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SUBJECT: Responds to NRC questions re FSAR changes to Table 3.8-1, Page 6 & Table 3.8-12, Page 3 transmitted by Amend 26. Info provided on alternative concrete & steel acceptance criteria utilized in selected structures.

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July 30, 1986
(NMP2L 0800)

Ms. Elinor G. Adensam, Director
BWR Project Directorate No. 3
U.S. Nuclear Regulatory Commission
7920 Norfolk Avenue
Washington, DC 20555

Dear Ms. Adensam:

Re: Nine Mile Point Unit 2
Docket No. 50-410

This letter responds to Nuclear Regulatory Commission staff questions about Nine Mile Point Unit 2 Final Safety Analysis Report changes to Table 3.8-1, page 6 and Table 3.8-12, page 3 transmitted by Amendment 26. The staff reviewer asked Niagara Mohawk Power Corporation to furnish information on the alternative concrete and steel acceptance criteria utilized in selected structures at Nine Mile Point Unit 2. We were asked to provide:

1. the structure and location where the practice was used,

2. the load and load combinations where the normal limits are exceeded,

3. the method of calculating governing stresses,

4. the minimum concrete compressive strength,

5. the actual strength and test data used, the expected deviation in those results, the age of the concrete when tested, and how much margin is available.



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Ms. Elinor G. Adensam
Page 2

The above information was requested separately for concrete and steel. That information is provided in Attachment 1 including Tables A and B.

Very truly yours,

C. V. Mangan
Senior Vice President

DLH:ja
1873G

Attachment

xc: W. A. Cook, NRC Resident Inspector
Project File (2)

Attachment 1

## USE OF MATERIAL TEST RESULTS

## FOR DESIGN ADEQUACY AT NMP2

NMP2 structures are designed in accordance with loads and loading combination described in FSAR section 3.8, ACI and AISC manuals for concrete and steel structures. During the normal design process, design stresses were within ACI and AISC minimum allowables. When structures were verified for actual system loads (cable trays, conduits, pipes, ducts, etc) the calculated stresses exceeded the allowable stresses in a few isolated cases. For these cases, actual strength test reports were used to satisfy the design conditions, without deviation from concrete and steel strength acceptance criteria, and the design meets FSAR and code requirements.

### Concrete

1. The use of actual compressive strength test reports for concrete were used at the following three locations during final structure verification efforts.

   A&B.- Two embedment plates at El. 265'-2" primary containment wall - B018 & B019.

   C. One embedment plate at El. 386'-10" secondary containment wall - IP-280.

2. The governing loads and load combinations from FSAR section 3.8 were considered to compute maximum member stresses. Structural components are designed for the most severe load combinations. Attached Table A indicates the load combination where the limits are exceeded.

3. Stresses in concrete structures are governed by the American Concrete Institute's (ACI 318-77) design criteria requirements. The design stresses are within ACI allowables (refer to Table A for design and allowable stresses).

4. In general, for the NMP2 project, the specified minimum compressive strength of concrete for major structures is 3000 psi at 28 days. Several structural components, such as primary containment wall, reactor pedestal, fuel pool area, screenwell building and intake tunnel are constructed using concrete with 4000 psi at 28 days.

5. Concrete is tested for compressive strength at 7 and 28 days. Test reports are traceable to specific pour locations and document the actual compressive strength of cylinders at 7 and 28 days.

Generally, the actual compressive strength of these cylinders is found to be between 15% to 40% higher than the minimum specified compressive strength at 28 days. When calculated stresses exceed the allowable design stresses, actual compressive strength test reports for the specific pour under consideration are obtained to justify final stresses by considering actual concrete strength.

A further consideration is the increase in strength that concrete experiences with time. Industry tests have demonstrated a significant increase in strength after the 28 day tests. Using the conservative value of 10%, the strength increase will exceed one standard deviation calculated from the specific test values used in the analysis.

For the first example shown in Table A, Primary Containment plates, the calculated average concrete strength, based on twelve cylinder tests for specimen age of 28 days is found to be 5748 psi.

Structural Steel

1. The use of certified material test reports (CMTRs) for structural steel is used when the stresses in any member, due to final system loads (cable trays, conduits, pipes, duct, etc.) exceed the allowables during final structures verification efforts. This practice is used for steel components at various locations in safety related structures.

   For a typical floor in the Primary Containment, approximately 6% of beams (19 out of 320 beams) used CMTRs to satisfy the design conditions.

2. The governing loads and load combinations from FSAR Section 3.8 were considered to compute maximum member stresses. Steel components are designed for most severe load combinations. Table B presents two examples where the original design limits were exceeded.

3. Stresses in structural steel members are governed by the American Institute of Steel Construction (AISC) design criteria requirements. The design stresses are always within AISC allowables.

4. In general, ASTM A36 material with Fy of 36KSI is used for structural steel framing. In certain areas, high strength steel conforming to A572, A588, Grade A or B with Fy of 50 ksi is used.

5. CMTRs are received with the purchased materials and are traceable to specific mark numbers. They provide documentation of the actual yield strength of the material. Generally, the actual yield strengths are found to be a minimum 10% higher than the

minimum yield strength required. When calculated stresses exceed the allowable design stresses, CMTRs for that steel member were obtained to justify the final stresses by considering actual yield strengths available during final structures verification efforts.

Typical examples and summary results of beam and column stresses before and after using the test results are represented in Table B of Attachment 1.

# TABLE A



| Building | Location | Type of Structure | Governing Load Combination | Calc. Pullout Loads (KIPS) | Design Concrete Strength f'c (psi) at 28 days | Concrete Pullout Capacity (KIPS) | Calc. Pullout Ratio to Allow. | Average Comp. Strength Results fc' (psi) | Revised Concrete Pullout Capacity (KIPS) | Revised Load Ratio to Allow. Load with Test Reports |
|---|---|---|---|---|---|---|---|---|---|---|
| Primary Contmnt | El 265'-2" AZ 349°-38' AZ 10°-57' | Embedded Plate B018 and B019 | FSAR Table 3.8-11 Equation 17 | 1,182 | 4,000 | 1,064 | 1.11 | 5,748 | 1,275 | 0.92 |
| Secondary Contmnt | El 386'-10" AZ 244° | Embedded Plate IP-280 | FSAR Table 3.8-11 Equation 4 | 133 | 4,000 | 125 | 1.06 | 5,620 | 148 | 0.90 |

# TABLE B

| Building | Location | Member Size | Governing Load Combination | Yield Strength Fy (KSI) | Interaction Formula Results | Yield Strength from CMTR Fy (KSI) | Interaction Formula Results with CMTR |
|---|---|---|---|---|---|---|---|
| Primary Contmnt | El 288'-3 1/4" | Beam W14 x 233 | FSAR Table 3.8-10 Equation 12 | 36 | 1.12 | 41.50 | 0.97 |
| Secondary Contmnt | El 261'-0" to 289'-0" | Column W14 x 109 | FSAR Table 3.8.10 Equation 5 | 36 | 1.05 | 40.70 | 0.92 |