



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

NOV 16 1983

Docket No. 50-410

MEMORANDUM FOR: A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing

FROM: Mary F. Haughey, Project Manager
Licensing Branch No. 2, DL

SUBJECT: STRUCTURAL DESIGN AUDIT OF NINE MILE POINT 2

DATE & TIME: November 29, 1983
8:00 AM - 4:00 PM

December 12, 1983
1:00 PM - 5:00 PM

December 13 thru December 15, 1983
9:00 AM - 5:00 PM

December 16, 1983
9:00 AM - 12:00 PM

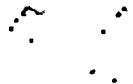
LOCATION: November 29, 1983
Tour: Nine Mile Point 2 - Plant Site

December 12 thru December 16, 1983
Stone & Webster offices, Cherry Hill, New Jersey

PURPOSE: Structural Design Audit

- Review of design reports and drawings
- Discussion of special or unique design features
- Detail analysis results and computer codes
- Determination of the extent of conformance to applicable design criteria, codes and standards
- Tour of structural aspects of plant

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PARTICIPANTS*:	<u>NRC</u>	<u>NMPC</u>	<u>SWEC</u>
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Mary F. Haughey, Project Manager
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Division of Licensing

Attachment: Guidelines

cc w/attachment:
See next page

*Meetings between NRC technical staff and applicants for licenses are open for interested members of the public, petitioners, intervenors, or other parties to attend as observers pursuant to "Open Meeting and Statement of NRC Staff Policy", 43 Federal Register 28058, 6/28/78.

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11/14/83

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1. The first part of the document is a list of names and addresses of the members of the committee.

2. The second part of the document is a list of names and addresses of the members of the committee.

3. The third part of the document is a list of names and addresses of the members of the committee.

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Nine Mile Point 2

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STRUCTURAL DESIGN AUDIT GUIDELINES

I. BASIC DESIGN CRITERIA

A. General Design Data

1. Wind and Tornado

- a. Wind profile
- b. Design pressure on flat and curve surfaces
- c. Surface coefficients
- d. Windward and leeward distribution
- e. Gust factors
- f. Conversion of wind velocities into forces
- g. Effects of missiles from tornadoes
- h. Others

2. Snow and Ice

- a. Design loads

3. Flood

- a. Design basis flood elevation
- b. Design groundwater table elevation

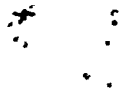
4. Earthquake

Design ground motion in the free field

- a. Peak acceleration or zero-period acceleration (in g's)
 - (i) Operating basis earthquake (OBE)
 - (ii) Safe shutdown earthquake (SSE)
- b. Response spectra
 - (i) OBE, SSE
 - (ii) Horizontal, vertical for various damping values
- c. Time history
 - (i) Source: natural or artificial
 - (ii) Composition: rising time, strong motion duration, decaying time
 - (iii) Baseline correction: check the integrated velocity and displacement time histories
 - (iv) Time interval
 - (v) Procedure of synthesizing



- (vi) Derived response spectra corresponding to time histories, and frequency intervals used
- d. Damping
- 5. Soil Properties
 - a. Soil profile -- layering
 - (i) Elevation
 - (ii) Depth of layers
 - (iii) Bearing capacity at foundation
 - (iv) Lateral soil pressure, static and dynamic
 - b. Physical properties of each layer
 - (i) Type of soil
 - (ii) Dry weight
 - (iii) Shear modulus and shear wave velocity
 - (iv) Poisson's ratio
 - (v) Bulk modulus
 - (vi) Damping characteristics
- 6. Blast Environment
 - a. Class of explosives
 - b. Distance of blast
 - c. Air blast and time pressure curves
 - d. Ground shock
 - e. Missiles and fragmentation
- 7. Aircraft Impact Environment
 - a. Weight of projectiles
 - b. Speed of projectiles
 - c. Explosion and forcing function
- 8. Turbine Missiles
- B. Applicable Codes, Standards and Specifications
- C. Materials
 - 1. Structural steel - modulus of elasticity, Poisson's ratio, yield strength and allowable stresses
 - 2. Concrete - modulus of elasticity, Poisson's ratio, ultimate strength, and allowable stresses
 - 3. Reinforcing steel - modulus of elasticity, Poisson's ratio, yield strength and allowable stresses
 - 4. Others (Specify)



II. GENERAL METHODS OF ANALYSIS AND DESIGN

- A. Static Analysis
 - 1. Overall analysis
 - 2. Localized analysis
 - 3. Computer codes used
- B. Seismic Analysis
 - 1. Selection of masses and degrees of freedom
 - 2. Number of modes considered
 - 3. Consideration of three components of motion
 - 4. Consideration of torsional and translational response
 - 5. Soil-structure interaction
 - 6. Development of floor response spectra
 - a. General procedures
 - b. Smoothing
 - c. Peak widening
 - d. Typical results
 - 7. Computer codes used
- C. Buckling Analysis
- D. Load Combinations
- E. Design Consideration for Tornado and Turbine Missiles
 - 1. Design requirements
 - 2. Local damage
 - 3. Overall response
 - 4. Conformance to SRP 3.5.3
- F. Special Considerations for Containment Structure
 - 1. Ultimate capacity analysis
 - 2. Special design loads - in addition to general design loads listed in Section I
 - a. Dead and live loads for various operating floors and base slab
 - b. Internal pressure and temperature
 - c. Pool dynamic loads (BWR only)
 - 3. Analysis of penetration effects
 - 4. Tangential shear (concrete containment only)
 - 5. Steel liner analysis (concrete containment and concrete basemat only)
- G. Interaction with Non-Category I Structures
- H. Quality Control Criteria



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III. SUMMARY OF ANALYSIS AND DESIGN

A summary of analysis and design should be provided for each structure or item listed in Section IV.

- A. General layout, dimensions, sections and details
- B. Generation of applicable dead and live loads
- C. Mathematical model; including idealized masses, geometrical and physical properties
- D. Summary of dynamic responses
- E. Computer input (if applicable)
- F. Computer output (if applicable)
- G. Governing load combinations and critical sections
- H. Design parameters for proportioning structural members
- I. Summary of key results
- J. Factor of safety against overturning, sliding and flotation (for foundations only)
- K. Verification that drawings reflect design calculations



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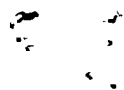
IV. AUDIT ITEMS

A. Containment Building

1. Containment Shell
2. Internal Structures (BWR plant)
 - a. Drywell wall
 - b. Weir wall
 - c. Operating floor
 - d. Reactor vessel supports or predestals
 - e. Coolant pump supports
 - f. Cable trays and their supports
 - g. Reactor shield walls
 - h. Polar crane support
 - i. Other structures (specify)
2. Internal Structures (PWR Plant)
 - a. Reactor vessel support
 - b. Reactor coolant pump support
 - c. Steam generator support
 - d. Primary shield walls
 - e. Secondary shield walls
 - f. Operating floor slab
 - g. Cable trays and their supports
 - h. Polar crane support
 - i. Other structures
3. Foundation Mat Including Reactor Pit
4. Audit of Key Designs

For each key design area audited, the design calculations should be reviewed together with applicable drawings, sketches, etc. Also, key details and/or sections, as appropriate, in this audit report should be included.

- a. Containment liner design
 - (i) Conformance with ASME B&PV Code Section III Div. 2-Article CC-3000 and Div. 1 for fatigue and tensile evaluation if liner is subjected to such loads
 - (ii) Key liner locations
 - (iii) Forces and displacements obtained from computer analysis



- (iv) Liner anchor design
- (v) Key penetration design
- b. Fuel pool liner design
 - (i) Analysis
 - (ii) Conformance to code
 - (iii) Corrosion effects (e.g. pitting) on liner integrity
- c. Containment Hatch Design
 - (i) Model, design assumptions and analysis procedures
 - (ii) Governing load combinations
 - (iii) Conformance to CC-3000
- d. Containment wall-base mat junction design
 - (i) Design requirements and model
 - (ii) Governing loads
 - (iii) Key results (Forces, moments & stresses)
 - (iv) Section showing details
 - (v) Any waterstop membranes at the joints their design considerations and installations
 - (vi) Conformance to CC-3000
- e. Dome to cylinder junction design
 - (i) Design requirements and model
 - (ii) Governing loads
 - (iii) Key results (Forces, moments & stresses)
 - (iv) Sections showing details
 - (v) Conformance to CC-3000
- f. Seismic Analysis for Buried Piping and/or Electrical Conduits
 - (i) Method of analysis
 - (ii) Stiffness calculations
 - (iii) Inputs
 - (iv) Key analysis results
- g. Post-Tensioning System
 - (i) Tendon system used
 - (ii) Prestressing force at transfer
 - (iii) Tendon load under LOCA



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(iv) Method used to calculate prestress losses:

- Initial
- Creep and shrinkage of concrete
- Tendon relaxation or degradation
- Other losses

h. Buttress Design for Post-Tensioning System

- (i) Maximum bursting stress in concrete
- (ii) Reinforcing provided to resist bursting stresses
- (iii) Stress under the anchor plate
- (iv) Allowable stresses
- (v) Stress under tendons anchorage
- (vi) Method for calculation of stresses

B. Other Category I Structures

Provide summary of analysis and design for structure and foundation of the following:

1. Auxiliary Building
2. Control Building
3. Diesel Generator Building
4. Fuel Handling Building
5. Miscellaneous (specify)

