



Carolina Power & Light Company

SERIAL: LAP-83-371

AUG 12 1983

Mr. Harold R. Denton, Director  
Office of Nuclear Reactor Regulation  
United States Nuclear Regulatory Commission  
Washington, DC 20555

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NOS. 1 AND 2  
DOCKET NOS. 50-325 AND 50-324  
LICENSE NOS. DPR-71 AND DPR-62  
STAFF MEETING ON BWR PIPE CRACKS

Dear Mr. Denton:

On behalf of Carolina Power & Light Company (CP&L), I would like to express our appreciation for the opportunity to present our case on the BWR pipe crack issue to members of your staff at a meeting on August 8, 1983. Copies of the slides presented at that meeting are attached for your information, as well as the requested data on the water chemistry history and leak detection instrumentation sensitivity for Brunswick Units 1 and 2. Supplementary information is also provided in regard to operator training, testing to be conducted during unscheduled shutdowns, and corrective action to be taken if IGSCC indications are detected. Additionally, commitments are provided which limits the inoperability of the sump flow integrator to no more than 72 hours as well as provided for daily monitoring of the leakage calculations by the on site nuclear review group.

We wish to reiterate that based on all inspections made to date on the Brunswick units, the relative age of the plants, and industry experience and research on the generation and growth of intergranular stress corrosion cracks, it is CP&L's position that acceleration of the inspections now scheduled for November 1983 is not justified. Whereas the recent EPRI test results do point out the need for continued training of UT inspectors in crack depth sizing techniques, CP&L has not based any of its actions to date on the ability to determine crack depth. Indeed, as previously presented to your staff, CP&L has and will continue to maintain a very conservative approach to detection and repair of these cracks.

Carolina Power & Light Company recognizes the need for continued detection, repair, and ultimate elimination of these cracks from BWR piping. Carolina Power & Light Company also recognizes the necessity for sound management practices and proper planning of plant activities. We will continue to review the present outage schedule in an effort to find alternative means of schedule acceleration; however, it remains our position that the disruption of outage preparation, direct and indirect cost increases to our customers, and potential increases in man-rem exposure that would result from an ordered, arbitrary change in the planned schedule at this late date are not justified.

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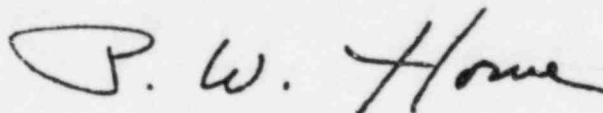
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Mr. H. R. Denton

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Carolina Power & Light Company welcomes any suggestions your staff might offer on this issue and trusts that a mutually acceptable solution can be found. Please do not hesitate to contact our staff should you have any questions.

Yours very truly,

A handwritten signature in dark ink, appearing to read "P. W. Howe". The signature is fluid and cursive, with the first letters of each name being capitalized and prominent.

P. W. Howe  
Vice President  
Brunswick Nuclear Project

JSD/mf (7640JSD)

Attachment

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

Attachment 1 to LAP-83-371

### Inspections Prior to the Scheduled Outage

CP&L commits to following action plan to perform inspections of large diameter recirculation pipe welds during unscheduled outages on Brunswick Unit No. 2.

Should an unscheduled outage occur, the duration will be estimated based on the cause of the shutdown; if this duration is ten days or longer, the following recirculation welds will be ultrasonic inspected:

<u>Weld No.</u>	<u>SRI</u>	<u>Carbon Content</u>	<u>Susceptibility Rank</u>
2-B32-28-A-3	1.46	0.059	1
2-B32-28-A-14	1.51	0.059	1
2-B32-28-A-15	1.42	0.059	1

If the initial outage duration is estimated to be less than ten days, but is subsequently extended, the inspections will be performed if at any time the estimated remaining duration is ten days or longer.

Spool replacement or overlay repairs will be performed on joints that are found to contain:

1. Unresolved circumferential indications with a length such that for a through-wall crack of that length, the combination of  $P_m$  and  $P_b$  for the crack cross section exceeds  $1.5 S_m$ , or
2. Through-wall cracks.

Axial cracks are not a safety concern regardless of depth because the section properties of the pipe are not affected. The criteria for circumferential cracks ensures that structural margin is maintained based on conservative assumptions regarding crack depth.

If any of the joints inspected requires repair by the criteria stated above, an additional three large diameter ( $\geq 12"$ ) weld joints will be inspected. If any joints in the second group require repair, an additional three joints will be inspected.

The inspection personnel will be qualified to the requirements of IEB 83-02 as amended by the letter of July 21, 1983. The inspection described in this plan will be performed only if qualified personnel with sufficient allowable radiation exposure are available from LMT or Southwest Research Institute.

### Leak Detection Sensitivity and Operability

The Primary Containment Sump Flow Integrating System measures the unidentified leakage to within 0.5 gpm for an eight-hour period. The current operability requirement is that any one leak detection system may be inoperable for up to 31 days. The three systems are: the Sump Flow Integrating System, the Primary Containment Atmosphere Particulate Radioactivity Monitoring System, and the Primary Containment Gaseous Radioactivity Monitoring System.

We will institute an administrative limit of three days for the Sump Flow Integrating System to be inoperable, after which the unit will be placed in at least hot shutdown within 12 hours and in cold shutdown within the following 24 hours. This limit will apply only to Unit No. 2 until the inspections required by IEB 83-02 are complete. As stated in previous submittals, we have already established a limit on the increase in unidentified leakage in the drywell of 2 gpm for a 24-hour period.

The On-Site Nuclear Safety group will review the Unit No. 2 drywell leakage data on a daily basis until the inspections required by IEB 83-02 are complete.

### Water Chemistry History

The total hours that the water chemistry exceeded technical specification limits since 1978 are tabulated below for each unit.

Total Hours Above Technical Specification Chemistry Limits

<u>Year</u>	<u>Unit No. 1</u>	<u>Unit No. 2</u>
1976	---	35.7
1977	68.3	28.7
1978	309	251
1979	124	242
1980	183	183
1981	14.5	241
1982	35.0	59.0
1983	13.1	2.0

### Operator Training

A discussion of IGSCC causes and effects, and a review of small break and large break LOCA emergency instructions have been included in the weekly shift briefings of Operations personnel excluding Fire Protection and Radwaste personnel. These briefings will also include appropriate current developments in this area.

Attachment 2 to LAP-83-371

## OUTLINE

I. CONCLUSIONS

II. INSPECTION RESULTS

III. BASES FOR CONCLUSIONS

IV. IMPACT

V. AVAILABILITY OF INSPECTION PERSONNEL

### CONCLUSIONS

- o Unit No. 2 inspections performed in February 1983, demonstrated low probability of IGSCC cracking
  - o Unit No. 1 inspection results support same conclusion
  - o Design features support lower susceptibility to IGSCC
  - o Sizing accuracy has no impact on BSEP
  - o Conclusions are based on detection, not sizing
  - o Three repairs made on Unit No. 1 conservatively overlaid
  - o Augmented leak detection surveillances implemented
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- o Continued operation of Unit No. 2 until November does not constitute a safety concern
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## SUMMARY OF UNIT NO. 2 INSPECTIONS

Inspection done February 7 and 8, 1983, prior to issuance of IEB 83-02; however, methods conform to Bulletin requirements. Level III inspector qualified at Battelle.

- o LMT used to perform UT inspections
  - o 1.5 MHz dual element transducer master/slave system
- o Eight 12" Jet pump inlet pipe to safe-end welds
  - o Highest carbon content and stress rule indices of system
  - o No indications
- o Four 4" Bypass line welds
  - o Small diameter; therefore, highly susceptible
  - o No indications
- o Leak test was performed to verify integrity of 12" lines (40 welds)
  - o Used LP developer to enhance technique
  - o Recirc pump run to pressurize piping

## SUMMARY OF UNIT NO. 1 INSPECTIONS

- o Inspection personnel complied with IEB 82-03
- o SWRI performed inspections, 1.5 MHz single-element transducer
- o Twenty 12" jet pump inlet pipe welds
  - o Two axial through-wall cracks found
- o Ten welds in piping 20" diameter or larger
  - o Sample included both end caps and all bimetallic welds (3)
  - o Two small axial indications 5% and 11% of wall thickness found on one 28" weld
  - o Sized using crack tip diffraction technique
- o Two Sweep-over to header welds adjacent to end caps
- o Four 4" bypass line welds
  - o No indications
- o No circumferential indications

**LIST OF WELDS INSPECTED ON  
BRUNSWICK UNIT 2 IN FEBRUARY 1983**

<u>WELD NO.</u>	<u>DESCRIPTION</u>	<u>SRI</u>	<u>C</u>
2-B32-12"-A-4	PIPE TO SAFE END	1.27	0.075
2-B32-12"-B-4	PIPE TO SAFE END	1.36	0.075
2-B32-12"-C-4	PIPE TO SAFE END	1.60	0.075
2-B32-12"-E-4	PIPE TO SAFE END	1.58	0.075
2-B32-12"-F-4	PIPE TO SAFE END	1.46	0.075
2-B32-12"-G-4	PIPE TO SAFE END	1.42	0.075
2-B32-12"-H-4	PIPE TO SAFE END	1.53	0.075
2-B32-12"-K-4	PIPE TO SAFE END	1.25	0.075
2-B32-4"-A-1	DISCHARGE VALVE BYPASS	1.22	0.071
2-B32-4"-A-10	DISCHARGE VALVE BYPASS	1.19	0.071
2-B32-4"-B-1	DISCHARGE VALVE BYPASS	1.22	0.071
2-B32-4"-B-10	DISCHARGE VALVE BYPASS	1.20	0.071

## BASES FOR CONCLUSIONS

### I. EVALUATION OF UNIT NO. 2 RESULTS

- o Personnel qualified at Battelle.
- o Welds inspected have high stress rule indices and carbon content, including highest in system.
- o Twelve welds UT inspected and 40 welds inspected with augmented visual technique represent significant sample size. No indications found.
- o The four 4-inch and eight 12-inch welds UT inspected are likely to experience cracking and leakage earlier than the larger piping.
- o Larger piping not inspected has larger margin of safety than smaller piping due to thicker wall.
- o Critical crack length is significantly longer for large pipes compared to crack length for leak detection.

## BASIS FOR CONCLUSIONS (Cont'd)

### II. EVALUATION OF UNIT NO. 1 RESULTS

- o Personnel qualified at Battelle.
- o Welds inspected have high stress rule indices and carbon content, including highest in system.
- o 36 welds UT inspected represent significant sample size. No circumferential cracks found. Three welds with axial indications. Only one large weld found with two shallow axial indications.
- o Sample included 3 bimetallic welds. No indications found in bimetallic welds.
- o Unit Nos. 1 and 2 designs are the same and installed by the same contractor and procedures.

## BASES FOR CONCLUSIONS (Cont'd)

### III. DESIGN FEATURES REDUCE SUSCEPTIBILITY TO CRACKING

- o RHR System is carbon steel
- o One short (2'1") connecting spool is SS
- o Three bimetallic welds
- o All 3 bimetallic welds inspected on  
Unit No. 1 - no indications
- o End caps have lower stress than other  
designs
- o Deep-dish design
- o No history of pipe vibration on recirc pipe  
or RHR
- o No indications found on Unit No. 1  
sweep-o-let welds

## BASES FOR CONCLUSIONS (Cont'd)

### IV. SIZING ERRORS DO NOT IMPACT BSEP

- o Conclusion that low probability of IGSCC cracking exists is based on lack of detection of cracking.
- o IIT personnel were qualified at Battelle on crack detection
- o Weld overlays were conservatively designed
- o Two through-wall axial leaks in 12" pipe have full thickness overlays.
- o 28" weld sized by LMT using crack tip diffraction. Indications estimated to be 5% and 11% deep and axial. The as-built minimum overlay thickness of 0.47" is adequate for a through-wall axial crack in the 28" pipe.

## BASES FOR CONCLUSION (Cont'd)

### V. AUGMENTED LEAK DETECTION SURVEILLANCES IMPLEMENTED

- o Increase in unidentified leakage limited to 2 gpm per 24 hours
- o Drywell sumps are monitored every 4 hours
- o Drywell atmospheric radiation monitor channel surveillance every 8 hours vs. 12 hours. In case of inoperability of monitor, grab samples are taken every 8 hours vs. every 24 hours.

### VI. LEAK-BEFORE-BREAK IS STILL VALID

- o Stable cracks will result in easily measurable leakage rates inside the containment long before factors of safety decrease to uncomfortable levels. Ample time is provided to assure safe plant shutdown.



## IMPACT

- o IMPACT ASSESSMENT BASED ON MINIMUM SCOPE AND NO REPAIRS
- o 30 DAYS FROM AUGUST 15
  - o \$200,000 DIRECT COSTS MINIMUM
  - o 70 MAN-REM MINIMUM
  - o \$2.3 MILLION REPLACEMENT POWER MINIMUM
  - o REDUCE RESERVES FROM 2072 MW to 1282 MW
  - o SEVERE DISRUPTION OF OUTAGE PREPARATION
- o 60 DAYS FROM AUGUST 15
  - o BEGIN MAJOR OUTAGE EARLY--17-DAY EXTENSION
  - o \$3.4 MILLION REPLACEMENT POWER
  - o REDUCE RESERVES FROM 2312 MW TO 1522 MW
  - o DISRUPTION OF OUTAGE DUE TO PREMATURE START
- o 90 DAYS FROM AUGUST 15
  - o \$160,000 DIRECT COSTS
  - o 55 MAN-REM
  - o NO INDIRECT COSTS
  - o FEWER PERSONNEL NEEDED

## AVAILABILITY OF INSPECTION PERSONNEL

- o Few available qualified at EPRI, as per latest requirement
- o Inspectors who could qualify have limited available exposure--4 Rem Corporate limit
- o Training inexperienced personnel is time-consuming, limited capacity
- o Extreme difficulty in obtaining trained personnel in 30 days. Inspection personnel available to support November outage date.