Mr. D. O. Myers (NRC-BSEP)
Mr. J. P. O'Reilly (NRC-R1I)
Mr. S. D. MacKay (NRC)

JUL 18 1983

BSEP

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Mr. J. C. Plunkett (LIS)
Mr. J. J. Sheppard
File: BC/A-4
File: B-X-0273

RECIRCULATION SYSTEM STRESS CORROSION CRACKING
JUSTIFICATION FOR CONTINUED OPERATION
BRUNSWICK STEAM ELECTRIC PLANT, UNIT NO. 2

The recent discovery of extensive pipe cracking in BWR Reactor Recirculation System welds has raised questions regarding the safety of continued operation of BSEP Unit No. 2. However, Ultrasonic Testing (UT) inspection and a system leak test performed in February 1983 and the relatively minor findings in Unit No. 1 indicate there is no immediate concern on Unit No. 2 that justifies an immediate shutdown. Additionally, the proposed inspection requirements have been partially fulfilled on Unit No. 2 using approved methods.

A total of 12 joints in the Unit No. 2 Reactor Recirculation System were inspected by UT in February 1983. These inspections were done with methods conforming to IEB 83-02. Eight jet pump inlet riser to safe-end welds and four 4-inch bypass line welds were inspected. Recent and historical industry experience and the results of Unit No. 1 inspections indicate that the joints examined have a high probability of cracking before other joints. All of the 12-inch joints had a carbon content of 0.075%; no weld in the system has a higher content. The 4-inch joints had a carbon content of 0.071%. The welds examined include the joint with the highest carbon content and highest Stress Rule Index (SRI) in the system. Of the twelve welds examined, ten have SRIs greater than 1.2 and three have SRIs greater than 1.5.

In addition to the UT inspections, a leak test was also performed in February on Unit No. 2. During this test, liquid penetrant developer was applied to all 12-inch joints (40) to ensure that even minute cracks characteristic of Intergranular Stress Corrosion Cracking (IGSCC) would be detected. During this test, the recirculation pump was running to pressurize the 12-inch piping.

The Unit No. 1 examinations, which were completed in January, revealed a relatively minor extent of cracking compared to other plants. A total of 36 welds were inspected, and the sample was in compliance with IEB 83-02. Two very short, tight through-wall cracks were found on 12-inch lines, and two short axial cracks, 11% and 5% of the wall thickness, were found on one of the 28-inch pump discharge line welds. Cracks of this type are not a significant safety concern because they do not reduce the section properties of the pipe, and they are certain to leak before they grow to any size of concern.

The Brunswick units have two design features that reduce susceptibility to IGSCC. The Residual Heat Removal System piping is carbon steel (except for a short section where the suction line connects to the Recirculation System), and thus is not susceptible to IGSCC. Also, the Reactor Recirculation System discharge manifold end caps are deeper than those at other plants, resulting in lower residual stresses. Neither the Recirculation System nor the Residual Heat Removal System has a history of vibration.

In conclusion, there is no immediate need to perform inspections on Unit No. 2 recirculation piping. The most susceptible welds were inspected in February 1983 using the best available techniques, and a leak test done at that time verified their integrity. Extensive inspections performed on Unit No. 1 revealed relatively minor cracking. Finally, a large body of analytical and experimental work and industry experience support that intergranular stress corrosion cracks will grow to through wall and leak before affecting structural load carrying capability of the piping.