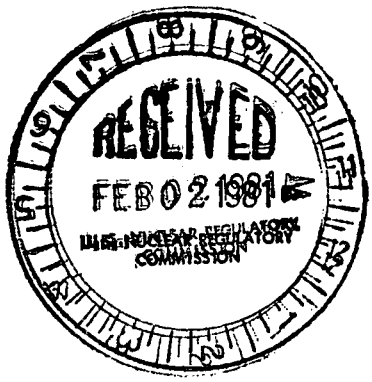
NRC-81-8

Central Files

WISCONSIN PUBLIC SERVICE CORPORATION

P.O. Box 1200, Green Bay, Wisconsin 54305



January 26, 1981

Mr. Gaston Fiorelli
Reactor Construction &
Engineering Support Branch
Region III
U. S. Nuclear Regulatory Commission
799 Roosevelt Road
Clen Ellyn, IL 60137

Dear Mr. Fiorelli:

Docket 50-305
Operating License DPR-43
IE Bulletin 80-11 "Masonry Wall Design"

In response to a request by Mr. Eugene Gallagher during a phone conversation of January 13, 1981, this letter submits for your information a copy of three (3) pages excerpted from letter KPS-5426 dated September 5, 1980 from Fluor Power Services to Wisconsin Public Service Corporation.

This information is submitted in support of our response to Bulletin 80-11. It verifies that the design criteria outlined in our letter of September 23, 1980, to Mr. Gaston Fiorelli were the original criteria used to design the safety Class I masonry walls at the Kewaunee Nuclear Power Plant.

This information along with our previous two (2) transmittals provides the information necessary to draw the conclusion as we have, that the seismic Class I masonry walls at the Kewaunee Nuclear Power Plant are conservatively engineered to withstand a Design Basis Earthquake.

Sincerely,

E. R. Mathews

E. R. Mathews, Vice President
Power Supply & Engineering

snf

Attach.

cc - Mr. Robert Nelson, NRC Resident Inspector
RR #1, Box 999, Kewaunee, WI 54216
Mr. Howard Wong, NRC Office of I&E, Div of
Resident & Regional Reactor Insp
Washington, D. C. 20555
Dir, Office of I&E - Div of Reactor Oper Insp

JAN 28 1981

8102230221

Q

DESIGN BASIS AND CRITERIA USED IN THE ORIGINAL DESIGN OF CONCRETE MASONRY WALLS IN NUCLEAR SAFETY RELATED AREAS (CLASS 1)

1. Design Documents

In the design calculations, drawings and specifications for the construction of concrete masonry walls in Class 1 areas in the Kewaunee Nuclear Power Plant, the following design basis and criteria were used. These documents have been checked and reviewed in accordance with the Quality Assurance procedures established during the time of the original design (1971).

2. Type of Walls

All masonry walls in Class 1 areas are non-load bearing, interior, single wythe construction and reinforced in the horizontal and vertical directions. These walls are primarily used for partitions and/or fire barriers.

3. Materials of Construction

The following materials were specified:

3.1. Masonry Units - Lightweight units corresponding to ASTM C-90 Grade N-1. The units conform to ASTM C-426 tests for moisture. Quality Control Documents on the manufacture of block walls exist. Tests on blocks were made for the Kewaunee job. The test results have been documented.

3.2. Mortar and Grout - Conforms to ASTM C-270 Type "S" mortar. Test results on the mix design have been documented Mortar proportions by volume are specified as:

One part Portland Cement, ¼ to ½ part hydrated lime 2¼ to 3½ parts sand and only enough water for a stiff mix. The grout shall attain a minimum compressive strength of 2000 psi at 28 days. Portland Cement shall conform to ASTM C-150 Type I or ASTM C-175, Type IA. Lime shall conform to ASTM C-207. Sand was specified to ASTM C-144.

3.3. Reinforcement - Horizontal reinforcement was specified as Extra Heavy Weight Dur-O-Wal reinforcement spaced at 24 inches on center. The side rods are required to be lapped six inches at a splice.

Vertical reinforcement was specified as ASTM A-615 Grade 60 deformed billet steel bars. Size and spacing was computed for each wall to carry all loads imposed on the wall in the vertical direction.

4. Loads

The primary loads imposed on the block walls were due to seismic events. Two levels of earthquakes were used - Operating Basis Earthquake, OBE and the Design Basis Earthquake, DBE, (2 times OBE). The loads obtained for the DBE were reduced by 2/3 to account for the 50 percent increase in allowable stresses. No increase in allowable stresses were permitted for the OBE.

The seismic loads were computed using the following basis:

4.1. Damping of 0.5 percent for OBE and DBE. This is highly conservative by today's standards.

4.2. Cracked moment of inertia for frequency calculation.

4.3. One way action for frequency calculation.

4.4. Boundary conditions: Simply supported or fixed at bottom and simply supported or free at top depending on the construction details at the top and bottom. Fixity was assumed when reinforcement was doweled into supporting concrete element. Simple supports were assumed when the walls were supported by steel support angles on both sides and separation between the wall and structural element was achieved by a joint filler.

4.5 The accelerations obtained from the response spectra were further increased to account for overall torsional effects of the buildings. These multiplying factors were obtained from the John A. Blume & Associate Report for the Kewaunee Plant, December 1968.

5. Allowable Stresses

Working stress method has been used in the design of masonry walls.

The allowable stresses used were taken from the 1967 Edition of the Uniform Building Code, Table No. 24-H under the requirement of special inspection. The value of f'_m was taken equal to 1350 psi per UBC-67.

Compression flexural = 0.33 f'_m	=	450 psi
Bond	=	140 psi
Shear (No shear reinforcement)	=	50 psi

6. Analysis Method

The stresses in the block walls were computed using one way action of the walls (spanning vertically). Typical boundary conditions used were:

Top	Bottom
Free	Fixed
Simply Supported	Simply Supported
Simply Supported	Fixed

6. Analysis Method (Continued)

Even though horizontal reinforcement was provided, no credit was taken for two way action of the walls. This is a conservative assumption.

For seismic analysis, the fundamental period was determined as:

$$t = 2\pi\sqrt{\frac{\Delta}{g}}$$

Where, Δ is the static deflection for uniformly distributed lateral load. Appropriate boundary conditions were used to calculate the deflection. Torsional acceleration of the building as a whole increased the spectral acceleration by 26 percent. The contribution of the higher modes are small (about 5 percent) and was not considered because of the other conservative assumptions used (lower damping, etc.).

7. Comparison with Present Codes and Practices

The design of masonry walls was carried out using the latest existing codes and analytical methods similar to those used in the design of reinforced concrete structural elements. In short, the walls were treated as structural elements and the same level of engineering and detailing as that for other structural elements was provided. A comparison with the current practices reveal the following:

1. Allowable stress levels by UBC-67 are of the same value or lower than the present ACI 531-79.

2. Seismic analysis procedures are not different. An order of magnitude lower damping value was used.

3. Simple but conservative analytical modeling was used. Arching action, two way slab action were not used. These actions would provide additional conservatism.

4. Construction practices used do not differ from the current ones. Attention was paid to details such as mechanical anchoring by angles at the top, reinforcing steel detailing including laps at splices, dowels into existing concrete for fixed end conditions.