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March 23, 1983

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Ms. E. G. Adensam, Chief
Licensing Branch No. 4

Re: Catawba Nuclear Station
Docket Nos. 50-413 and 50-414

Dear Mr. Denton:

Ms. Elinor G. Adensam's letter of January 10, 1983 transmitted question 210.122 regarding the Catawba design documentation for a Class 2 and 3 piping system. A response to this question is attached.

Very truly yours,

Hal B. Tucker

Hal B. Tucker

ROS/php
Attachment

cc: (w/o attachment)
Mr. James P. O'Reilly, Regional Administrator
U. S. Nuclear Regulatory Commission
Region II
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30303

Mr. P. K. Van Doorn
NRC Resident Inspector
Catawba Nuclear Station

Mr. Robert Guild, Esq.
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2135½ Devine Street
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cc: (w/o attachment)
Mr. Jesse L. Riley
Carolina Environmental Study Group
854 Henley Place
Charlotte, North Carolina 28207

Mr. Henry A. Presler, Chairman
Charlotte-Mecklenburg Environmental Coalition
943 Henley Place
Charlotte, North Carolina 28207

210.122 (a) For branch connections with small (d/D), an i-factor of 1.0 has been used. This is acceptable provided a fillet radius, $r_2$, is specified and is present in the "as-built" branch connections. Has the fillet radius, $r_2$, been provided and, if not, how is i=1.0 justified?

Response: The branch connections with small (d/D) ratios identified above are constructed using either 3000 lb. or 6000 lb. half couplings and meet all ASME Code requirements presented in paragraph NC-3643.2 (b). The half couplings are joined to the run pipe in accordance with Figure NC-3643.2 b-1 and paragraph NC-4244 (b) for Category D full penetration corner welded joints. All connections are perpendicular to the run pipe.

The full penetration corner weld is capped with a transition fillet weld. The specified size (throat dimension) of this fillet weld meets the Code requirement for $t_c$ as shown in Figure NC-4244 (b)-1. No specific requirement for an $r_2$ radius to be ground at the fillet weld is specified.

Typically, the $r_2$ radius identified in Footnote 6e of Figure NC-3673.2 (b)-1 lies within the weld metal provided by the transition fillet weld. In these instances, grinding to meet the $r_2$ radius can reduce the remaining throat dimension below that required by the Code.

The "branch connection equation" from Figure NC-3673.2 (b)-1 of the Code was used to calculate i-factors for the above design configurations. Whenever this equation yielded an i-factor such that either i or .75i were less than 1.0 a value equal to 1.0 was assumed. Use of the "branch connection equation" is justified because the fillet weld specified provides adequate transition between the half coupling and run pipe in place of the $r_2$ radius requirement. All remaining requirements of Footnote 6, Figure NC-3673.2 (b)-1 are satisfied.

Use of a fillet weld in this capacity is a common practice. A condition similar to this is illustrated in the Code (Winter '81 Addenda) by Figure NC-3236.2 (a)-1 wherein a fillet weld is shown as a suitable alternative for the $r_2$ radius. Additionally, actual "as-built" conditions tend to further enhance the transition effect of the fillet weld. For instance, in most cases the actual fillet weld throat exceeds the minimum specified while the weld surfaces are generally concave in nature.

210.122 (b) The applicant uses a stress limit for Code Eq. (10) of 22500 psi. This limit is in accordance with the Code only if the stress reduction factor f=1.0. Provide the basis for using f=1.0.

Response: For ASME Class 2/3 piping, Duke has made the engineering judgment that 7000 full thermal cycles for the design life of Catawba Nuclear Station is conservative. The basis for making this judgment is that no ASME Class 2/3 system has been identified as anticipating more than 7000 full thermal cycles. 7000 cycles is the equivalent to approximately one cycle every other day (175/year) for 40 years.

Based on the judgment that the number of cycles will not exceed 7000 a f factor of 1.0 is used to calculate the Eq. 10 SA allowable for all ASME Class 2/3 piping analysis. If in the future a system is identified as anticipating greater than 7000 cycles, it will be evaluated with a modified f factor.

Problem RNE would have to average 3 full thermal cycles a day for 40 years before the stress allowable in equation 10 was exceeded and 7 full thermal cycles a day before the allowable in equation 11 was exceeded. With only a few exceptions all of the Class 2/3 piping analysis problems if evaluated against equation 11 would have a stress margin of greater than 20%. For those problems at least 1.5 full thermal cycles a day for 40 years would have to be averaged before the stress allowables of equation 11 were exceeded.

210.122 (c) Evidence has not been provided that the 21 tees used in the RNE piping system meet the pressure-design requirements given in the Code NC/ND-3640. Provide this evidence and indicate where this evidence is filed.

Response: The requirements of NC/ND 3643 for Catawba Nuclear Station are satisfied and documented by the following (included as attachments 1-3).

1. Appendic E (branch selection) of Spec. No. CNS-1206.00-02-1002 (Piping procurement spec). Reference calculations for Appendix E included as attachment 1.1 & 1.2.
2. Calculation Number CNC-1206.00-02-1001 (Verification of required half-coupling ratings for branch connections on Piping Drawings)
3. Calculation (Fabricated tee reinforcement verification for internal pressure) for each system requiring verification (RN calculation number is CNC-1206.00-02-1024)

Appendix E (Atta. 1) is the base specification to select branch connections for pressure reinforcement considerations. All branch connections not meeting Appendix E have been qualified by Atta. 2 & 3.

All calculations are on file in the Duke Power General Services Area

The following list addresses those branches reviewed on Problem RNE

NC 3640 QUALIFICATION FOR BRANCHES ON PROBLEM RNE (Catawba Unit 1)

| | SIZE | QUANTITY | TYPE | COMMENT | QUALIFIED BY |
|---|---|---|---|---|---|
| 1. | 20x20x20 | 1 | TEE | | ANSI B16.9 |
| 2. | 30x30x20 | 2 | RED TEE | | ANSI B16.9 |
| 3. | 30x30x18 | 2 | RED TEE | | ANSI B16.9 |
| 4. | 30x1/2 | 2 | 3000 # H/C | | CNC-1206.00-02-1001 |
| 5. | 20x1 | 1 | " | | " |
| 6. | 20x3/4 | 2 | " | | " |
| 7. | 20x1/2 | 1 | " | | " |
| 8. | 24x1 | 1 | " | | " |
| 9. | 24x1/2 | 1 | " | | " |
| 10. | 18x1 | 4 | " | | " |
| 11. | 18x1/2 | 4 | " | | " |
| 12. | 18x2 | 2 | 6000 # H/C | | Appendix E CNS-1206.00-02-1002 |
| 13. | 24x24x8 | 2 | REINF. FTEE | SCH 20 PAD BCH XS PAD Reqd | CNC-1206.00-02-1024 |
| 14. | 24x24x6 | 1 | " | For Loads Other Than Pressure | " |
| 15. | 24x24x6 | 1 | FTEE | No PAD | " |
| 16. | 24x24x4 | 2 | FTEE | No PAD | " |
| 17. | 18x18x4 | 3 | FTEE | No PAD | " |
| 18. | 18x18x4 | 1 | REINF FTEE | SCH STD PAD Reqd. For Loads Other Than Pressure | " |

ATTACHMENT 1

# APPENDIX E

| | |
|---|---|
| TABLE 8.2-6 | GUIDELINES FOR THE DESIGN & APPLICATION OF BRANCH OUTLETS - SHOP & FIELD FABRICATION |
| TABLE 8.2-7 | BRANCH TYPE SELECTION BY PREFERENCE |

## GUIDELINES FOR THE DESIGN & APPLICATION OF BRANCH OUTLETS - SHOP & FIELD FABRICATION

CLASSES A-B-C-D-E-F-G-H

TABLE E-2-6

| TYPE OF BRANCH OUTLET | CLASS | | | SIZING | | BRANCH OUTLET QUALIFICATIONS | | | | HEADER QUALIFICATIONS | | REINFORCEMENT CALCULATIONS MANDATORY | SEE DPCO. DWG. CH-1676-1. DETAILS | NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | UMRE | ASME SECT. III | ANSI B31.1.0 | BRANCH OUTLET RANGE (NPS) | HEADER RANGE (NPS) | INTEGRALLY REINFORCED | SHAPED TO HEADER O.D. | BEVELED AT HDR ATTACHMENT END | FULL PENETRATION WELD | OPENING TO MATCH I. D. OF RUN-OUT BRANCH PIPE | OPENING TO MATCH I. D. OF SOURCE FITTING | | | |
| EE, CROSS & LATERAL | A | 1 | - | ≤ 2" | ≤ 2" | YES | N/A | N/A | N/R | N/A | N/A | NO | N/R | (1) |
| ITTINGS, FORGED | B-D | 2 | - | " | " | " | " | " | " | " | " | " | " | (2) |
| OCKET WELD & SCREWED | C | 3 | - | " | " | " | " | " | " | " | " | " | " | (2) |
| | E-F-G | - | YES | " | " | " | " | " | " | " | " | " | " | (3) (17) |
| FITTINGS, SOURCE, | A | 1 | - | ≤ 2" | ≤ 2½" | YES | YES | YES | YES | NO | YES | NO | Y | (1) (4) (15) |
| WELDED OUTLET, SOCKET | B-D | 2 | - | " | " | " | " | " | " | " | " | " | Y | (2) (4) (15) |
| WELD & SCREWED | C | 3 | - | " | " | " | " | " | " | " | " | " | Y | (2) (4) (15) |
| | E-F-G | - | YES | " | " | " | " | " | " | " | " | " | Y | (3) (4) (15) (17) |
| HALF COUPLING, FORGED | A | 1 | - | ≤ 2" | ≤ 2½" | YES | YES | YES | YES | YES | YES | YES | R | (1) (4) |
| SOCKET WELD & SCREWE | B-D | 2 | - | " | " | " | " | " | " | " | " | " | R | (2) (4) |
| | C | 3 | - | " | " | " | " | " | " | " | " | " | R | (2) (4) |
| | E-F-G | - | YES | " | " | " | NO | NO | NO | " | " | NO | Z | (3) (4) (17) |
| PIPE NOZZLES, P.E. | A | 1 | - | ≤ 2" | ≤ 2½" | NO | YES | YES | YES | YES | YES | YES | R | (1) (5) (6) |
| OR THREADED, FOR | B-D | 2 | - | " | " | " | " | " | " | " | " | " | R | (2) (5) (7) (16) |
| SOCKET WELD OR SCREW | C | 3 | - | " | | " | " | " | " | " | " | " | R | (2) (5) (7) (16) |
| JOINT RUN-OUT CONN'S | E-F-G | - | YES | " | " | " | " | NO | NO | " | " | NO | R-X | (3) (5) (7) (16) (17) |
| TEE & CROSS FITTINGS | A | 1 | - | ≤ 2½" | ≤ 2½" | YES | N/A | N/R | N/R | N/A | N/A | NO | N/R | (8) |
| WROUGHT, FORGED OR | B-D | 2 | - | " | " | " | " | " | " | " | " | " | " | (18) |
| CAST, BUTT WELD | C | 3 | - | " | " | " | " | " | " | " | " | " | " | (18) |
| | E-F-G | - | YES | " | " | " | " | " | " | " | " | " | " | (9) (17) |
| FITTINGS, SOURCE, | A | 1 | - | ≤ 2½" | ≤ 2½" | YES | YES | YES | YES | NO | YES | NO | Z | (4) (15) |
| WELDED OUTLET, WROUGHT | B-D | 2 | - | " | " | " | " | " | " | " | " | " | Z | (4) (15) |
| FORGED OR CAST, BUTT | C | 3 | - | " | " | " | " | " | " | " | " | " | Z | (4) (15) |
| WELD | E-F-G | - | YES | " | " | " | " | " | " | " | " | " | Z | (4) (15) (17) |
| FITTINGS, SOURCE, | A | 1 | - | ≤ 2½" | ≤ 2½" | YES | YES | YES | YES | NO | YES | NO | AA | (4) (10) |
| WELDED OUTLET, FORGED | B-D | 2 | - | " | " | " | " | " | " | " | " | " | AA | (4) (10) |
| OR CAST BUTT WELD | C | 3 | - | " | " | " | " | " | " | " | " | " | AA | (4) (10) |
| | E-F-G | - | YES | " | " | " | " | " | " | " | " | " | AA | (4) (10) (17) |
| PIPE NOZZLES, BEVELED | A | 1 | - | ≤ 2½" | ≤ 2½" | NO | N/A | N/A | N/A | N/A | N/A | N/A | N/R | (8) |
| ENDS FOR GIRTH BUTT | B-D | 2 | - | " | " | " | " | " | " | " | " | " | " | (8) |
| WELD ATTACHMENT FOR | C | 3 | - | " | " | " | " | " | " | " | " | " | " | (5) |
| RUN-OUT | E-F-G | - | YES | " | " | " | YES | YES | YES | YES | YES | YES | O | (5) (14) (16) (17) |

## NOTES APPLICABLE TO TABLE 8.2-6

(1) Screwed joints permitted only if seal-welded (See ASME Section III, NB-3671.3).

(2) Screwed joints permitted subject to limitations of ASME Section III, NC-3671.3.

(3) Screwed joints permitted subject to limitations of ANSI B31.1, Paragraph 114.

(4) SOURCE FITTING: For the purpose of this Specification in general, and Table 8.2-6 specifically, the term "Source Fitting" is defined as any type of manufacture of component which has the following characteristics:

a. One end is shaped and beveled for attachment by welding to a run or header pipe. It may be attached at an angle of either 90° or 45° off the centerline of such header. It may also be attached to the header at the "heel" of a 90° elbow as design requirements indicate.

b. The fitting on the end opposite to that described in a., above, may be prepared for butt-welding and beveled to suit; or it may have a counterbore for socket-welding; or it may be female threaded for a screwed connection.

c. It has integral reinforcement designed into it such that it is inherently of sufficient magnitude as to render it as equal to or greater than the full strength of uninterrupted straight pipe, hence no calculations for reinforcement are required for such opening.

d. Included in such group of fittings, are the following common terms although others may be included if so qualified by the foregoing description:

i) Half couplings, forged, 3000 or 6000# pressure rating, with the attachment-to-header end shaped to fit the O.D. of header to which attached and beveled for full penetration welding. The opposite end, for piping runout, may be counterbored for socket welding or female threaded for a screwed connection.

ii) Weldolets, forged, having pressure ratings to suit the system design requirements. The attachment-to-header end is beveled and shaped to the header O.D. The opposite end is beveled for butt welding of runout.

iii) Sockolets, forged, having pressure ratings to suit the system design requirements. Attachment-to-header is same as d., ii), and opposite end is counterbored for socket-welding of runout.

iv) Threadolets, forged, having pressure ratings to suit the system design requirements. Attachment-to-header is same as d., ii), and opposite end is female threaded for a screwed joint to runout.

v) Sweepolets, forged or cast, having pressure ratings to suit the design requirements. Attachment-to-header is made at the

Notes Applicable to Table 8.2.6 (continued)

skirted edge of the fitting, the edge of such fitting and the header opening to receive it are beveled for attachment and
- joining by means of a full penetration girth, butt weld.

(5) The pipe nozzles contemplated in this category are those made from pipe having wall thickness only sufficient to contain internal pressure.

(6) Branch Outlets in this category are limited such that the angle between axes of the intersecting pipes is not less than 60° nor more than 120°.

(7) The use of Tees and Crosses is mandatory in this category. Branch connections made by intersectional welding of pipe (branch) to pipe (header) is prohibited. Alternately, consideration may be given to the use of "Source Fittings" (see Item 6), below, which same are acceptable.

(8) The use of Butt Weld Tees and Crosses for Branch Outlets in these classes is limited to those drawings design conditions where their utilization proves to be more advantageous from an economical basis. DPCo will only designate tees where welded branch outlets are not desired.

(9) Branch Outlets in this category contemplate the use of Sweepolets or their equivalent.

(10) Branch Outlets, using pipe, may be used where all of the reinforcement requirements of Paragraph NB-3643, ASME Section III have been met.

(11) Branch Outlets, using pipe, may be used where all of the reinforcement requirements of Paragraph NC-3643, ASME Section III have been met.

(12) The use of pipe nozzles in this category and class will be limited to the condition where the Branch Outlet NPS < 50% of the Header NPS, except where specifically designated otherwise by the DPCo design drawings.

(13) Branch Outlets, using pipe, may be used where all of the reinforcement requirements of Paragraph 104.3, ANSI B31.1.0, have been met.

(14) Weldolets, Sockolets, Threadolets, Teelets, Branchlets, etc., are contemplated by this category.

(15) Factory-made shaped nipples are also included in this category.

(16) Class H Branch Connections: No special category assigned to this class. Branch connections may be made the same as for Classes E, F, & G or any other method provided the requirements of "good commercial practices" are met.

(17) The use of Butt Weld Tees and Crosses for Branch Outlets in these classes will be limited to the condition that the branch NPS is ≥ 50% of the Header NPS, except where specifically designated otherwise by DPCo design drawings.