50-329/330 OM, OL
Midland Plant, Units 1&2

Exhibits of John P Matra, Jr. [illegible]

Naval Surface Weapons Center
(NRC Consultant)
during
Oral Deposition on 1/7/81

Exhibits 1 - 4

T

JOHN P. MATRA JR

STRUCTURAL ANALYSIS STAFF
NAVAL SURFACE WEAPONS CENTER

RECEIVED
FEB 09 1981
U.S. NUCLEAR REGULATORY COMMISSION

JOHN P. MATRA JR
14010 JARRETTSVILLE PIKE
PHOENIX MD 21131

EMPLOYED AS A STRUCTURAL ENGINEER ON THE STRUCTURAL ANALYSIS STAFF OF THE NAVAL SURFACE WEAPONS CENTER, WHITE OAK SILVER SPRING. MD. 20910

PROFESSIONAL QUALIFICATION

1) GRADUATED FROM NORTH TARRYTOWN HIGH SCHOOL 1948
ALSO RECEIVED COLLEGE ENTRANCE DIPLOMA FROM NEW YORK STATE.

2) RECEIVED BACHELOR OF AERONAUTICAL ENGINEERING (MAJORED IN STRUCTURES) FROM RENSSELAER POLYTECHNIC INSTITUTE. (1953)

HAVE BEEN ELECTED TO GAMMA ALPHA RHO
A NATIONAL AERONAUTICAL HONORARY SOCIETY

3) RECEIVED MASTER OF SCIENCE IN MECHANICAL ENGINEERING FROM DREXEL INSTITUTE OF TECNOLOGY. (1962)
(MAJORED IN STRUCTURES)

Matra depo Ex 1
1-7-81 [illegible]

4) TOOK COURSES AT HOPKINS AND THE UNIVERSITY OF MARYLAND TOWARD A DR DEGREE IN APPLIED MATH. HAVE ABOUT 20 CREDITS TOWARD THIS - DEGREE DO NOT HAVE DEGREE.

PROFESSIONAL EXPERIENCE

1) 1953 TO 1967 GLEN L. MARTIN CO. (STRUCTURAL ENGINEER)

2) 1967 TO PRESENT NAVAL SURFACE WEAPONS CENTER (STRUCTURAL ENGINEER)

PUBLISHED THESIS

1) ON THE PROPAGATION OF A DISTURBANCE IN A VISCO-ELASTIC MEDIUM.

2) ON THE DEVELOPMENT OF THEORETICAL METHODS OF PREDICTING THERMAL PROPERTIES OF A HETEROGENEOUS MATERIAL.

FACILITY REVIEW - ADMINISTRATIVE DATA

Applicant: Consumers Power Company (CPCo)

Facility Name: Midland Plant Units 1 and 2

Docket Numbers: 50-329 & 50-330 Docket Date: / /

Project Leader: Branch:

Branch Chief: OL or CP:

Assistant Director: Group:

Reviewer: Assignment Date: / /

Acceptance Review

Start / / Complete / /

Hours Percent Deficient

Initial Review

Start / / Complete / /

Hours No. of Questions

Second Review

Initial Response / / Complete Response / /

Start / / Complete / /

Hours No. of Questions: New Reask

Third Review

Initial Response / / Complete Response / /

Start / / Complete / /

Hours No. of Remaining Inadequate Responses

Evaluation Report

Start / / Complete / / Hours

Outstanding Issues:

Evaluation Report Supplement

Start / / Complete / / Hours

Figure 1

SEB Form 18 dtd 1 OCT 79

Matra ... 1-7-8...

CORRESPONDENCE SUMMARY

Document	Date Dispatched	Comments

Figure 1 (cont'd)

SEB Form 10 dtd 1 OCT 79

Figure Two. Technical Data

NUCLEAR POWER FACILITY STRUCTURAL DATA SHEET	NAME: MIDLAND PLANT UNITS 1 AND 2

GENERAL PLANT DATA AND STRUCTURES

LOCATION: SOUTH SHORE OF THE TITTABAWASSEE R. IN THE CITY OF MIDLAND, MICHIGAN, ADJ. THE DOW CHEMICAL COMPANY'S MIDLAND

DOCKET NUMBER 50-329 ~~50-330~~ COMPANY/UTILITY/OWNER CONSUMERS POWER CO.

NSSS TYPE PRESSURIZED WATER REACTOR TYPE NSSS SUPPLIER BABCOCK & WILCOX COMPANY

ARCHITECT/ENGINEER BECHTEL PRINCIPAL CONTRACTOR BECHTEL

CONTAINMENT: TYPE POST-TENSIONED REINFORCED CONCRETE & A STEEL LINER

OVERALL REFERENCE DWGS (CITE PAGE, TAB, & REFERENCE)
PLAN 1.2-8 THRU 1.2-9 E/W ELEV 1.2-11 N/S ELEV ___

FOUNDATION FINISHED GRADE ELEVATION 634 (FT)
DEPTH TO ROCK (FT) 289' 6" ELEVATION OF BASE SLAB 593' 6" ROCK ANCHORS? ___
GROUND WATER HEIGHT (FT, - VALUES ABOVE SLAB) 10' 6" ROCK/SOIL BEARING STRENGTH ___
ROCK/SOIL CLASSIFICATION ___

BASE SLAB
OUTSIDE DIAMETER (FT) 124 FT SLAB THICKNESS (FT) 9' TO 13' INSIDE DIAMETER (FT) ___

WALLS (SHELL)
HEIGHT, BASE SLAB TOP TO SPRINGLINE 153' WALL THICKNESS: AT BASE SLAB 3' 6" AT MID HEIGHT ___

DOME ELLIPTICAL (✓) OR SPHERICAL ( )
INSIDE RADIUS (FT) 87' 6" KNUCKLE RADIUS (FT) 34' 6¾" DOME THICKNESS: AT APEX 3' AT ___

LINER
THICKNESS (IN)
IN: DOME ___ SIDEWALL 1/4" FLOOR ___

OTHER CATEGORY I STRUCTURES:

STRUCTURE	TYPE	REF COMMENTS	DEPTH OF ELEV
UNIT (1) CONTAINMENT	REF CONCRETE		
UNIT (2) CONTAINMENT	"		593.
AUXILIARY BUILD.			593.
DIESEL/GEN BUILD			
SERVICE WATER COOLING Build			
BORATED WATER STORAGE TANKS			

7

... Form 13 ... / ... Sheet 1

NUCLEAR POWER FACILITY STRUCTURAL DATA SHEET	NAME		PAGE TWO OF EIGHT

SITE DATA

WIND 3.3.1.1

DESIGN SPEED (MPH, 30' LEVEL) 85 MPH RECURRENCE INTERVAL (YR) 100

TORNADO 3.3.2.1

TRANSLATIONAL SPEED (MPH) 360 MPH ROTATIONAL SPEED (MPH) 290 MPH

TOTAL PRESSURE DROP (PSI) 3 PSI DROP RATE (PSI/SEC) 2 PSI/SEC

TORNADO MISSILE SPECTRUM: 3.5 TABLE 3.5-9, & 3.5-10

FLOOD 3.4

HEIGHT ABOVE GRADE, MAX. DESIGN BASIS FLOOD ELEV (FT) 635.1 FT

MAX HISTORIC FLOOD (FT) 610 ft

PMF HEIGHT MPF (FT) 631 MAX. GROUND WATER TABLE ELE (FT) 610 FT

PLANT FLOOD PROTECTION FEATURES:

FIG. 2.4.10 ... FLOOR ELEV. 634 FT

3 FT HIGHER THAN PMF, WATER TIGHT ... etc

& SEE 2.4.12

SEC 2.3 **SNOW/ICE** 2.4.12 ... SNOW 40 PSF ... PMF WEIGHT 34.8 ... 70.8 PSF

DESIGN LOAD (#/FT²) 375 KIPS or 1.5 KIPS/FT, 1.8 KIPS/FT RECURRENCE INTERVAL (YR) 100 YEARS

BLAST ENVIRONMENT (DESCRIBE)

SEC 2.2.3.1.1.1 OVERPRESSURE - NOT TO EXCEED 2.3 #/IN²

AIRCRAFT IMPACT ENVIRONMENT (DESCRIBE)

SEC 3.5.1

OBE = OPER BASIS EARTHQUAKE; SSE = SAFE SHUTDOWN EARTHQUAKE

SEISMOLOGY

SEISMIC ZONE (UBC) 1 NEAREST FAULT TO SITE (MI) Howell Anticline, Lucas-Monroe Monocline 70 MI

Vert = 2/3 Hor

OBE: VERTICAL .04 (g) HORIZONTAL .06 (g)

SSE OR DBE (g): VERTICAL .08 (g) HORIZONTAL .12 (g)

SITE RESPONSE SPECTRA: TYPE 3C-TOL-4-A

LOCATION

FREQUENCY	33	20	9	5	2.5	1	.025	0.1
HORIZ. AMP. FACTOR (2% DAMPING)					8	—		

SITE PROFILE

ELEV	
	PLANT GRADE
630 – 584	SOIL STRATA I: TYPE; UNIT WT 115#/FT³; SHEAR MODULUS 1.71x10⁴ P..; POISSONS RATIO .49
584 – 494	SOIL STRATA II: TYPE; UNIT WT 135#/FT³; SHEAR MODULUS 1.54x10⁴ PSI; POISSONS RATIO .42
494 TO 240	SOIL STRATA III: TYPE; UNIT WT 135#/FT³; SHEAR MODULUS 2.62x10⁵ PSI; POISSONS RATIO .34
	SOIL STRATA IV: TYPE; UNIT WT; SHEAR MODULUS; POISSONS RATIO
	SOIL STRATA V: TYPE; UNIT WT; SHEAR MODULUS
	BEDROCK: SHEAR WAVE VELOCITY 5000 FT/SEC; SHEAR MODULUS 9.4x10⁵ PSI; BULK MODULUS; E = 2.16x10⁶ PSI

Poissons ratio = .33

Long. Wave Vel. = 10,300

NUCLEAR POWER FACILITY STRUCTURAL DATA SHEET	NAME:	DATE:	PAGE THREE OF EIGHT

MISSILE BARRIER DESIGN

BARRIER DESIGN PROCEDURE:
DESCRIBED IN BC-TOP-9A

DESIGN APPROACHES:

CAT. I STRUCTURES	METHOD FOR LOCAL REQ.	METHOD FOR OVERALL REQ.
UNIT (1) CONTAINMENT		
UNIT (2) CONTAINMENT		
AUXILIARY BLDG	[illegible]	
DIESEL GENERATOR BLDG		
SERVICE WATER COOLING TOWER		
[illegible]		

DESIGN AGAINST TURBINE MISSILE NEEDED (?) YES ✓ NO ____

IF YES, DESCRIBE METHOD USED AND SAR REF. PAGE: 3.5-29
[illegible] Research Laboratory, [illegible]

DESIGN AGAINST AIRCRAFT MISSILE NEEDED (?) YES ✓ NO ____

IF YES, DESCRIBE METHOD USED AND SAR REF PAGE: 3.5-29
BC-TOP-9-A (

SEISMIC SYSTEM AND SUBSYSTEM DESIGN & ANALYSIS

METHOD OF SEISMIC ANALYSIS: TIME HISTORY METHOD (✓)
RESPONSE SPECTRUM METHOD (✓)
OTHER EQUIVALENT STATIC METHOD (✓) MODAL SUPERPOSITION

SEISMIC MOTION DEFINITION:
R.G. 1.60 SPECTRA ____ SITE SPECIFIC SPECTRA HOUSNER AND NEWMARK-DERMAN RESPONSE SPECTRA
SITE SPECIFIC ENSEMBLE OF TIME HISTORIES: MODIFIED TAFT N21E, 1952
DAMPING VALUES USED: R.G. 1.61 - ANNEX 3A BC-TOP-4A (?)
R.G. 1.61 DAMPING VALUE 0 TO 5% OTHER DAMPING VALUES ____
SUPPORTING MEDIA FOR SEISMIC CATEGORY I STRUCTURES:
CONTAINMENT ____ OTHER CAT. I STRUCTURES ____
SPECIAL STRUCTURES ____ TURBINE BUILDING ____
IS SOIL-STRUCTURE INTERACTION ANALYSIS IMPLEMENTED? YES ✓ NO ____
IF YES, DESCRIBE THE METHOD USED: Coupling Structure [illegible]
(ROCK LEVEL, DISPLACEMENT, BOUNDARY VARIATION, PROCEDURES) [illegible]
Foundation [illegible]
Impedance Function [illegible] - TABLE 3-2 - BC-TOP-4-A

NUCLEAR POWER FACILITY STRUCTURAL DATA SHEET	NAME:	DATE:	PART FOUR OF EIGHT

SEISMIC SYSTEM & SUBSYSTEM DESIGN AND ANALYSIS (CONT'ED)

STRUCTURAL MODELING METHODS: (CHECK APPROPRIATE SPACES)

NAMES OF CAT. I STRUCTURES	FEM/FINITE DIFF. 2D	AXISYM.	3D	STICK MODEL 2D	3D	OTHER MODELING METHODS
Unit 1 Containment						
Unit 2 Containment						
Auxiliary Bldg						
Diesel Gen. Bldg						
Service Water [illegible] Bldg, [illegible]						
[illegible] Storage [illegible]						

NOTES:

DEVELOPMENT OF FLOOR RESPONSE SPECTRA: (EC-[illegible])

TIME HISTORY METHOD ✓, OTHER EQUIVALENT METHOD ____

THREE COMPONENTS INPUT ____ TWO COMPONENTS INPUT ____ OTHERS ____

IS FLOOR SPECTRA PEAK BROADENING APPLIED? YES ____, NO ____

IF YES, INDICATE THE BROADENING % APPLIED, ±10% ____, ±15% ____, OTHER% ____

IF MODAL ANALYSIS IS USED, INDICATE METHOD OF MODAL RESPONSE COMBINATION ADOPTED: SRSS ____, SRSS & ABS FOR CLOSE MODES ____

OTHER COMBINATION METHODS ____

See 3.7.2-11 IF TORSIONAL INPUT EFFECTS ARE ACCOUNTED FOR? YES ✓, NO ____

IF YES, DESCRIBE HOW? Application [illegible] seismic [illegible] resulting from decoupled seismic system analysis at an eccentricity [illegible] [illegible] the location of the c.s. eccentric[illegible] or 5% of the width of the structure normal to the direction of input [illegible]

IF ACCIDENTAL TORSIONAL EFFECTS ARE ACCOUNTED FOR? YES ____, NO ____

IF YES, DESCRIBE HOW? ____

IS INTERACTION OF NON CAT. I STRUCTURES W/ CAT. I STRUCTURES CONSIDERED?

YES ✓, NO ____. IF YES, DESCRIBE HOW? [illegible]

SAFETY FACTORS AGAINST SEISMIC OVERTURNING ____, SLIDING ____

MAX. ALLOW. BEARING PRESSURE ____

PROCEDURES FOR ACCOUNTING DIFF. DAMPING VALUES IN DIFF. STRUCTURAL PARTS:

STIFFNESS MATRIX WEIGHTING ____, MASS MATRIX WEIGHTING ____

OTHER METHOD ____, DESCRIBE THE METHOD BRIEFLY ____

NUCLEAR POWER FACILITY STRUCTURAL DATA SHEET	NAME:	DATE:	PAGE [illegible] OF [illegible]

SEISMIC SYSTEM AND SUBSYSTEM DESIGN AND ANALYSIS (CONT'D)

EQUIVALENT STATIC METHOD OF ANALYSIS FOR SUBSYSTEMS: YES ✓, NO ___

IF, YES, DESCRIBE THE CRITERIA USED [illegible]

[illegible]

ANALYSIS CRITERIA AND PROCEDURES FOR PIPING: [illegible]

SEISMIC ANALYSIS OF MULTIPLE SUPPORTED SUBSYSTEMS: ___

TORSIONAL EFFECTS IN SUBSYSTEM ANALYSIS: (DESCRIBE THE CRITERIA) ___

SEISMIC ANALYSIS AND DESIGN OF SPECIAL STRUCTURES

CATEGORY I DAM STRUCTURE: YES ___, NO ✓

IF YES, DESCRIBE STRUCTURAL DIMENSIONS AND ANALYSIS CRITERIA:

CATEGORY I INTAKE STRUCTURE AND SUBMERGED PIPES/TUNNELS: YES ✓, NO ___

IF YES, DESCRIBE KEY STRUCTURAL DIMENSIONS AND ANALYSIS CRITERIA:

CATEGORY I BURIED PIPING/TUNNELS: YES ✓, NO ___

IF YES, DESCRIBE KEY STRUCTURAL DIMENSIONS AND ANALYSIS CRITERIA:

[illegible]

NUCLEAR POWER FACILITY STRUCTURAL DATA SHEET	NAME:	DATE:	PAGE SIX OF EIGHT

SEISMIC ANALYSIS AND DESIGN OF SPECIAL STRUCTURES (CONT'ED)

SEISMIC ANALYSIS OF STRUCTURE/PILE/SOIL MEDIUM SYSTEM: YES ___, NO ___

IF YES, DESCRIBE STRUCTURAL MODELING, ANALYSIS CRITERIA, ASSUMPTIONS AND COMPUTER CODES USED: ______

SEISMIC ANALYSIS AND DESIGN OF CATEGORY I TANKS: YES, ___ NO, ___

IF YES, DESCRIBE STRUCTURAL MODELING, ANALYSIS CRITERIA, ASSUMPTIONS AND COMPUTER CODES USED: ______

SEISMIC ANALYSIS AND DESIGN OF UNDERDRAIN SYSTEMS: YES, ___ NO, ___

IF YES, DESCRIBE KEY STRUCTURAL DIMENSIONS, ANALYSIS CRITERIA AND DESIGN PROCEDURES USED: ______

SEISMIC DESIGN AND ANALYSIS OF SPENT/NEW FUEL POOL STRUCTURES: YES, ______ NO, ______

IF YES, DESCRIBE KEY DIMENSIONS, DESIGN AND ANALYSIS CRITERIA, STDS. OR CODES USED: ______

SEISMIC INSTRUMENTATION

DESCRIBE TYPE, NOS, LOCATION OF SEISMIC INSTRUMENTATIONS USED:

SIX TRIAXIAL TIME-HISTORY STRONG MOTION [illegible]

[illegible]

(NO) IS INSTRUMENTATION NEEDED FOR MEASURING TORSIONAL INPUT PROVIDED

IF YES, DESCRIBE TYPE, NOS, AND LAYOUT OF THE TORSIONAL INSTRUMENTATION: ______

12

NUCLEAR POWER FACILITY STRUCTURAL DATA SHEET	NAME:	DATE:	PAGE [illegible]

CATEGORY I STRUCTURES

CONTAINMENT STRUCTURE: [illegible] STEEL [illegible] CONCRETE [illegible]

TYPE OF CONTAINMENT: REINFORCED CONCRETE ( ), PRESTRESSED CONCRETE (✓), STEEL SHELL, ( )

DESIGN CODES USED: TABLE 3.2-1 ACI-318, AISC ANS [illegible] [illegible]

LOAD COMBINATIONS: a) D + F + L + To b) [illegible] + F + [illegible] + P + To
c) D + L + E + P + T, D = DEAD LOAD, E = [illegible] LOAD, L = [illegible]
[illegible] INTENSITY P = DESIGN [illegible] T = THERMAL [illegible]
[illegible] LOADS [illegible] To = THERMAL [illegible]

STATIC ANALYSIS METHOD AND CODES: FINITE [illegible] AXISYMMETRIC GLOBAL LOAD [illegible]
INCLUDING NONLINEAR TRANSIENT [illegible] [illegible]
[illegible] NONAXISYMMETRIC GLOBAL LOADING [illegible]

DYNAMIC ANALYSIS METHOD AND CODES:

SPECIAL CONSTRUCTION TECHNIQUES USED, FSAR AT: 3.8.1.6

UNIQUE PROBLEMS (IF ANY) AND THEIR DISPOSITION:

DESCRIPTION OF BASE MAT, DOME, HATCH AND PENETRATION DESIGN: FIG. 3.8-1-3
BASE MAT - REINFORCED CONCRETE SLAB - [illegible] FOR POST TENSIONING
[illegible] WALL PRESTRESSING [illegible] OF (VERT) [illegible] TENDONS
DOME - [illegible] PRESTRESSING [illegible] TENDONS [illegible]
[illegible] WELDED [illegible]
PENETRATIONS ARE FABRICATED OF STEEL [illegible] WELDED TO LINER PLATE [illegible]

POLAR CRANE SUPPORT DESIGN: F. 3.8-46

CONTAINMENT MAT BEARING PRESSURE:

CONTAINMENT INTERIOR STRUCTURE DESIGN:

"KEY CONTAINMENT INTERIOR STRUCTURES"	DESIGN METHOD, CODES
[illegible] SUBSECTION [illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible] SUBSECTION [illegible]	

CONTAINMENT OPERATIONAL DESIGN AND TESTING:

NUCLEAR POWER FACILITY STRUCTURAL DATA SHEET	NAME:	DATE:	PAGE EIGHT

CATEGORY I STRUCTURES (CONT'D)

DESIGN METHOD/CODES FOR OTHER CATEGORY I STRUCTURES:

CATEGORY I STRUCTURES (OTHER THAN CONTAINMENT)	DESIGN CODE AND ANALYSIS METHODS	LOAD COMBINATIONS (PROVIDE REF. SUP. NO. OR)
[illegible] Building	Regulatory Guide 1.13	P6 3.[illegible]
[illegible] Area [illegible]		Load Comb. [illegible]
Service Water [illegible]		3.[illegible]
[illegible] Water Storage Tank	ASME Boiler & Press. Vessel	Table 3.[illegible]
	(Roark & Flat [illegible])	

EXCEPTIONS TAKEN TO THE DESIGN CODE USED: (IF APPLICABLE)

UNIQUE DESIGN PROBLEM(S) (IF ANY) AND THEIR DISPOSITION:

MATERIALS, QUALITY CONTROL AND SPECIAL CONSTRUCTION TECHNIQUES:

Subsection 3.8.1.6

TESTING, INSPECTION REQUIREMENTS:

SPECIAL DESIGN AND ACCEPTANCE CRITERIA: (IF ANY)

SPECIAL DESIGN AND ANALYSIS PROCEDURES (IF ANY):

OTHER ITEMS:

RESPONSE EVALUATION SUMMARY			Page ______ of ______ pages
FACILITY:		REVIEWER:	
REQUEST NUMBER	REFERENCE NUMBER	AMENDMENT NUMBER/PAGES	RESPONSE EVALUATION/ACTION

Figure 3. SEC Response Evaluation Sheet

SEC Form 14 [illegible] (Oct [illegible])

II. REVIEW TECHNICAL CHECKLIST AND ELEMENTS SUMMARY

CHECKLIST AND REVIEW SUMMARY

SECTION 3.3.1 WIND LOADING

A. DESIGN WIND VELOCITY, RECURRENCE INTERVAL, VERTICAL VELOCITY PROFILES AND GUST FACTORS (3.3.1.1) — F 3.3-1

Values reviewed for information only

- or -

SWESSAR

85 MPH @ 30 FT 100 YEAR, GF 1.0

VERTICAL VELOCITY PROFILE ASCE 3269 TABLE 1(a)

B. WIND FORCE DISTRIBUTION, SHAPE COEFFICIENTS AND VELOCITY/PRESSURE TRANSFORMATION PROCEDURES (3.3.1.2) — F 3.3-1

The provision of A58.1-1972 are applied

- or -

The provisions of ASCE Paper 3269 are applied

- or -

Stone & Webster Safety Analysis Report SWESSAR

C. OTHER CONSIDERATIONS — N/A

SECTION 3.3.2 TORNADO LOADINGS

Section 3.5 of 7

A. TORNADO TRANSLATIONAL AND TANGENTIAL VELOCITIES, TORNADO PRESSURE DIFFERENTIAL AND TIME INTERVAL AND TORNADO MISSILE SPECTRUM WITH SPECIFIED CHARACTERISTICS (3.3.2.1) Pg. 3.3-2 / Pg. 2.3-?

Values reviewed for information only

- or -

SWESSAR

TRANSLATIONAL Vt = 5? 70 MPH, ROTATIONAL V = 290 MPH

PRESSURE DIFFERENTIAL = 3 LB/in² DROP IN 1.5 SEC FOLLOWED BY A LAG OF 2 SEC ... 3 LB/in² IN 1.5

B. TORNADO FORCE DISTRIBUTION, SHAPE COEFFICIENTS AND VELOCITY/PRESSURE TRANSFORMATION PROCEDURES (3.3.2.2) Pg. 3.3-2

The provision of ASA.1-1972 with shapes as specified in ASCE 3269 are applied

- or -

The provisions of ASCE Paper 3269 are applied exclusively

- or -

SWESSAR

(BC-TOP-3A)

C. VENTING CONSIDERATIONS (3.3.2.2) Pg. 3.3-2

The procedures by which venting, if considered, is used to reduce to tornado vacuum are described

- or -

BC-TOP-3, SWESSAR

+ PROVISION OF VENTS ?

APPLIES TO AUXILARY BLDG ONLY - OTHER BUILDINGS NOT MENTIONED

D. TORNADO MISSILE LOAD TRANSFORMATION PROCEDURES (3.3.2.2) Pg. 3.5-23 INFO ?

The procedures by which tornado generated missiles are transformed into effective loads are described

- or -

BC-TOP-9, SWESSAR

E. TORNADO LOAD EFFECT COMBINATION (3.3.2.2) Pg. 3.3-2

The tornado wind and pressure effects will be combined directly in a manner such as to be conservative for the structural element being considered. A satisfactory method of combining these effects is as follows:

(i) $W_t = W_w$

(ii) $W_t = W_p$

(iii) $W_t = W_m$

(iv) $W_t = W_w + .5\ W_p$

(v) $W_t = W_w = W_m$

(vi) $W_t = W_w + .5\ W_p = W_m$

where: W_t ..... total tornado load,

W_w ..... tornado wind load,

W_p ..... tornado differential pressure load, and

W_m ..... tornado missile load.

For each particular structure or portion thereof, the most adverse of the above combinations are used, as appropriate

- or -

BC-TOP-3, SWESSAP.

F. PROVISIONS FOR CATEGORY I STRUCTURES FROM TORNADO FAILURE OF NON-CATEGORY I STRUCTURES (3.3.2.3) PG. 3.3-3

Structures and components exposed to but not designed for tornado loads will be determined not to ~~fail or [illegible]~~ generate missile to the extent that Category I structures will be damaged.

- or -

Category I structures are designed to resist failure, collapse and missiles from structures and components not designed for tornado loads

- or -

BC-TOP-3, SWESSAP.

G. OTHER CONSIDERATIONS FIG. 3.3-1 & 2

[Q] SECTION 3.3.1.2 STATES THAT DESIGN WIND LOADINGS FOR EACH CATEGORY I STRUCTURE IS SHOWN IN FIG'S 3.3-1 & 2 HERE ONLY FOUR THE AUXILIARY BUILDING, THE SERVICE WATER PUMP STRUCTURE, DIESEL GENERATOR BUILDING AND THE CONTAINMENT ARE IDENTIFIED. IN SECTION 3.2 YOU IDENTIFY MORE THAN FOUR BUILDINGS AS CATEGORY I STR. WHERE IS INFO FOR OTHER CATEGORY I STRUCTURES?

SECTION 3.4.2 ANALYSIS PROCEDURES (FLOOD)

A. DESIGN FLOOD AND/OR GROUND WATER LEVELS AND LOADINGS (3.4.2) — P 3.4-1-7

Flood level values reviewed for information only. Flood level's indicated as applied as hydrostatic loadings or properly relieved by appropriate means

- or -

SWESSAR.

Compliance with Regulatory Guide 1.59 ?
(Appendix 3A)

B. DYNAMIC FLOOD-TO-LOAD TRANSFORMATION PROCEDURES (3.4.2) — P 3.4-1-7

COMPARE 1Q The procedures as delineated in the U.S. Army Coastal Engineering Research Center Technical Report No. 4 are applied

- or -

SWESSAP.

→ Compliance with Regulatory Guide 1.59 ?

(Hardened Protection Approach)

C. STATIC FLOOD-TO-LOAD TRANSFORMATION PROCEDURES (3.4.2) — P 3.4-1-7

Except where relieved by drainage and pumping, the hydrostatic head from highest flood or ground water level is applied as a direct foundation slab and basement wall load for structural and buoyancy computations. For lateral and overturning effects total wave included head is considered

- or -

SWESSAR.

Compliance with Regulatory Guide 1.59 ?

(Hardened Protection Approach)

2Q ① What is Hardened Protection App. ② How does the use of these two criteria affect results

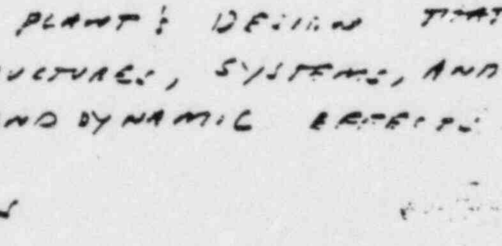
Hardened Protection Approach - Structural provisions are incorporated in the plant design that protect safety-related structures, systems, and components from the static and dynamic effects of a flood.

D. Other Considerations — 3.4-263

Water Level 635.5

Grade Level 634.0

Water Membrane Level 632.0 ?



SECTION 3.5.3 STRUCTURAL (BARRIER) DESIGN PROCEDURES

A. PROCEDURES FOR CONCRETE LOCAL DAMAGE PREDICTION (3.5.3) — P 3.5-28

Modified Petry equation as given in "Design of Protective Structures" (Amerikian), NP-3726.

\- or -

Other equations shown to have equivalent conservatism.

\- or -

Test data for missiles and barriers employed.

\- or -

USED BC-TOP-9, SWESSAP.

Q CONSIDER THRU CRACKS FOR BUILDING WITH SETTLEMENT DIAGRAMS SITE THE EVALUATION

B. PROCEDURES FOR STEEL LOCAL DAMAGE PREDICTION (3.5.3) — P 3.5-28

Stanford Research Institute equations

\- or -

Other equations shown to have equivalent conservatism

\- or -

Test data for missiles and barriers employed

\- or -

BC-TOP-9, SWESSAP

C. PROCEDURES FOR COMPOSITE SECTION LOCAL DAMAGE PREDICTION (3.5.3) — P 3.5-28

The method of Recht and Ipson is applied when the first barrier is steel

\- or -

BC-TOP-9

D. PROCEDURES FOR OVERALL RESPONSE PREDICTION (3.5.3) — P 3.5-28

The Williamson and Alvy procedure (NP-6515) is employed

\- or -

Procedures that produce comparable results are employed.

\- or -

BC-TOP-9, SWESSAP.

F. SPALLING AND SCABBING PROCEDURES. — P 3.5-28-29

Reviewed on a case-by-case basis. "No position."

J.V. Rotz "Results of Missile Impact Tests on Reinforced Concrete Panels" (pg 3.5-2)

G. OTHER CONSIDERATIONS. — 3.5-29

ARE TURBINE MISSILES AND OTHER COMPONENTS CONSIDERED TREE 'A. TURBINE AXIS PARALLEL TO CONTAINMENT, AUX BLDG & [illegible]

ARE COMPARISON OF LOW TRAJ. AND HIGH TRAJECTORY MISSILE [illegible]

SECTION 3.7.1 SEISMIC INPUT

A. DESIGN RESPONSE SPECTRA (SSE AND OBE) (3.7.1.1) — P 3.7-1

Amplification factors are indicated as following Regulatory Guide 1.60 for all damping values and applied at finished grade.

- or -

BC-TOP-4, SWESSAP

B. DECONVOLUTION ANALYSIS PROCEDURES (3.7.1.1) — NA

The maximum acceleration at foundation level shall not be less than 60% of that at the surface and the procedures used are described.

NOT DISCUSSED

APPLIED @ FOUNDATION LEVEL

C. RESPONSE SPECTRA APPLICABILITY FOR VARIOUS FOUNDATION LOCATIONS (3.7.1.) — NA

The basis for the location selected should be described.

NOT DISCUSSED

APPLIED @ FOUNDATION LEVEL

D. RESPONSE SPECTRA/TIME HISTORY COMPARISON (3.7.1.2) — pg 3.7-1

Time history response spectra envelope the design response spectra for all damping values used in design with no more than five (5) points falling below (all within ten (10) percent) design spectra.

- or -

BC-TOP-4 (if 8 points below are allowed), SWESSAP

** USED ... COMPARED WITH THE DESIGN SPECTRA

E. PERIOD INTERVALS FOR TIME HISTORY RESPONSE SPECTRA (3.7.1.2) — P 3.7-1

Frequency intervals demonstrated small enough that reduction does not result in more than ten (10) percent change in computed spectra.

- or -

Minimum set chosen such that each frequency is within ten (10) percent of previous one

- or -

Table 3.7.1.1 review plan values are used.

- or -

BC-TOP-4, SWESSAP

F. PERCENTAGE OF CRITICAL DAMPING VALUES (3.7.1.3) 3.3.7-1&2

Damping values are indicated as being in accord with Regulatory Guide 1.61.

- or -

Higher values are justified.

- or -

FC-TOP-4, SWESSAR

SEE APPENDIX 3 A REGULATORY GUIDE 1.61
FOR CALCULATION OF ROTATION DAMPING - NO CRITERIA FOR MATERIAL DAMPING

G. SUPPORTING MEDIA FOR EACH CATEGORY I STRUCTURE (3.7.1.4) 3.7-2

Information is provided for each structure of foundation embedment depth; to bedrock, foundation width, structure height and soil properties (shear-wave velocity, shear modulus, density) as a function of depth.

VALUES FOR ALL BUT THE BORATED WATER STORAGE TANKS. I DON'T SEE THESE VALUES - TABLE 3.7-1

H. OTHER CONSIDERATIONS 3.7-6

CONSIDERATION OF THE EFFECTS DUE TO ACCIDENTAL TORSIONAL FORCES IN DESIGN (AS A MAXIMUM 5% BASE DIMENSION OFF-SETTING CRITERIA SHOULD APPLY).

FRANK

× CHECK PROBLEM WITH SPECTRA. IT APPEARS THEY HAVE A DIP IN THE MIDDLE FREQUENCIES, ACCORDING TO ONE REVIEWER.

SEE PAGE 2 - SAME CONCERN

SECTION 3.7.2 SEISMIC SYSTEM ANALYSIS

A. DYNAMIC SEISMIC ANALYSIS METHODS USED (3.7.2.1) p 3.7-2

Time history or response spectrum method is used.

\- or -

Equivalent static load method is fully justified

\- or -

BC-TOP-4, SWESSAP

USED Response Spectra M...

(WANT ... ...)

B. DYNAMIC SEISMIC ANALYSIS METHOD ACCOUNTING FOR SOIL-STRUCTURE INTERACTION (3.7.2.4) p 3.7-4

An appropriate method for consideration of soil-structure interaction is indicated to include consideration given to adjacent structures. For rock formations and shallowly embedded deep soil foundations with uniform prospectus, single or multiple spring mass or finite element methods is used. For deeply embedded soil cases the finite element method is used. For all other cases either the multiple-spring-mass or finite element method is used.

\- or -

BC-TOP-5

IMPEDANCE FUNCTIONS ~ EQUIVALENT SPRING

RADIATION DAMPING COEF ... BC-TOP-4

C. DYNAMIC SEISMIC ANALYSIS METHOD CONSIDERATION OF FOUNDATION TORSION, ROCKING AND TRANSLATION (3.7.2.1) p 3.7-6

Consideration is given to foundation torsion, rocking, and translation in the model.

\- or -

BC-TOP-4, SWESSAP

READ PER 3.7.2.11

D. SELECTION OF SIGNIFICANT MODES (3.7.2.1) pg 3.7-2

Investigation is made to ensure that inclusion of additional modes in the result will not effect the result by more than a ten (10) percent increase in response.

\- or -

Twice the number of modes with frequencies lower than 33 cps is used in the result.

\- or -

BC-TOP-4

E. DYNAMIC SEISMIC ANALYSIS CONSIDERATION OF MAXIMUM RELATIVE DISPLACEMENT ALONG SUPPORTS (3.7.2.1) p 3.7-2

Consideration is given in the seismic dynamic analyses of support relative displacement.

- or -

BP-TOP-1 (for piping), SWESSAR

MAXIMUM RELATIVE SEISMIC DISPLACEMENTS ARE CONSIDERED IN ACCORDANCE WITH BC-TOP-4-A

F. OTHER SIGNIFICANT EFFECTS ACCOUNTED FOR IN DYNAMIC SEISMIC ANALYSIS SUCH AS EXTERNAL RESTRAINTS, PIPING INTERACTIONS, HYDRODYNAMIC EFFECTS AND NON-LINEAR RESPONSE (3.7.2.1) p 3.7-2

Consideration is indicated for inclusion of specific significant effects.

- or -

BP-TOP-1 (but not hydrodynamic effects and nonlinear response), SWESSAR

HYDRODYNAMIC EFFECTS CONSIDERED IN THE SEISMIC SYSTEM ANALYSIS

G. MODAL RESPONSE COMBINATION PROCEDURE (3.7.2.7) p 3.7-5

Modes are combined by square root of sum of squares except where closely spaced modes (i.e., modes with frequencies within 10% of each other) are encountered. For closely spaced modes the absolute sum is used

- or -

$$R = \left[\sum_{K=1}^{N} R_k^2 + s \sum R_l R_m \right]^{1/2}$$

- or -

REGULATORY GUIDE 1.92 - WITH EXCEPTIONS STATED IN APPENDIX 3A

H. DYNAMIC ANALYSIS DAMPING SYNTHESIS PROCEDURES (3.7.2.15) p 3.7-[illegible]

The usage of a mass weighting function (fixed base model)

- or -

The usage of a stiffness weighting function (lump spring or (fixed base models)

- or -

A structural and foundation modal synthesis procedure

- or -

The method of Tsai is indicated.

- or -

BC-TOP-4, SWESSAR

EXCEPT DAMPING VALUES [illegible] IN SUBSECTION 3.7.1.3

REFERS TO APPENDIX 3A FOR DISCUSSION W RG 1.61

J. CRITERIA EMPLOYED FOR SYSTEM/SUBSYSTEM DECOUPLING (3.7.2.3) p3.7-4

The following criteria are acceptable:

If RM < 0.01, decoupling can be done for any R_f

If $0.01 \leq R_m \leq 0.1$, decoupling can be done

If $R_f < .8$ or $R_f < 125$

If $R_m > 0.1$, an appropriate model of the subsystem is included

If $R_m > 0.1$, an appropriate model of the subsystem is included where

$R_m = \frac{\text{Total Mass s Supported}}{\text{Total Mass of Support}}$

$R_f = \frac{\text{Fundamental frequency, supported system}}{\text{Frequency of predominant support motion.}}$

SUBSYSTEM DECOUPLING IN ACCORDANCE WITH SECTION 3.2 OF BC-TOP-4-A

K. SELECTION OF LUMPED MASS PROCEDURES (3.7.2.3) P3.7-4

The number of masses selected is adequate when the addition of masses (degrees of freedom) does not result in more than a ten (10) percent increase in response.

\- or -

BC-TOP-4

L. MODELING THREE DIMENSIONAL CONSIDERATIONS (3.7.2.3) P3.7-4

Three dimensional models should be used unless it is justified that coupling among omitted degrees-of-freedom are not significant.

\- or -

BC-TOP-4, SWESSAR

FEEL YOU NEED MORE JUSTIFICATION

M. USE OF CONSTANT VERTICAL AMPLIFICATION FACTORS (3.7.2.10) P3.7-4

Structure is justified as rigid in vertical direction by showing that lowest frequency is more than 33 cps

\- or -

A vertical seismic dynamic analysis model is indicated.

\- or -

BF-TOP-1, SWESSAR

CONSTANT VERTICAL FACTORS ARE NOT USED

N. METHODS FOR ACCOUNTING FOR TORSIONAL EFFECTS (3.7.2.11) p 3.7-4

Dynamic analysis model incorporated torsional degrees-of-freedom

\- or -

Justified static factors are employed.

\- or -

BC-TOP-4, SWESSAR

Application of an eccentricity ... of the ... value ... 5% of the width of the ... normal to ... the input ...

O. FLOOR RESPONSE SPECTRA DEVELOPMENT PROCEDURES (3.7.2.5) p 3.7-5

The three components of motion of individual floor response spectra are combined by square root of sum of square addition at each frequency.

\- or -

BC-TOP-4,

P. FLOOR RESPONSE SPECTRA BROADENING (3.7.2.9) p 3.7-6

Effect of parameter variation in floor response spectrum are accounted for by increasing individual peak widths by ± 15 percent

\- or -

modal frequencies are varied according

to $\Delta f_j = \sqrt{(0.05f_j)^2 + \Sigma(\Delta f_j)_m}$

\- or -

BC-TOP-4, SWESSAR

Q. SEISMIC OVERTURNING MOMENT AND BASE SHEAR CALCULATIONS (3.7.2.14) p 3.7-7

The seismic overturning moment calculation includes consideration of three components of earthquake motion and conservative consideration of vertical and lateral seismic forces.

\- or -

BC-TOP-4, SWESSAR

R. INTERACTION OF CATEGORY I STRUCTURES WITH NON-CATEGORY I STRUCTURES (3.7.2.8) p 3.7-5

The interface between both types is designed for load produced by both types of structures. In addition, all non-category I structures are provided for such that 1) collapse will not strike a Category I structure, or 2) collapse impact will not impair integrity of impacted

Category I structure, or 3) non-Category I structures are designed and analyzed to Category I standards.

S. TIME HISTORY/RESPONSE SPECTRUM RESPONSE COMPARISON (3.7.2.12) P 3.7-7
Results of modal time history and modal response spectra analysis are compared at selected points as a methods check for equivalency.
- or -
SWEBAP
Comparison for containment and auxiliary building presented in Table 3.7-3

T. THREE COMPONENT EARTHQUAKE STRUCTURAL RESPONSE PROCEDURES (3.7.2.6) PG 5.7
When response spectra method is used, the maximum structural response due to each of the three components is obtained as the square root of the sum of the squares of the maximum codirectional response
- or -
If the time history method is used, either the maximum response due to each of three components is obtained and combined as indicated previously or the three components are added algebraically at each time step.
- or -
BC-TOP-4, RR 1.92

U. NATURAL FREQUENCIES, RESPONSE LOADS AND RELATED DATA (OL) (3.7.2.2) P 3.7-F
A summary is provided for representative Category I structures of natural frequencies, mode shapes and modal responses. Time histories are provided for major plant equipment elevations and points of support.
[illegible] for containment & auxiliary buildings

V. METHODS FOR CATEGORY I DAM SEISMIC ANALYSIS (3.7.2.13) PG 3.7-7
A finite element analysis procedure which accounts for time history of forces, behavior of soils and evaluation of deformation is used.
- or -
The method of Seed, Lee and Idriss is employed
(Not utilized)

SECTION 3.7.3 SEISMIC SUBSYSTEM ANALYSIS

A. SEISMIC ANALYSIS METHOD USED (3.7.3.1) — P 3.7-9
The procedures of 3.7.2 are applied as indicated in 3.7.2, items A, C, D, E, F
- or -
SWESSAP
Seismic Category I subsystems other than piping analyzed by use of the response spectrum method ... for piping see appendix 3 ...

B. SEISMIC CYCLES FOR SUBSYSTEMS (3.7.3.2) — P 3.7-9, Appendix ..., P 3D-13
The SSE and five OBE are assumed with the number of maximum stress cycles obtained from a time history of ten seconds minimum duration equal to a minimum of ten maximum stress cycles
- or -
SWESSAP
ASME Section III Nuclear Class I piping ... two occurrences ... equivalent seismic cycles ... times ... (NB-3650 ...)

C. PROCEDURES FOR ANALYTICAL MODELING (3.7.3.3) — P 3.7-11, ...
The procedures of 3.7.2 are applied as indicated in 3.7.2, items I, J, K, L
- or -
SWESSAP
Also BC-TOP-4-A

D. DYNAMIC CHARACTERISTICS OF SUBSYSTEMS (3.7.3.4) — P 3.7-11
Fundamental frequency of subsystems is controlled to be greater than twice or less than one-half the dominant frequency of supporting system
Fundamental frequency ... in accordance with BC-TOP-4-A

E. EQUIVALENT STATIC LOAD METHOD (3.7.3.5) — P 3.7-11 & 12
Justification is provided that system can be represented by simple model and conservative results are obtained in terms of structural response
- and -
The method accounts for relative motion between all points of structural response
- and -
A factor of 1.5 is applied to applicable floor response spectra or a lesser factor justified
BC-TOP-4, SWESSAP
See Appendix 3D Section 3D.3 of 3D

F. MODELING THREE DIMENSIONAL CONSIDERATION (3.7.3.6) p 3.7-12
The procedures of 3.7.2 are applied as indicated in 3.7.2, item L

- or -

BC-TOP-4, SWESSAR

See Appendix 3D -

G. MODAL RESPONSE COMBINATION PROCEDURES (3.7.3.7) p 3.7-12
The procedures of 3.7.2 are applied as indicated in 3.7.2, item G

- or -

BC-TOP-4, SWESSAR

See Appendix 3D - Section 3D.5

H. PIPING ANALYSIS PROCEDURES (3.7.3.8) p 3.7-12
The procedures of 3.7.2 are applied as indicated in 3.7.2, items A, C, D, E, F (dynamic analysis)

- or -

The procedures of 3.7.3 are applied as indicated in 3.7.2, item E

- or -

RP-TOP-1, SWESSAR

See Section 3D.2 of Appendix 3D

Also look at BC-TOP-4

I. MULTIPLY SUPPORTED SUBSYSTEM PROCEDURES (3.7.3.9) p 3.7-13
An upper bound envelope of all individual support point response spectra or, for multiple supports on a single system, the worst floor response spectrum from a set of floor response spectra obtained at various floors is employed to be applied at all support points. In addition, the most unfavorable combination of relatively support point displacements is superimposed.

- or -

Time histories of all supports point motions can be applied directly and simultaneously.

- or -

BC-TOP-4 or RP-TOP-1

Note: No NSSS subsystems are considered as multiply supported

Ref. Appendix 3D

J. TORSIONAL EFFECTS OF ECCENTRIC MASSES (3.7.3.11) p 3.7-14
If the torsional effect of eccentric mass is significant the mass and its eccentricity are included in the model. Criteria for "significance" judged on case-by-case basis.

- or -

BC-TOP-4, SWESSAP

SEE APPENDIX 3D - SECTION 3D.3 OF APPENDIX 3D IF SIGNIFICANT TORSIONAL EFFECTS TAKEN INTO ACCOUNT BY ACCEPTED METHOD

L. BURIED PIPING AND TUNNELS (3.7.3.12) P 3.7-14

The initial effects due to earthquakes are considered on the analysis using the procedures established in "Fundamentals of Earthquake Engineering" or Newmark's paper on "Earthquake Response Analysis of Reactor Structures" in NE and D, vol 20, pp. 303-322.

- and -

The static resistance of surrounding soil is considered using "Beams on Elastic Foundation"

- and -

The effects of local soil arching and settlement are considered.

- or -

BC-TOP-4, SWESSAP

SEE APPENDIX 3D - SECTION 3D.4 - DISCUSSES THE TECHNIQUES USED TO CALCULATE STRESSES FOR SEISMIC LOADS FOR BURIED PIPING AND TUNNELS

M. INTERACTION OF CATEGORY I AND NON-CATEGORY I PIPING (3.7.3.13) P 3.7-14

Non-Category I piping is designed to be isolated from Category I piping or analyzed according to Category I seismic criteria.

- or -

SWESSAP

TECHNIQUES USED DESCRIBED IN SECTION 3.4 OF BP-TOP-1

N. CRITERIA FOR SEISMIC ANALYSIS OF REACTOR INTERNALS (3.7.3.14) P 3.7-14

Dynamic analysis is employed with procedures equivalent to those established for seismic systems. The three components of earthquake motion are considered in a manner analogous to that used for seismic systems.

METHODS USED IN ACCORDANCE WITH B&W TOPICAL REPORT BAW-10008 & B&W TOPICAL REPORT BAW-1012

O. DYNAMIC ANALYSIS DAMPING SYNTHESIS PROCEDURES (3.7.3.15)

The procedures of 3.7.2 are applied as indicated in 3.7.2, item H

- or -

BC-TOP-4, SWESSAP

EXCEPT DAMPING VALUES SPECIFIED IN SUBSECTION 3.7.1.3 OF FSAR

SECTION 3.7.4 SEISMIC INSTRUMENTATION

A. ADHERENCE TO REGULATORY GUIDE 1.12 (3.7.4.1) P 3.7-15

The seismic instrumentation is in compliance with AEC RG 1.12.

\- or -

SWESSAP

Compliance with Regulatory Guide 1.12 discussed in Appendix 3A

B. INSTRUMENT LOCATION AND DESCRIPTION (CP) (3.7.4.3) P 3.7-15

A triaxial time history accelerograph will be installed in the free field or on the containment foundation; a seismic switch with control room readout will be installed on the containment foundation or free field; a triaxial response spectrum recorder with remote control room readout will be installed on the containment foundation; and, in addition, additional instrumentation will be provided at other locations.

\- or -

SWESSAP

C. SEISMIC INSTRUMENTATION PLAN (OL) (3.7.4.2) P 3.7-15

A detailed plan that includes a description of instrumentation locations and how these locations are related to output vibratory motion is provided.

\- or -

SWESSAP

D. OPERATOR NOTIFICATION (3.7.4.3) P 3.7-17

The seismic switch located on the foundation of the containment is connected to event indicators in the control room in such a manner that a signal is given when the preset threshold level (OBE) acceleration) is exceeded

\- and -

The triaxial time history monitor will readout peak acceleration in the control room

\- and -

The response spectrum recorder will readout values at discrete frequencies

\- or -

SWESSAP

SECTION 3.8.1 CONCRETE CONTAINMENT

A. CONTAINMENT GENERAL DESCRIPTION (3.8.1.1)
The description includes plans and sections of the containment and adjacent and abjoining structures, systems and components; details of the base slab; and details of the containment wall and domes.
- or -
SWESSAP, RC-TOP-5
[illegible]
1/2" Liner [illegible]

B. APPLICABLE CODES, STANDARDS AND SPECIFICATIONS (3.8.1.2)
The following are employed:
ACI/ASME 359; RG 1.10, 1.15, 1.18, 1.19, 1.35, 1.55.
- or -
SWESSAP
ACI-359 not used .. Majority of Containment design done prior to issuance of ACI 359
Table 3.8-25 [illegible]
[illegible]

C. LOADS AND LOADING COMBINATIONS (3.8.1.3)
The loads and loading combinations are as specified in ACI-359. Where post-LOCA flooding is a design consideration 1.0D + 1.0L + 1.0Feqo is also applied.
- or -
SWESSAP (2) How about the pressure test [illegible]
Load Combinations specified on [illegible] of FSAR.
See note above on ACI-359 [illegible]

D. DESIGN AND ANALYSIS PROCEDURES (3.8.1.4)
The design and analysis procedures are as established in ACI-ASME 359, Article CC-3000.
- or -
For boundary conditions using foundation finite elements, a further extension would not affect results by more than fifteen (15 percent). For boundary conditions not using foundation finite elements, the foundation slab is used as a boundary with appropriate soil spring representation.
The effects of non-axisymmetric loads such as those induced by wind, tornado, earthquakes and pipe rupture are considered. ?
For localized and transient loads, the overall behavior is determined first and the localized load is superimposed.
For creep, shrinkage and cracking, appropriate procedures are employed.
For computer programs, the program is a recognized program; or the program has been checked against a recognized program; or it has been validated against classical solutions and experimental tests and a summary comparison of all validations are provided.
For tangential shear the provisions of Article CC-3000 are applied. ?

For physical material properties variations, upper and lower bound values are used.
For thickened penetrations, local effect considerations apply.
For steel liner and anchors, CC-3600 applies.
For steel penetrations, section NE applies.

- or -

SWESSAP

E. STRUCTURAL ACCEPTANCE CRITERIA (3.8.1.5) p 3.8-12

For containment shell acceptance, the stress and strain limits are in accordance with CC-3400 provisions, except that for section CC-3411.5, the tangential shear stress carried by concrete, V_c, is limited to 40 psi and 60 psi for the 7th and 8th combinations of Table CC-3000-1.

- and -

For liner plant acceptance, the stress and strain allowables of TAbles CC-3700-1 and CC-3700-2 are applied.

- or -

SWESSAP, BC-TOP-5 ← why not use C... 7.2

Before Feb 1-1971: ACI-318-63 After Feb 1 - ACI 31..

F. MATERIALS, QUALITY CONTROL AND CONSTRUCTION TECHNIQUES (3.8.1.6) p 3.8-15-46

The material provisions of Article CC-2000 of ACI-359 are being followed. The construction and quality control provisions of ACI-359 are being followed.

- or -

SWESSAP

Used ASTM C 150 (cement), ASTM C 33 (aggregates), ACI 613 (mix), ACI 211, ACI-318. ETC

G. TESTING AND INSERVICE SURVEILLANCE (3.8.1.7) P 3.8-..

The provisions of Article CC-6000 of ACI-359 are being followed as augment by the provisions of RG 1.18. For prestressed containments, the inservice surveillance requirements of RG 1.35 (ungrouted tendons) or RG 1.___ (grouted tendons) are followed as applicable.

- or -

SWESSAP, BC-TOP-5A Rev 3

Test procedures complies with NRC Rg ... except as ... in Appendix 5G — Test ...

SECTION 3.8.2 STEEL CONTAINMENT SYSTEM

NA

A. CONTAINMENT GENERAL DESCRIPTION (3.8.2.1) — *p 3.8-*

General information pertaining to the containment shell is provided on (1) the bottom of the steel containment, (2) the cylindrical wall, (3) the dome of the steel shell and (4) major penetrations.

Containment - Prestressed, Reinforced Concrete Structure - This section does not apply.

B. ACCEPTABLE CODES, STANDARDS AND SPECIFICATIONS (3.8.2.2) — *NA*

Subsection NE of the ASME, Section III Division I and Regulatory Guide 1.57 are employed.

B. ACCEPTABLE CODES, STANDARDS AND SPECIFICATIONS (3.8.2.2) — *NA*

Subsection NE of the ASME Section III Division I and Regulatory Guide 1.57 are employed.

C. LOADS AND LOADING COMBINATIONS (3.8.2.3) — *NA*

The loads are as specified in Subsection NE, Section III of the ASME Code and R.G. 1.57. The load combinations employed are: (1) $D+L+P_t+T_t$, (2) $D+L+T_o+P_o$, (3) $D+L+T_o+P_o+E$, (4) $D+L+T_e+R_e+P_e+E'$; (7) $D+L+T_e+R_e+P_e+E'$; (8) $D+L+T_a+R_a+P_a+Y_r+Y_j+Y_m+E'$; and (9) $D+L+F+L+E$

D. DESIGN AND ANALYSIS PROCEDURES (3.8.2.4) — *NA*

The design and analysis procedures are indicated as in compliance with article NE-3000 of the ASME Code Section III Division I and R.G. 1.57. Specific treatment of axisymmetric and non-axisymmetric loads and treatment of transient and localized loads is indicated. Computer codes used in the analysis are described and indicated.

E. STRUCTURAL ACCEPTANCE CRITERIA (3.8.2.5) — *NA*

The stress allowables are indicated as in compliance with Subsection NE, Section III of the ASME Code as tabulated by Table 3.8.2-1 on page 3.8.2-8 of the Standard Review Plan.

F. MATERIALS, QUALITY CONTROL AND SPECIAL CONSTRUCTION TECHNIQUES (3.8.2.6) N/A

The provisions of Article NE-2000 of the ASME Code Section III Division 1 are followed and the Q/A program is in accordance with Articles NE-4000 and NE-5000 of the ASME Code Section III Division 1. Special construction techniques used are discussed and justified.

G. TESTING AND INSERVICE SURVEILLANCE REQUIREMENTS (3.8.2.7) N/A

The preoperational structural proof test is indicated as following Article NE-6000 of ASME Section III Division 1.

SECTION 3.8.3 CONCRETE AND STRUCTURAL STEEL INTERNAL STRUCTURES OF STEEL OR CONCRETE CONTAINMENTS

A. DESCRIPTION OF INTERNAL STRUCTURES (3.8.3.1) — P 3.8-?

For PWR dry containments the description includes reactor supports, steam generator supports, reactor coolant pump supports, primary and secondary shield walls, floors and polar crane structures. For PWR ice condensor containments the description includes, in addition, the divider barrier and ice condenser. For BWR containments the description includes the drywell, weirwall, refueling pool, operating floor, reactor and recirculatory pump supports, reactor pedestal, reactor shield and miscellaneous platforms.

- or -

SWESSAR

B. APPLICABLE CODES, STANDARDS AND SPECIFICATIONS (3.8.3.2) — P 3.8-?

The following are employed:

ACI 318; ACI 349; ASME B&PV Code, Section III, Division 1, Subsections NE and NF; AISC Specifications; ANSI N45.2.5; RG 1.10; RG 1.15; RG 1.55.

- or -

SWESSAR

See P. 3.8-67 thru 70 a

C. LOADS AND LOAD COMBINATIONS (3.8.3.3) — P 3.8-72 (*needs more work AT*)

Except for divider-barrier and ice-condenser elements of PWRs, the drywell of BWR Mark III containments, and linear steel supports of the reactor coolant system, the following apply:

Service Load Conditions:

Concrete and Steel for WSD: (S) (1.33S-Concrete) (1.50S-Steel)

D+L, D+L+E and, if thermal stress is present,

D+L+To + Ro, D+L+To + Ro + E

Concrete for USD: (U)

1.4D + 1.7L, 1.4D + 1.7L + 1.9E

and where thermal stress is present; (U)

(.75) (1.4D + 1.7L + 1.7To + 1.7Ro)

(.75) (1.4D + 1.7L + 1.9E + 1.7To + 1.7Ro)

Steel for Plastic Design:

1.7D + 1.7L, 1.7D + 1.7L + 1.7E

and where thermal stress is present: (Y)

1.3 (D+L + To + Ro)

1.3 (D+L + E+To + Ro)

Factored Load Conditions:

Steel for WSD (1.6S)

D+L+To+Ro+E', D+L+Ta+Ra+Pa,

D+L+Ta+Pa+Pa+ Y + E

D+L+Ta+Pa+Pa+ Y + E'

Steel for Plastic Design and concrete for USD: (1.75) (.9Y)

D+L+To+Po+E', D+L+Ta + Pa + 1.5Pa,

D+L+Ta+1.25 Pa + Y + 1.25 E,

D+L+Ta+Pa+Pa + Y + e'

For the divider barrier and Mark III drywell the loads, load combinations and stress limits of CC-3000 apply.

For ice condenser elements the following apply:

Service Load Conditions:

Steel for WSD:

D+L, D+L+E

Steel for Plastic Design: (Y)

1.7D + 1.7L, 1.7D+1.7L+1.7E

Steel for test verification: (c)

1.9D+1.9L+1.9E

Where thermal stresses are present, the procedures of NF-3221.1 are applied.

F. MATERIALS QUALITY CONTROL AND SPECIAL CONSTRUCTION TECHNIQUES (3.8.4.6) P 3.8-19

Compliance with ACI 318-71 for concrete, AISC-69 for steel, ASME NF for linear supports (Category I components), ANSI N45.2.5 for general quality control, and ACI-359 for repairing bar welding.

- or -

SWESSAR

SEE PAGES 3.8-19 TO 41 ALSO

PAGES 3.8-60 TO 3.8-70 A

G. TESTING AND INSERVICE SURVEILLANCE (3.8.4.7) P 3.8-76

No specific requirements

COMPLIES WITH BC-TOP-5-A & NRC R.G. 1.18 PG. 3.8-60

NOT PLANNED FOR INTERNAL STRUCTURES P 3.8-76

SECTION 3.8.5 FOUNDATIONS

A. DESCRIPTION OF FOUNDATIONS (3.8.5.1)
The foundations, the descriptive information consists of plans and sections for each Category I foundation and method of separation between foundations. For containment base slab, the general arrangement and method of shear transfer is described. 3.8-

SWESSAR - or -

INFO ABOUT CONTAINMENT ... UPPER FLOOR, GORAND WATER STRUCTURE ... ALSO METHOD OF SHEAR IS NOT FULLY DESCRIBED.

B. APPLICABLE CODES, STANDARDS AND SPECIFICATIONS (3.8.5.2)
The following are employed:
ACI 318, ACI 359; ASME B&PV Code, Section III, Div. 1, Subsections I and NF; AISC; ANSI N45.2.5; RG ... Subsections 13.8-5

SWESSAR - or -

C. LOADS AND LOAD COMBINATIONS (3.8.5.3)
Load combinations and stress limits of 3.8.4 apply. Additional load combinations of sliding and overturning are: P 3.8-7

	Sliding	Overturning	Flotation
D+H+E, D+H+W	1.5	1.5	
D+H+E' , D+H+Wt	1.1	1.1	
D+F'			1.1

SWESSAR - or -

CONTAINMENT 3.8.1.3 PAGE 3.8-4

OTHER CAT I 3.8.6 PAGE 3.8-78 TABLE 3.8-9

D. DESIGN AND ANALYSIS PROCEDURES (3.8.5.4)
For concrete structures, ACI 318-71 is utilized. For steel structures, AISC specifications are utilized. 3.8-59

SWESSAR - or -

CONTAINMENT 3.8.1.4 (SECTION)

OTHER CAT I TABLE 3.8-22 3.8.4.4

S.F. FOR SLIDING & OVERTURNING

E. STRUCTURAL ACCEPTANCE CRITERIA (3.8.5.5)
The limits tabulated opposite the load equations apply. 3.8-59

SWESSAR - or -

SUBSECTION 3.8.1.5, S.F.S.S 3.8.4.5, TABLE 3.8-...

SETTLEMENTS FIG 2.5-47, TABLE 3.8-24

F. MATERIALS, QUALITY CONTROL AND SPECIAL CONSTRUCTION TECHNIQUES (3.8.5.6)

P. 3.F-..

The procedures and methods for the Category I containment structures are applied for containment base slab. No special acceptance standards apply to others.

- or -

SWESSAR 3.8.1.6

Sugg...

Load Comb... Combinations (3.8.3.3)

P ...

Factored Load Conditions:

Steel for WSD: (1.35)

D+L+E', D+L+Pa, D+L+Pa+E' (1.6S)

Steel for Plastic Design: (Y)

1.3D+ 1.3L + 1.3E', 1.3D+1.3L+1.3Pa,

1.2D + 1.2L + 1.2Pa+1.2E'

Steel for test verification: (C)

1.4D+1.4L + 1.4E', 1.4D+1.4L+1.4Pa

1.3D + 1.3L + 1.3Pa + 1.3E'

For reactor coolant linear steel supports, the following apply:

For WSD; (Limit of XIII-1100, NF)

D+L+E (X 1.0), D+L+E' (X 1.e), D+L+E' + Pa + Y (X 1.6)

For Plastic Design: (.7Y)

1.7 (D+L+E)

1.3 (D+L+E')

1.0 (D+L+E' + Pa + Y)

- or -

SWESSAR

D. DESIGN AND ANALYSIS PROCEDURES (3.8.3.4)

3.8-4 7-...

For PWR Dry Containments the design and analysis procedures for linear reactor coolant supports are in accordance with Subsection NF. The primary shield wall, secondary shield wall, other interior structures and the reactor cavity design and analysis procedures are in accordance with ACI 318-71.

For PWR ice-condenser divider barriers and BWR drywells, design and analysis procedures are in accordance with those delineated in section CC-3000 of ACI-359 for concrete elements and subsection NE for steel elements. For BWR steel drywell elements the design and analysis acceptance criteria of Section 3.8.2 apply.

- or -

SWESSAR

WSM STEEL

USM CONCRETE

BN-TOP-2 & BC TOP-9A (PIPE BREAK EFFE...

E. STRUCTURAL ACCEPTANCE CRITERIA (3.8.3.5)

With the exception of the divider-barrier and ice condenser elements of PWR containments; the drywell of the Mark III; and the linear steel supports of the reactor coolant system; the stress limits tabulate opposite the load equations apply where S = the required section strength based on elastic allowables of ACI-318 and the AISC specifications, Part I; U = the required section ultimate strength, Y = the AISC specification allowables, Part II, and C = tested collapse strength. For the PWR divider barrier and BWR dry well, concrete CC-3400 applies. For the PWR divider-barrier and BWR dry well steel, Subsection NE applies.

\- or -

SWESSAR

Structural Acceptance Criteria Subsection 3.8.6.5

F. MATERIALS, QUALITY CONTROL AND SPECIAL CONSTRUCTION TECHNIQUES (3.8.3.6)

Compliance with ACI 318-71 for concrete, AISC-69 for steel, ASME NF for reactor coolant system supports, ANSI N45.2.5 for general quality control and ACI-359 for reinforcing bar welding.

Subsection 3.8.1.6

SECTION 3.8.4 OTHER CATEGORY I STRUCTURES

A. DESCRIPTION OF OTHER CATEGORY I STRUCTURES (3.8.4.1) p3.8-5?

For other Category I structures the description includes the containment enclosure building, auxiliary building, fuel storage building, control building, diesel generator building, and miscellaneous Seismic Category I structures.

\- or -

SWESSAP

Containment ... [illegible] ... Service Water Pump Structure ... Retaining Walls, Discharge ... Structures & Valve ... Water Storage Tank.

B. APPLICABLE CODES, STANDARDS AND SPECIFICATIONS (3.8.4.2) p3.8-?

The following are employed:

ACI 318; ACI 359; ASME B&PV Code Section III, Div. 1, Subsections NF and NE; AISC; ANSI 45.2.5; RG 1.10; RG 1.15; RG 1.55

Subsection 3.8.6.2 + Specific Options

C. LOADS AND LOAD COMBINATIONS (3.8.4.3) p3.8-?

The following load combinations apply

Service Load Conditions:

Concrete and Steel for WSD: (S)

D+L, D+L+E, D+L+W

and if thermal stress is present (1.3S-Concrete 1.5S-steel)

D+L + To + Ro, D+L+To+Ro+E

D+L+To+Ro+W

Concrete for USD;

1.4D+1, 1.4D+L+1.9E,

1.4D+1.7L+1.7W

and if thermal stress is present (U)

(.75) (1.4D+1.7L+1.7To+1.7Ro)

(.75) (1.4D+1.7L+1.9E+1.7To+1.7Ro)

(.75) (1.4D+1.7L+1.7W+1.7To+1.7Ro)

Steel for Plastic Design: (Y)

1.7D+1.7L, 1.7D+1.7L+1.7E,

1.7D+1.7L+1.7W

Factored Load Conditions:

Steel for WSD: (1.6S)

D+L+To+Ro+E' and W_T, D+L+Ta+Ra+Pa

D+L+Ta+Ra+Pa+Y+E

Steel for plastic design and concrete for USD: (1.0S) (.9Y)

D+L+To+Ro+E' and W_T, D+L+Ta+Ra+1.5Pa

D+L+Ta+1.25Pa+Y+1.25E,

D+L+Ta+Ra+Pa+Y+E'

\- or -

SWESSAP

D. DESIGN AND ANALYSIS PROCEDURES (3.8.4.4) P. 3.8-55

For concrete structures ACI 318-71 is utilized. For steel STRUCTURES, AISC specifications are utilized.

\- or -

SWESSAR

Subsection 3.8.4.4 — Specifies ACI & AISC Code Usage

E. STRUCTURAL ACCEPTANCE CRITERIA (3.8.4.5) P. 3.8-56

The stress limits tabulated opposite the load equations apply.

\- or -

SWESSAR

See Subsection 3.8.4.5

Table 3.8-10 to 22 [illegible]

MIDLAND PLANT [UNIT 1 & 2]

CATEGORY I STRUCTURES (PG - 3.8-51)

1) UNIT 1 & 2 CONTAINMENT
2) AUXILIARY BUILD.
3) DIESEL GEN. BUILD.
4) SERVICE WATER COOLING TOWER
5) BORATED WATER STORAGE TANKS.

QUESTIONS SECTION 3.3

(1) CATEGORY I STRUCTURES - SHOWING WIND FORCES & DISTRIBUTION ARE THE AUXILIARY BUILDING, CONTAINMENT, SERVICE WATER PUMP STRUCTURE AND THE DIESEL GENERATOR BUILDING. WHAT ABOUT THE BORATED WATER STORAGE TANKS? DO NOT SEE ANY WIND LOADING'S FOR THIS (CATEGORY I) STRUCTURE.

(2) FIG 3.3-1 & 3.3-2

(3) IN CASE OF RUPTURE OF THE BORATED WATER TANKS DUE TO A TORNADO OR TORNADO GENERATED MISSILE, THE LIQUID WOULD BE CONTAINED WITHIN THE REINFORCED CONCRETE DYKE SURROUNDING THE TANKS. (PG 3.8-54 -) ??

QUESTIONS: SECTION 3.4.2

① DO THE FLOOD STATIC & DYNAMIC EFFECTS AS DESCRIBED IN REGULATORY GUIDE 1.59 COMPLY WITH THE U.S ARMY COSTAL ENGINEERING RESEARCH CENTER TECHNICAL REPORT NO 4 OR SWESSAC ?

QUESTIONS 3.5.3

1. FOR CONCRETE LOCAL DAMAGE PREDICTION
WHAT IF ANY ARE THE DIFFERENCES BETWEEN THE MODIFIED PETRY EQUATION AS GIVEN IN "DESIGN OF PROTECTIVE STRUCTURES" (AMERICAN), NP-3726 AND BC-TOP-9, OR SWESSAP?

2. PROCEDURES FOR STEEL LOCAL DAMAGE PREDICTION
WHAT IF ANY ARE THE DIFFERENCES BETWEEN THE STANFORD RESEARCH INSTITUTE EQUATIONS AND BC-TOP-9, OR SWESSAP?

3. PROCEDURES FOR COMPOSITE SECTION LOCAL DAMAGE PREDICTION.
WHAT IF ANY ARE THE DIFFERENCES BETWEEN THE METHOD OF RECHT AND IPSON IS APPLIED WHEN THE FIRST BARRIER IS STEEL & WHEN BC-TOP-9 IS USED UNDER SIMILAR CONDITIONS?

4. PROCEDURES FOR OVERALL RESPONSE PREDICTION
WHAT IF ANY ARE THE DIFFERENCES BETWEEN WILLIAMSON AND ALVY PROCEDURE (NP-6515) AND BC-TOP-9 OR SWESSAP?

5. QUESTIONS 1 TO 4 ARE FOR MYSELF-

QUESTIONS ... 3.7-1

① SUPPORTING MEDIA FOR EACH CATEGORY I STRUCTURE.

DID NOT SEE VALUE FOR BORATED WATER STORAGE TANKS (TABLE 3.7-1). I BELIVE THE BORATED WATER TANKS ARE CATEGORY I STRUCTURES — AM I CORRECT?

IF SO WOULD LIKE TO SEE THESE VALUES. (IN TABLE)

1) EMBEDMENT DEPTH —
2) BEDROCK
3) FOUNDATION WIDTH (52' DIA TANK)
4) STRUCTURE HEIGHT (32' HEIGHT)

QUESTION 3.7.2.3

1) THE STATEMENT THE CONSTRUCTION AND DESIGN OF CATEGORY I STRUCTURES MINIMIZE THE COUPLING EFFECTS BETWEEN PRINCIPAL BUILDING DIRECTION BY ITSELF DOES NOT JUSTIFY THE USE OF LESS COMPLEX THAN COMPLETE 3-D MODELS. BUT TELL WHAT IN THE CONSTRUCTION AND DESIGN LEADS YOU TO THIS CONCLUSION.?

P. 3.7-2 TO 3.7-4

QUESTIONS 3.8.5 FOUNDATION

① P. 3.8-57 OF FSAR MENTIONS THAT THE FOUNDATION DESIGN INCORPORATES A WATERPROOF MEMBRANE UP TO ELEVATION 632 FT FOR THE CONTAINMENT, THE AUXILIARY BUILDING AND PORTION OF THE TURBINE BUILDING.

WHAT IS THIS WATERPROOF MEMBRANE ? IS IT THE 1/4 STEEL LINER FOR THE CONTAINMENT ?

② P. 3.8-57 OF FSAR STATES THAT DUE TO THE [illegible] CONFIGURATION OF THE FOUNDATIONS SHEAR TRANSFER WILL NOT BE AFFECTED BY THE MEMBRANE. WHAT DO THEY MEAN BY THIS.

THE AUXILIARY BUILD FOUNDATION IS AT SIX DIFFERENT ELEVATIONS - THE CONTAINMENT IS AT ONE - JUST DONT UNDERSTAND THEIR STATEMENT ? DOES IT APPLY TO ALL CAT I STRUCTURES ?

LOADS & LOADING COMBINATIONS

CONTAINMENT. DESIGN LOADS (WORKING STRESS BASIS)

a. $D + F + L + T_0$

b. $D + F + L + P + T_A$

c. $D + L + F + P_t + T_t$

D = DEAD LOAD
F = PRESTRESS LOAD
L = LIVE LOAD
P_t = PRESSURE (STRUCTURAL INTEGRITY OR LEAK RATE TEST)
P = DESIGN PRESSURE LOAD WITHIN CONTAINMENT GENERATED BY DESIGN BASIS ACCIDENT
T_0 = THERMAL LOAD DUE TO OPERATING TEMP
T_t = THERMAL EFFECTS AND LOADS DURING TEST
T_A = THERMAL LOADS BASED ON TEMPERATURE DISTRIBUTION CORRESPONDING TO ACCIDENT PRESSURE

FACTORED LOADS

a) $C = 1/\phi\,(1.05D + 1.5P + 1.0T_A + 1.0F)$

b) $C = 1/\phi\,(1.05D + 1.25P + 1.0T_A + 1.25H + 1.25E + 1.0F)$

c) $C = 1/\phi\,(1.05D + 1.25H + 1.0R + 1.0F + 1.25E + 1.0T_0)$

d) $C = 1/\phi\,(1.05D +$

QUESTIONS SECTION 3.3.2 OF SER

(1) TORNADO MISSILE SPECTRA DOES NOT INCLUDE TOTAL MISSILE SPECTRA OF STANDARD REVIEW PLAN 3.5.1.4 WHICH ARE PART OF CURRENT NRC MISSILE SPECTRA?

(2) IN SECTION 3.5 ASK QUESTION ON HOW VENTS (AUXILIARY BUILD) ARE IF AT ALL FREE MISSILES ?

(3) PROVIDE INFORMATION ON BUILD DESIGN WIND LOADING FOR ALL CATEGORY I STRUCTURES - DON'T SEE ANY CRIT. FOR THE BORATED WATER STORAGE TANKS?

(4) STATEMENT ON EVALUATION FINDINGS - SHOULDNT THIS BE CHANGED WHEN DISCREPANCIES OR QUESTIONS ON SECTION EXIST?

QUESTION SECTION 3.4.2 OF [illegible]

ROD/IT ① HOW DOES THE PROCEDURES AS DOCUMENTED IN THE U.S. ARMY COSTAL ENGINEERING RESEARCH CENTER TECHNICAL REPORT NO 4 COMPARE WITH REGULATORY GUIDE 1.59 ?? ← QUESTION RAISED SINCE THEY MENTION RG 1.59 ?

R[illegible] ② HOW DOES THE HARDEN PROTECTION APPROACH COMPARE WITH R.G 1.59 ??.

③ WATER LEVEL 635.5 (MAX FLOOD)
GRADE LEVEL 634.0
WATER MEMBRANE LEVEL 632.0 ??

This seems to be below WATER LEVEL

a) WHAT EFFECT - DOES THIS HAVE ON STRUCTURE?

b) DURING FLOOD - CAN WATER SEEP - INTO BUILD'G.

c) WHY not bring MEMBRANE ABOVE MAX FLOOD WATER LEVEL?

④ STATEMENT ON EVALUATION FINDINGS - SHOULDN'T THESE BE REMOVED.

SECTION 3.8.3 & 4

REQUESTED APPLICANT TO GIVE NRC DETAIL INFORMATION ON CATEGORY I CONCRETE WALL

REF MEMO APRIL [illegible], [illegible]

FINAL EVALUATION TO BE COMPLETED UPON RECEIPT OF [illegible] INFORMATION.

WANT COPY OF THIS REQUEST -
WAS WHEN IT & TO WHOM ?
WHAT DETAILS & INFORMATION
WAS ASK FOR -

Section 3.3.1 A SEE PAPER 3259

3.3.2 BCTOP 3-A
BCTOP -9-A

3.4.2 RG 1.59

3.5.2 BCTOP-9-A

3.7.1 BCTOP-...
3.7.2 RG 1.92
3.7.3 } → BCTOP-1
BCW TOP ... 1-... & ...

3.9.1 RG 1.10
1.15
1.15
1.79
1.35
RG 1.55
BCTOP -7A
BCTOP -3A
3.9.3 BCTOP-2

SECTIONS 3.3
3.4
3.5.3
3.7
3.9

(1) CONTAINMENT DESIGNED BY
BECHTEL POWER CORPORATION (BECHTEL)

PRINCIPAL BUILDINGS AND STRUCTURES

CAT I → a) UNIT 1 CONTAINMENT STRUCTURE
CAT I → b) UNIT 2 CONTAINMENT STR
c) TURBINE BUILDING
CAT I → d) AUXILIARY BUILDING
e) ADMINISTRATIVE AND SERVICE BUILDING
CAT I → g) DIESEL GENERATOR BUILDING
h) SOLID RADWASTE BUILDING
i) COMBINATION SHOP
j) COOLING POND WITH INTAKE AND DISCHARGE STR
CAT I → k) SERVICE WATER COOLING TOWERS
l) RIVER INTAKE AND DISCHARGE STR

(2) page ~~1-2-6 - CODES AND STANDARDS SPECIFICATIONS~~ →
~~CAN THEY PICK THREE OWN~~ — ?
~~SK MUST THEY COMPLY WITH A~~
CERTAIN SET →

(3) ASCE PAPER 3269

(4) SEC 3.5.3
~~NATIONAL DEFENSE RESEARCH COMMITTEE FORMULA~~ (NDRC)
CONCRET BARRIERS

~~BALLISTIC RESEARCH LABORATORY FORMULA~~ (BRL) STEEL

3.8.1.2.1 Codes Page 3.8-2

... for local buckling - the allowable ... the ... effects of ... are 90% yield for steel ... ult. ...

Computer Programs

(1) FINEL — FINITE ELEMENT STRESS ANALYSIS
STATIC ANALYSIS — PLANAR OR AXISYMMETRIC ...

(2) ASHSD — AXISYMMETRIC SHELL & SOLID ANALYSIS
STATIC ANALYSIS OF LINEAR ELASTIC AXISYMMETRIC STRUCTURES WITH AXISYMMETRIC OR NON AXISYMMETRIC LOADING

(3) SAP — STRUCTURAL ANALYSIS PROGRAM
STATIC ANALYSIS OF LINEAR ELASTIC THREE-DIMENSIONAL STRUCTURES USING FEM

(4) KSHEL — ANALYSIS OF AXISYMMETRIC SHELLS
PROGRAM CALCULATES ELASTIC DEFLECTIONS AND STRESSES IN THIN WALLED AXISYMMETRIC SHELL SUBJECTED TO ARBITRARY SURFACE EDGE AND RING LOADS (MECHANICAL AND THERMAL)
SHELL WALL CAN CONSIST OF LAYERS OF DIFFERENT ISOTROPIC OR ORTHOTROPIC MATERIALS

STRUCTURAL ACCEPTANCE CRITERIA

Before FEB 1 1973 ACI 318-63

After FEB 1 1973 ACI 318-71

EXCEPTIONS

a) FACTORED LOAD CONDITIONS
b) COMPRESSION IN CONCRETE

Stress does not exceed .85 f'c

Strain does not exceed .003

TENSION IN CONCRETE

TENSILE STRENGTH IS NEGLECTED IN RESISTING FLEXURAL MEMBRANE FORCES

RADIAL SHEAR IN CONCRETE page 3.8-13 & 14

MEMBRANE SHEAR IN CONCRETE page 3.8-14

(1) BSAP — BECHTEL STRUCTURAL ANALYSIS PROGRAM
MODIFIED VERSION OF SAP

(2) ICES-STRUDL — INTEGRATED CIVIC ENGINEERING SYSTEM STRUCTURAL DESIGN LANGUAGE

Performs linear elastic, static, frame analyses.

NAJ/ STARDYNE STATIC AND DYNAMIC STRUCTURAL ANALYSIS SYSTEM

(F.E. program - analyze linear elastic structures.

634	634	634
- 50	140	340
5?	494	294

COMPUTER PROGRAMS USED IN THE SEISMIC ANALYSIS

1) SPECTRA
2) MODAL ANALYSIS OF PLANE FRAMES
3) TIME HISTORY ANALYSIS
4) RESPONSE SPECTRA
5) COMPOSITE DAMPING FOR SOIL-STRUCTURE SYSTEMS
6) BECHTEL STRUCTURAL ANALYSIS PROGRAMS

(

WANT BC-TOP-4-A

BC-TOP-9-A

Appendix 3D

B&W TOPICAL REPORT BAW 10003 PART 1 REV. 1

B&W TOPICAL REPORT BAW [illegible] REV. 1

... FOR ACCIDENTAL TORSIONAL EFFECTS ...

1) MULTIPLE SUPPORTED SUBSYSTEMS
TORSIONAL EFFECTS ...

(2) [illegible]

(3) BURIED ... [illegible]

(4) STRUCTURE / PIPE / [illegible]

(5) [illegible]

(6) UNDERDRAIN SYSTEMS

(7) [illegible]

---

(1) SEISMIC ANALYSIS OF PIPING SYSTEMS [illegible]

(2) [illegible]

BC-TOP-7-A
BC-TOP-5 REV 1 > BUTTRESS AND [illegible] TENDON ANCHORAGE REGION

[illegible] OF BC-TOP-1 REV. 1 > SMALL PENETRATION BLOCKOUTS

BC-TOP-9-A
KSHELL > PIPE RESTRAINT EMBEDMENTS

BC-TOP-5A SUBSECTION 4.5.7 of > RADIAL TENSION DUE TO CURVATURE IN POST TENSIONING

ACI 318-63 > -Basic Shear Concrete
ACI 318-71

Containment

1. L = D + F (Initial transfer of prestress)
2. L = D + F (Construction ...)
3. L = D + F + L + T_0 (WINTER) — OK
4. L = D + F + L + T_0 (SUMMER)
5. L = D + F + L + P + T_A (WINTER) — OK
6. L = D + F + L + P + T_A (SUMMER)
7. L = D + F + L + P_T — Not OK, left out T_0 term
8. L = 1.05D + F + 1.5 P + T_A (WINTER) — OK
9. L = 1.05 D + F + 1.5P + T_A (SUMMER)
10. L = 1.05 D + F + 1.25 P + T_A + 1.25 E (WINTER) — No H
11. L = 1.05D + F + 1.25 P + T_A + 1.25 E (SUMMER)
12. L = 1.05 D + F + T_0 + 1.25 E (WINTER) — No ... term
13. L = 1.05 + F + T_0 + 1.25 E (SUMMER)
14. L = D + F + P + T_A + E' (WINTER) — N...
15. L = D + F + P + T_A + E' (SUMMER)
16. L = D + F + T_0 + E' (WINTER) — No H ... term
17. L = D + F + T_0 + E' (SUMMER)

C = 1/8 (1.0D + 1.0M + 1.0F) ←

FIGURE 3.8-85 to 3.8-86

NOTE: SEISMIC LOADS TAKEN FROM ASHSD [illegible] AND [illegible] ON THE FINEL RESULTS

FIGURES 3.8-1 THROUGH 17

COMPUTER PROGRAMS - CONTAINMENT - INTERNAL ST. PG 3.8-47

(1) SAP - BSAP

(2) FINEL

(3) [illegible] - STRUDAL

(4) STARDYNE

COMPUTER PROGRAMS - OTHER CATEGORY I STRUCTURES PG 3.8-[illegible]

(1) STRESS - STRUCTURAL ENGINEERING SYSTEMS SOLVER DISPLACEMENT METHOD - LINEAR ELASTIC - STATICALLY [illegible] AND [illegible]

(2) PLATE BENDING - FINITE ELEMENT LINEAR ELASTIC

(3) BUILDING DEFORMATION (TORNADO) THREE DIMEN-

FOUNDATIONS OF CAT I STRUCTURES DEFINED ON PAGES 3.8-[illegible]

LOADS - DEFINITION OF TERMS - 3.8-[illegible] B, C, D, [illegible] 71

PROBABLE MAXIMUM FLOOD (PMF) - ACCOUNTED FOR IN SEC 2

Modal Superposition Method

Containment / Aux. Bldg. > Lumped Mass Model

3.7-1? Service Water / Pump Structure

Seismic Category I Systems - Modal Superposition Method (MSM)

1) Design System Responses - (MSM) + Site Design Response Spectra

2) Response Spectra - (MSM) + design Time - History

3.7-4

The effects of multiple components of input motion are considered in system design rather than the seismic analyses.

(Soil dynamic uniform foundation medium modulus of elasticity = 22,000 KSF poissons ratio = .42)

3.?.? [illegible] Instrumentation

a) 6 - String [illegible] oscillators ([illegible])

b) 3 - Brush writing oscillographs (BRA)

c) 2 - [illegible] [illegible] ([illegible])

d) 1 - [illegible] spectrum analyzer

e) Recording and playback console

3.7.2.4 Soil Structure Interaction

a) LUMPED PARAMETER REPRESENTATION WHICH USE [illegible] OF [illegible] OF SOIL WAS EMPLOYED.

b) UNIFORM FOUNDATION MEDIA E = 22,000 [illegible] ν = .42

c) [illegible] width to depth of foundation media [illegible] 1/2 for all seismic category I structures

LUMPED MASS-SPRING METHOD USED FOR CASE WHERE DEPTH OF EMBEDMENT IS SHALLOW AND SOIL FOUNDATION IS RELATIVELY UNIFORM AND SUFFICIENT DEPTH THAT IT CAN BE CONSIDERED AS HALF SPACE.

d) Small ratio of structure embedment depth to structure width reduces influence of embedment effect - BC-TOP-4-A APPENDIX F

3.7.2.1 Seismic Analysis - [illegible]

Category I systems analyzed - [illegible]

[illegible]

lumped mass model used [illegible]

and [illegible]

Q. would [illegible] combination of torsional, rocking and translation response of structures and their found[ation]

3.7.2.2 NATURAL FREQUENCIES AND RESPONSE [illegible]

3.7.2.3 PROCEDURE USED FOR MODELING

Q.1 DO NOT SEE JUSTIFICATION THAT THE COUPLING EFFECTS OF DEGREES OF FREEDOM THAT ARE OMITTED FROM THE THREE-DIMENSIONAL MODEL ARE NOT SIGNIFICANT?

Q.2 DO NOT SEE WHERE [illegible] THE SUBSYSTEM IS SATISFIED?

C MENTION OF SECTION 3.2 OF BC-TOP-4-A IS GIVEN - BUT THE RESULTS OF THIS ARE NOT GIVEN - SEE S.R.P. 3.7.2

3.7.2 Development of Floor Response Spectra

3.7.2 The Component of Earthquake Motion

.7 OK

.9 OK

.10 OK Constant Vertical Static Factor 1/3 of

11 - Torsional effects not included in dynamic analysis
[illegible] Horizontal seismic loading [illegible] from decoupled seismic system [illegible] at an eccentricity no less than [illegible] of [illegible] eccentricity of 5% of the width of the structure normal to the direction of the input motion under consideration

12 Comparison show 0 to 64% difference between response spectrum & time history methods - for containment & auxiliary bldg

13. OK No (DAMS)

14. (OK)

15. [illegible] composite modal damping or [illegible] synthesis technique - account for element - associated damping (use [illegible])

3.8 DESIGN OF CATEGORY I STRUCTURES

3.8.1.1 DESCRIPTION OF CONTAINMENT OK

I 3.8.1.2 APPLICABLE CODES, STANDARDS & SPECIFICATIONS
MAJORITY OF CONTAINMENT DESIGN DONE PRIOR TO ISSUANCE OF ACI 359 - APRIL 1973.
TABLE 3.8-25 COMPARES APPLICABLE CODES, REG. GUIDES WITH THOSE ACTUALLY USED

REGULATORY GUIDES 1.10, 1.15, 1.17, 1.19, 1.35, 1.55 USED

3.8.1.3 LOADS & LOAD COMBINATIONS
PAGE 3.8-4 EQUATION (b) ... (a) ... OK

PAGE 3.8-5 EQUATION (a) (1) LEFT OUT LIVE LOAD
(2) USED 1.05 INSTEAD OF 1.0 FOR FACTOR ON DEAD LOAD
(3) FACTOR 1/Ø ?
(4) LEFT OUT PIPE RUPTURE ...

ALL HAVE 1/Ø FACTOR

ABNORMAL

EQUATION (b) (1) LEFT OUT LIVE LOAD
(2) USED 1.05 INSTEAD OF 1.0 FOR FACTOR ON DEAD LOAD
(3) FACTOR 1/Ø ?

ABNORMAL/SEVERE ENVIRONMENTAL

(4) USE 1.05 FOR FACTOR OF T₀ THERMAL EXPANSION DUE TO PIPE - GUIDE GIVES 1.0 AS FACTOR BUT IS FOR THERMAL EFFECTS AND LOADS DBA AND INCLUDES THERMAL EFFECTS AND LOADS DURING NORMAL OPERATING OR SHUTDOWN - MOST CRITICAL TRANSIENT OR STEADY STATE CONDITION.

C

C

EQUATION C
(1) LEFT OUT LIVE LOAD
(2) USED 1.05 FACTOR INSTEAD OF 1.0 FOR DEAD LOAD
ABNORMAL / SEVERE ENVIRONMENTAL
(3) INCLUDED PIPE RUPTURE NOT INCLUDED IN [illegible]
(4) PIPE THERMAL REACTION USED FACTOR 1.25 SPEC. USES 1.0

EQUATION D
(1) LEFT OUT LIVE LOAD
(2) USED 1.05 FACTOR INSTEAD OF 1. FOR DEAD LOAD
ABNORMAL
(3) INCLUDED TORNADO LOAD NOT CALLED FOR IN [illegible]

ABNORMAL / EXTREME ENVIRONMENTAL
EQUATION E.
(1) LEFT OUT LIVE LOAD
(2) DOES NOT INCLUDE PIPE REACTION TERM

EQUATION F
(1) LEFT OUT LIVE LOAD
(2) INCLUDED PIPE REACTION
(3) INCLUDED PIPE RUPTURE
(4) DOES NOT INCLUDE EXTERNAL PRESSURE TERM
EXTREME / ENVIRONMENTAL

MAX FLOOD
EQUATION - g
(1) LIVE LOAD LEFT OUT

Show 7 of 17 Cases

End of page 3.8-7

EQUATION C — (1) LEFT OUT LIVE LOAD
(2) USED 1.05 FACTOR INSTEAD OF 1.0 FOR DEAD LOAD
ABNORMAL/SEVERE ENVIRONMENTAL — (3) INCLUDES PIPE RUPTURE NOT INCLUDED IN [illegible]
(4) PIPE [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

EQUATION D — (1) LEFT OUT LIVE LOAD
(2) USED 1.05 FACTOR INSTEAD OF 1.0 FOR DEAD LOAD
ABNORMAL — (3) INCLUDES TORNADO LOAD NOT CALLED FOR IN [illegible]

ABNORMAL/EXTREME ENVIRONMENTAL — EQUATION E. — (1) LEFT OUT LIVE LOAD
(2) DOES NOT INCLUDE PIPE REACTION TERM

EQUATION F. — (1) LEFT OUT LIVE LOAD
(2) INCLUDES PIPE REACTION
EXTREME/ENVIRONMENTAL — (3) INCLUDES PIPE RUPTURE
(4) DOES NOT INCLUDE EXTERNAL PRESSURE TERM

MAX FLOOD — EQUATION g — (1) LIVE LOAD LEFT OUT

Stru 7 9 17 Cases [illegible]

End of page 3.8-7

3.8.1.4 DESIGN & ANALYSIS PROCEDURE

~~(D... ... METH... FOR ... ...~~
~~... ...~~

3.8.1.7

3.8.2 STEEL CONTAINMENT NOT APPLICABLE

3.8.3 CONCRETE & STRUCTURAL STEEL INTERNAL CONT.

3.8.3.1 DESCRIPTION OF INTERNAL STRUCTURES

3.8.6.3 - OTHER SEISMIC CATEGORY I STRUCTURES

STEEL STRUCTURES - OTHER THAN PIPE RESTRAINTS
DESIGNED BY WORKING STRESS METHOD

CONCRETE STRUCTURES ULTIMATE STRENGTH METH.

3.8.6.3.2 PAGE 3.8-72

EQUATION (1) OK
(2)

ACI - 359

D = Dead Load

L = Live Load

F = Prestress Load

T_o = Thermal Load - Normal Operation

R_o = Pipe Reactions "

P_v = External Pressure Loads

P_t = Pressure Load During Leak Rate Test

T_t = Thermal Load During Test

W = Loads Generated By Design Wind

E_o = Loads Generated By OBE

E_{ss} = Loads Generated By SSE

W_t = Tornado Loading Including Missile Impact
Note Included in W_t are the (Following)

W_{tq} = Tornado Wind Pressure Load

W_{tp} = Differential Pressure Loads Due to Atmospheric Pressure Change

W_{tm} = Tornado Generated Missile Impact Effects

(Design Base Accident) (DBA)

P_a = Design Pressure Load within Containment

T_a = Thermal Loads Generated By (DBA) Including T_o

R_a = Pipe Reaction (DBA) Including R_o

R_r = Local Effects (DBA) Including The Following

R_{rr} = Reaction of a Ruptured High Energy Pipe (DBA)

R_{rj} = ~~Jet Impingement From~~ " " " (DBA)

R_{rm} = Impact of a Ruptured " " " (DBA)

ACI -359

SERVICE

1) TEST

$$D + L + F + P_t + T_t$$ [illegible] EQUATION [illegible]

2) CONSTRUCTION

$$D + L + F + T_o$$ [illegible] EQUATION [illegible]

[illegible]

3) NORMAL

$$D + L + F + T_o + R_o + P_v$$ EQUATION [illegible]

4) SEVERE ENVIRONMENTAL

$$D + L + F + T_o + E_o + R_o + P_v$$

$$D + L + F + T_o + W + R_o + P_v$$

[illegible]

FACTORED

5) SEVERE ENVIRONMENTAL

$$D + 1.3L + F + T_o + 1.5E_o + R_o + P_v$$

$$D + 1.3L + F + T_o + 1.5W + R_o + P_v$$

6) EXTREME ENVIRONMENTAL

$$D + L + F + T_o + E_{ss} + P_v$$

$$D + L + F + T_o + W_t + P_v$$

7) ABNORMAL

$$D + L + F + 1.5P_a + T_a + R_a$$

$$D + L + F + P_a + T_a + 1.25R_a$$

8) ABNORMAL/SEVERE ENVIRONMENTAL

$$D + L + F + 1.25P_a + T_a + 1.25E_o + R_a$$

$$D + L + F + 1.25P_a + T_a + 1.25W + R_a$$

$$D + L + F + T_o + E_o + W$$

9) ABNORMAL/EXTREME ENVIRONMENTAL

$$D + L + F + P_a + T_a + E_{ss} + R_a + R_R$$

Service Load Conditions:

$D + L$

$D + L + E$

If Thermal Stress Present

$D + L + T_o + R_o$

$D + L + T_o + R_o + E$

Concrete

$1.4D + 1.7L$

$1.4D + 1.7L + 1.9E$

When Thermal Stress Present

$.75 (1.4D + 1.7L + 1.7T_o + 1.7R_o)$

$.75 (1.4D + 1.7L + 1.9E + 1.7T_o + 1.7R_o)$

RINALDI

MIDLAND NPP — REVIEW Units 1 & 2
by: Frank Rinaldi

START: 4-21-80

pre - ACI-359
CONSUMERS POWER CO. (CPCo)
Midland City Michigan
B & W NSSS
1,300 MWe PWR
SRP RG 1.70 Rev 2 + Exception Letter 6/..

CHECKLIST AND REVIEW SUMMARY

SECTION 3.3.1 WIND LOADING

PAGE

A. DESIGN WIND VELOCITY, RECURRENCE INTERVAL, VERTICAL VELOCITY PROFILES AND GUST FACTORS (3.3.1.1) — 3.3-1

Values reviewed for information only ✓

- or -

SWESSAR —

85 MPH @ 30FT 100YR GF 1.05

VERTICAL VELOCITY PROFILE PER ASCE 3269 Table 1(a)

B. WIND FORCE DISTRIBUTION, SHAPE COEFFICIENTS AND VELOCITY/PRESSURE TRANSFORMATION PROCEDURES (3.3.1.2) — 3.3-1

The provision of A58.1-1972 are applied

- or -

The provisions of ASCE Paper 3269 are applied ✓

- or -

SWESSAR

C. OTHER CONSIDERATIONS — N.A.

(*) OTHER CAT I STRUCTURES DO NOT HAVE 150FT RADIUS LIMITATION FOR 360 MPH INSTEAD THE 360 MPH IS A UNIFORM CONSIDERATION.

(**) TORNADO MISSILE SPECTRA TABLE 3.5-9

DOES NOT INCLUDE TOTAL MISSILE SPECTRA

PLANK ROD AUTO POLE	INCLUDED	3"⌀ STL PIPE 6"⌀ " " 12"⌀ " "	NOT INCLUDED

[Q] Consider the effect of the missiles not considered in your missile spectra, which are part of the current NRC missile spectra and assess the protection provided by the current design parameters of controlling roof and wall slabs to the impact of these additional missiles. In the event that the current barriers are not capable of meeting the current acceptance criteria, identify the consequences. Pls, consider in your evaluation the effect of the cracks reported for several Category I structures as result of the settlement problem for the Midland NPP currently reporter to NRC

SECTION 3.3.2 TORNADO LOADINGS

A. TORNADO TRANSLATIONAL AND TANGENTIAL VELOCITIES, TORNADO PRESSURE DIFFERENTIAL AND TIME INTERVAL AND TORNADO MISSILE SPECTRUM WITH SPECIFIED CHARACTERISTICS (3.3.2.1) 3.3-2

Values reviewed for information only

- or -

SWESSAR

360 MPH (290 ROT. + 70 TRANS) R=150 FT.

3 PSI @ 2 PSI/sec ↓ & 2 PSI/sec. ↑ 3 PSI

B. TORNADO FORCE DISTRIBUTION, SHAPE COEFFICIENTS AND VELOCITY/PRESSURE TRANSFORMATION PROCEDURES (3.3.2.2) 3.3-2

The provision of A58.1-1972 with shapes as specified in ASCE 3269 are applied

- or -

The provisions of ASCE Paper 3269 are applied exclusively

- or -

SWESSAR BC TOP 3-A ✓

C. VENTING CONSIDERATIONS (3.3.2.2) 3.3-2

The procedures by which venting, if considered, is used to reduce to tornado vacuum are described

- or -

BC-TOP-3-A SWESSAR Applies to Auxiliary Bldg. not Other Bldgs are mentioned. VENTS PROTECTION FROM MISSILES

D. TORNADO MISSILE LOAD TRANSFORMATION PROCEDURES (3.3.2.2) 3.3-2

The procedures by which tornado generated missiles are transformed into effective loads are described

- or -

BC-TOP-9 ✓ SWESSAR Section 3.5 for INFO.

E. TORNADO LOAD EFFECT COMBINATION (3.3.2.2) 3.3-2

The tornado wind and pressure effects will be combined directly in a manner such as to be conservative for the structural element being considered. A satisfactory method of combining these effects is as follows:

(i) $W_t = W_w$

(ii) $W_t = W_p$

(iii) $W_t = W_m$

(iv) $W_t = W_w + .5 W_p$

(v) $W_t = W_w = W_m$

(vi) $W_t = W_w + .5 W_p = W_m$

where: W_t ..... total tornado load,

W_w ..... tornado wind load,

W_p ..... tornado differential pressure load, and

W_m ..... tornado missile load.

For each particular structure or portion thereof, the most adverse of the above combinations are used, as appropriate

- or -

BC-TOP-3, SWESSAP.

Section 3.4 of REFERENCE

F. PROVISIONS FOR CATEGORY I STRUCTURES FROM TORNADO FAILURE OF NON-CATEGORY I STRUCTURES (3.3.2.3) 3.3-3

Structures and components exposed to but not designed for tornado loads will be determined not to ~~fail or otherwise~~ generate missile to the extent that Category I structures will be damaged.

- or -

Category I structures are designed to resist failure, collapse and missiles from structures and components not designed for tornado loads

- or -

BC-TOP-3, SWESSAP.

G. OTHER CONSIDERATIONS GENERAL Fig 3.3-1&2

[Q] Figures 3.3-1&-2 identify the Auxiliary Building, the Service Water Pump Structure and the Containment Building as the Category I Structures for the plant. In section 3.3 you identify more than three buildings as Category I structures. Pls provide the same type of information provided in Figs 3.3-1&-2 for the remainder of the Category I structures.

* CONSIDERATIONS FOR UNDER DRAINS – WELL QUALIFICATI[illegible]

SECTION 3.4.2 ANALYSIS PROCEDURES (FLOOD)

A. DESIGN FLOOD AND/OR GROUND WATER LEVELS AND LOADINGS (3.4.2) 3.4-1

Flood level values reviewed for information only. Flood levels indicated as applied as hydrostatic loadings or properly relieved by appropriate means

\- or -

SWESSAR.

RG 1.59 Table 3.4-1 Safety Related Systems Protected

Design Basis Flood = Worst Probable Site Related Flood

B. DYNAMIC FLOOD-TO-LOAD TRANSFORMATION PROCEDURES (3.4.2) 3.4-1 & -3

Q The procedures as delineated in the U.S. Army Coastal Engineering Research Center Technical Report No. 4 are applied

\- or -

SWESSAR.

RG 1.59 Appendix 3A

3.8.6.3 ; 2.4.3.5 ; 2.4.3.6

C. STATIC FLOOD-TO-LOAD TRANSFORMATION PROCEDURES (3.4.2) 3.4-1 & -3

Except where relieved by drainage and pumping, the hydrostatic head from highest flood or ground water level is applied as a direct foundation slab and basement wall load for structural and buoyancy computations. For lateral and overturning effects total wave included head is considered

\- or -

SWESSAR.

RG 1.59 & HARDEN PROTECTION APPROACH

Q WHAT IS THIS HARDENED APPROACH

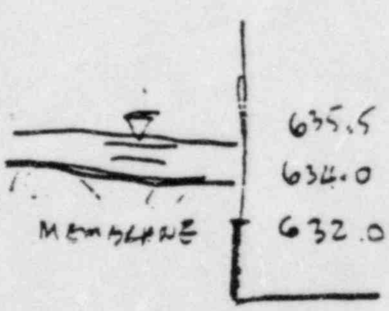
HOW THE USE OF TWO CRITERIA EFFECTS

D. OTHER CONSIDERATIONS 3.4-2 & -3

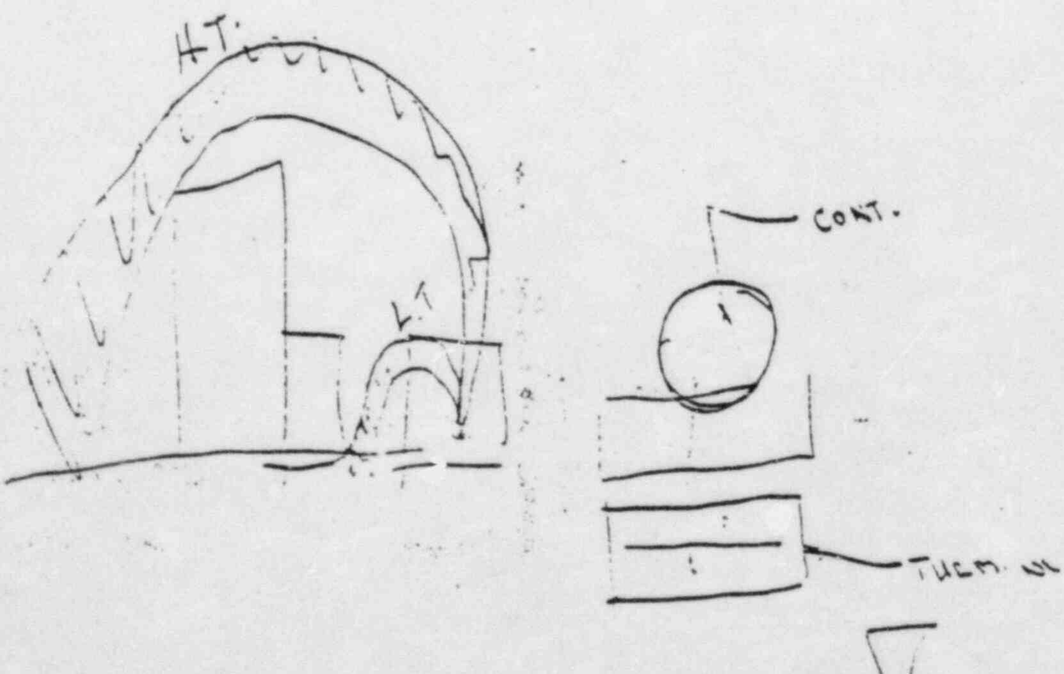
WATER LEVEL 635.5

GRADE LEVEL 634.0

WATER MEMBRANE LEVEL 632.0



- MINIMUM WALL THICKNESS ACCEPTANCE CRITERIA CHANGED
- CONSIDERATION OF CRACKS IN EVALUATION OF [illegible] & [illegible] FAILURE
- EFFECTS OF MISSILE SPECTRA NOT SAME AS [illegible] SPECTRA
  WHAT EFFECTS [illegible] FAILURE
  - POSTULATED
  - (COMPUTED)



SECTION 3.5.3 STRUCTURAL (BARRIER) DESIGN PROCEDURES

A. PROCEDURES FOR CONCRETE LOCAL DAMAGE PREDICTION (3.5.3) 3.5-28

Modified Petry equation as given in "Design of Protective Structures" (Amerikian), NP-3726.

- or -

Other equations shown to have equivalent conservatism.

- or -

Test data for missiles and barriers employed.

- or -

BC-TOP-9A SWESSAR.

[C] CONSIDER THRU CRACKS FOR BLOCKS WITH SUBSEQUENT PROBLEMS IN THE EVALUATION [TABLE 3.5-18 FOR WALLS & ROOF DESIGN DATA]

B. PROCEDURES FOR STEEL LOCAL DAMAGE PREDICTION (3.5.3) 3.5-28

Stanford Research Institute equations

- or -

Other equations shown to have equivalent conservatism

- or -

Test data for missiles and barriers employed

- or -

BC-TOP-9A SWESSAR

C. PROCEDURES FOR COMPOSITE SECTION LOCAL DAMAGE PREDICTION (3.5.3) 3.5-28

The method of Recht and Ipson is applied when the first Barrier is steel

- or -

BC-TOP-9-A

D. PROCEDURES FOR OVERALL RESPONSE PREDICTION (3.5.3)

The Williamson and Alvy procedure (NP-3515) is employed

- or -

Procedures that produce comparable results are employed.

- or -

BC-TOP-9A SWESSAR.

E. SPALLING AND SCABBING PROCEDURES 3.5-29

Reviewed on a case-by-case basis. No position.

Protecting Equipment Considered by Applicant

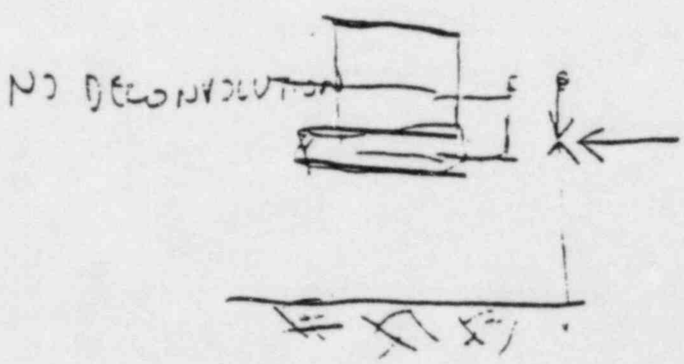
F. OTHER CONSIDERATIONS 3.5-29 - Tables + Figur

TURBINE MISSILES and other components Considered

Axis Parallel to Containment, Aux. Bldg & Diesel Bldg.

Comparison of Low Trajectory & High Trajectory Missiles Considered

(4) For Certain Frequencies are less conservative
There was a Question on this
[illegible] answered it? Is it OK!



SECTION 3.7.1 SEISMIC INPUT

A. DESIGN RESPONSE SPECTRA (SSE AND OBE) (3.7.1.1) 3.7-1

Amplication factors are indicated as following Regulatory Guide 1.60 for all damping values and applied at finished grade. —

- or -

BC-TOP-4, SWESSAR

Housner Design Response Spectra increased by 50% to bring comp. with Newmark's [illegible] spectra. Comparison [illegible] RG 1.60 [illegible] in Appendix 3-[illegible]. Vertical 2/3 of horizontal Spectra

B. DECONVOLUTION ANALYSIS PROCEDURES (3.7.1.1) NA

The maximum acceleration at foundation level shall not be less than 50% of that at the surface and the procedures used are described.

Applied @ Foundation Level

C. RESPONSE SPECTRA APPLICABILITY FOR VARIOUS FOUNDATION LOCATIONS (3.7.1.) NA

The basis for the location selected should be described.

Applied @ Foundation Level

D. RESPONSE SPECTRA/TIME HISTORY COMPARISON (3.7.1.2) 3.7-1

Time history response spectra envelope the design response spectra for all damping values used in design with no more than five (5) points falling below (all within ten (10) percent) design spectra.

- or -

BC-TOP-4-A (if 8 points below are allowed), SWESSAP

Taft N21E, 1952 Record

Fig 3.7-3 to 3.7-8 Comparison with Site spectra @ Foundation

E. PERIOD INTERVALS FOR TIME HISTORY RESPONSE SPECTRA (3.7.1.2) 3.7-1

Frequency intervals demonstrated small enough that reduction does not result in more than ten (10) percent change in computed spectra.

- or -

Minimum set chosen such that each frequency is within ten (10) percent of previous one

- or -

Table 3.7.1.1 review plan values are used.

- or -

BC-TOP-4A SWESSAP

F. PERCENTAGE OF CRITICAL DAMPING VALUES (3.7.1.3) 3.7-18-2

Damping values are indicated as being in accord with Regulatory Guide 1.61.

\- or -

Higher values are justified.

\- or -

✓ RC-TOP-4, SWESSAP —

Appendix 2A for Comparison to RG 1.61

\- For calculation of Radiation Damping - No credit for Material Damping

G. SUPPORTING MEDIA FOR EACH CATEGORY I STRUCTURE (3.7.1.4) 3.7-2

Information is provided for each structure of foundation embedment depth, to bedrock, foundation width, structure height and soil properties (shear wave velocity, shear modulus, density) as a function of depth.

Table 3.7-1

H. OTHER CONSIDERATIONS 3.7-6

CONSIDERATION OF THE EFFECTS DUE TO ACCIDENTAL TORSIONAL FORCES IN DESIGN (AS A MINIMUM 5% BASE DIMENSION OFF-SETTING CRITERIA SHOULD APPLY).

CHECK PROBLEM WITH SPECTRA — IT APPEARS THAT THEY HAVE A DIP IN THE MIDDLE FREQUENCIES, ACCORDING TO ONE REVIEWER.

See page 22 (*) — Same Concern

SECTION 3.7.2 SEISMIC SYSTEM ANALYSIS

A. DYNAMIC SEISMIC ANALYSIS METHODS USED (3.7.2.1) 3.7-2

Time history or response spectrum method is used.

- or -

Equivalent static load method is fully justified —

- or -

BC-TOP-4A SWESSAR

Eq 3.7-9 to 3.7-11 & 3.7-68

Use Compliance function for uniform soil media

B. DYNAMIC SEISMIC ANALYSIS METHOD ACCOUNTING FOR SOIL-STRUCTURE INTERACTION (3.7.2.4) 3.7-4 (3.7-1) Table 3.7-1 2.5.4.7

An appropriate method for consideration of soil-structure interaction is indicated to include consideration given to adjacent structures. For rock formations and shallowly embedded deep soil foundations with uniform prospectus, single or multiple spring mass or finite element methods is used. For deeply embedded soil cases the finite element method is used. For all other cases either the multiple-spring-mass or finite element method is used.

- or -

BC-TOP-4A

Appendix A of this Topical discusses Embedment Effect

Cont. & Aux Bldg Analyzed w/ Coupling ... 10 Hz. Cutoff

C. DYNAMIC SEISMIC ANALYSIS METHOD CONSIDERATION OF FOUNDATION TORSION, ROCKING AND TRANSLATION (3.7.2.1) 3.7-2

Consideration is given to foundation torsion, rocking, and translation in the model.

- or -

BC-TOP-4A SWESSAR

D. SELECTION OF SIGNIFICANT MODES (3.7.2.1) 3.7-2

Investigation is made to ensure that inclusion of additional modes in the result will not effect the result by more than a ten (10) percent increase in response.

- or -

Twice the number of modes with frequencies lower than 33 cps is used in the result.

- or -

BC-TOP-4A

E. DYNAMIC SEISMIC ANALYSIS CONSIDERATION OF MAXIMUM RELATIVE DISPLACEMENT ALONG SUPPORTS (3.7.2.1) — 3.7-2

Consideration is given in the seismic dynamic analyses of support relative displacement.

- or -

BP-TOP-1 (for piping), SWESSAR

BC-TOP-4A for MAX DISPLACEMENT DUE TO SEISMIC LOADS

F. OTHER SIGNIFICANT EFFECTS ACCOUNTED FOR IN DYNAMIC SEISMIC ANALYSIS SUCH AS EXTERNAL RESTRAINTS, PIPING INTERACTIONS, HYDRODYNAMIC EFFECTS AND NON-LINEAR RESPONSE (3.7.2.1) — 3.7-2

Consideration is indicated for inclusion of specific significant effects.

- or -

BP-TOP-1 (but not hydrodynamic effects and nonlinear response), SWESSAR

HYDRODYNAMIC EFFECTS CONSIDERED

G. MODAL RESPONSE COMBINATION PROCEDURE (3.7.2.7) — 3.7-5

Modes are combined by square root of sum of squares except where closely spaced modes (i.e., modes with frequencies within 10% of each other) are encountered. For closely spaced modes the absolute sum is used

- or -

$$R = \left[\sum_{K=1}^{N} R_k^2 = s \Sigma R_1 R_m \right]^{1/2}$$

- or -

RG 1.92 as discussed in Appendix 3A FOR EXCEPTIONS

H. DYNAMIC ANALYSIS DAMPING SYNTHESIS PROCEDURES (3.7.2.15) — 3.7-7

The usage of a mass weighting function (fixed base model)

- or -

The usage of a stiffness weighting function (lump spring or (fixed base models)

- or -

A structural and foundation modal synthesis procedure

- or -

The method of Tsai is indicated.

- or -

BC-TOP-4A, SWESSAR

Section 3.2 & 3.3 Method, Values as per Section 3.7.1.3 which Refers to Appendix 3A for discussion & Comparison w/ RG 1.61

J. CRITERIA EMPLOYED FOR SYSTEM/SUBSYSTEM DECOUPLING (3.7.2.3) 3.7-4

The following criteria are acceptable:

If RM < 0.01, decoupling can be done for any R_f

If $0.01 \leq R_m \leq 0.1$, decoupling can be done

If $R_f < .8$ or $R_f < 125$

If $R_m > 0.1$, an appropriate model of the subsystem is included

If $R_m > 0.1$, an appropriate model of the subsystem is included where

R_m $\frac{\text{Total Mass s Supported}}{\text{Total Mass of Support}}$

$R_f = \frac{\text{Fundamental frequency, supported system}}{\text{Frequency of predominant support motion.}}$

Section 3.3 of BC-TOP-4A

K. SELECTION OF LUMPED MASS PROCEDURES (3.7.2.3) 3.7-4

The number of masses selected is adequate when the addition of masses (degrees of freedom) does not result in more than a ten (10) percent increase in response.

\- or -

BC-TOP-4A

L. MODELING THREE DIMENSIONAL CONSIDERATIONS (3.7.2.3) 3.7-5

Three dimensional models should be used unless it is justified that coupling among omitted degrees-of-freedom are not significant.

\- or -

BC-TOP-4A SWESSAR

See Compliance w/ RG1.92 as discussed in Appendix 3A

M. USE OF CONSTANT VERTICAL AMPLIFICATION FACTORS (3.7.2.10) 3.7-6

Structure is justified as rigid in vertical direction by showing that lowest frequency is more than 33 cps

\- or -

A vertical seismic-dynamic analysis model is indicated.

\- or -

BP-TOP-1, SWESSAR

Constant Vertical Load Factors are not used for the design of Cat. I systems

N. METHODS FOR ACCOUNTING FOR TORSIONAL EFFECTS (3.7.2.11) 3.7-6

Dynamic analysis model incorporated torsional degrees of freedom

- or -

Justified static factors are employed.

- or -

BC-TOP-4, SWESSAR

O. FLOOR RESPONSE SPECTRA DEVELOPMENT PROCEDURES (3.7.2.5) 3.7-5

The three components of motion of individual floor response spectra are combined by square root of sum of square addition at each frequency.

- or -

BC-TOP-4A

P. FLOOR RESPONSE SPECTRA BROADENING (3.7.2.9) 3.7-6

Effect of parameter variation in floor response spectrum are accounted for by increasing individual peak widths by ± 15 percent

- or -

modal frequencies are varied according

to $\Delta f_j = \sqrt{(0.05 f_j)^2} - \Sigma(\Delta f_j)_m$

- or -

BC-TOP-4A SWESSAR

Q. SEISMIC OVERTURNING MOMENT AND BASE SHEAR CALCULATIONS (3.7.2.14) 3.7-7

The seismic overturning moment calculation includes consideration of three components of earthquake motion and conservative consideration of vertical and lateral seismic forces.

- or -

BC-TOP-4A SWESSAR

R. INTERACTION OF CATEGORY I STRUCTURES WITH NON-CATEGORY I STRUCTURES (3.7.2.8) 3.7-5

The interface between both types is designed for load produced by both types of structures. In addition, all non-category I structures are provided for such that 1) collapse will not strike a Category I structure, or 2) collapse impact will not impair integrity of impacted

Category I structure, or 3) non-Category I structures are designed and analyzed to Category I standards.

S. TIME HISTORY/RESPONSE SPECTRUM RESPONSE COMPARISON (3.7.2.12) 3.7-7 Table 3.7-1
Results of modal time history and modal response spectra analysis are compared at selected points as a methods check for equivalency.

- or -

SWESSAP

Response Spectrum Method with Time History & Modified Taft record for Floor Response Spectra determination.

T. THREE COMPONENT EARTHQUAKE STRUCTURAL RESPONSE PROCEDURES (3.7.2.6) 3.7-5
When response spectra method is used, the maximum structural response due to each of the three components is obtained as the square root of the sum of the squares of the maximum codirectional response

- or -

If the time history method is used, either the maximum response due to each of three components is obtained and combined as indicated previously or the three components are added algebraically at each time step.

- or -

BC-TOP-4, PG 1.92 See Comparison in Appendix 3A

U. NATURAL FREQUENCIES, RESPONSE LOADS AND RELATED DATA (OL) (3.7.2.2) 3.7-29
A summary is provided for representative Category I structures of natural frequencies, mode shapes and modal responses. Time histories are provided for major plant equipment elevations and points of support.

Table 3.7-2 + Fig 3.7-12 to 3.7-53

V. METHODS FOR CATEGORY I DAM SEISMIC ANALYSIS (3.7.2.13) 3.7-7
A finite element analysis procedure which accounts for time history of forces, behavior of soils and evaluation of deformation is used.

- or -

The method of Seed, Lee and Idriss is employed

N.A

SECTION 3.7.3 SEISMIC SUBSYSTEM ANALYSIS

A. SEISMIC ANALYSIS METHOD USED (3.7.3.1) 3.7-8

The procedures of 3.7.2 are applied as indicated in 3.7.2, items A, C, D, E, F

- or -

SWESSAP —

Fig 3.7-54 to 3.7-63

Appendix 3D

B. SEISMIC CYCLES FOR SUBSYSTEMS (3.7.3.2) 3.7-9

One SSE and five OBE are assumed with the number of maximum stress cycles obtained from a time history of ten seconds minimum duration equal to a minimum of ten maximum stress cycles

- or -

SWESSAP

Section 3D.1 Appendix 3D

Also see Response to R.G 1.48 IC.3

C. PROCEDURES FOR ANALYTICAL MODELING (3.7.3.3) 3.7-10

The procedures of 3.7.2 are applied as indicated in 3.7.2, items I, J, K, L

- or -

SWESSAP

Appendix 3D

D. DYNAMIC CHARACTERISTICS OF SUBSYSTEMS (3.7.3.4) 3.7-11

Fundamental frequency of subsystems is controlled to be greater than twice or less than one-half the dominant frequency of supporting system

BC-TOP-4A Sect 4.2.1

Breakdown between NSSS Subsystems and Non-NSSS Subsystems

E. EQUIVALENT STATIC LOAD METHOD (3.7.3.5) 3.7-11

Justification is provided that system can be represented by simple model and conservative results are produced in terms of structural response

- and -

The method accounts for relative motion between all points of structural response

- and -

A factor of 1.5 is applied to applicable floor response spectra or a lesser factor justified

- or -

BC-TOP-4, SWESSAP

~~See Appendix 3D~~ Section 3D.2 & 3D.4 For Piping

F. MODELING THREE DIMENSIONAL CONSIDERATION (3.7.3.6) 3.7-12

The procedures of 3.7.2 are applied as indicated in 3.7.2, item L

\- or -

BC-TOP-4, SWESSAP

Appendix 3D

G. MODAL RESPONSE COMBINATION PROCEDURES (3.7.3.7) 3.7-12

The procedures of 3.7.2 are applied as indicated in 3.7.2, item G

\- or -

BC-TOP-4, SWESSAP

Appendix 3D

H. PIPING ANALYSIS PROCEDURES (3.7.3.8) 3.7-13

The procedures of 3.7.2 are applied as indicated in 3.7.2, items A, C, D, E, F (dynamic analysis)

\- or -

The procedures of 3.7.3 are applied as indicated in 3.7.2, item E

\- or -

BP-TOP-1, SWESSAP

Appendix 3D — Also Sect 3.7.3.1.2

I. MULTIPLY SUPPORTED SUBSYSTEM PROCEDURES (3.7.3.9) 3.7-13

An upper bound envelope of all individual support point response spectra or, for multiple supports on a single system, the worst floor response spectrum from a set of floor response spectra obtained at various floors is employed to be applied at all support points. In addition, the most unfavorable combination of relatively support point displacements is superimposed.

\- or -

Time histories of all supports point motions can be applied directly and simultaneously.

\- or -

BC-TOP-4 or BP-TOP-1

Also Section 3D.4 of Appendix 3D

K. TORSIONAL EFFECTS OF ECCENTRIC MASSES (3.7.3.11) 3.7-..

If the torsional effect of eccentric mass is significant the mass and its eccentricity are included in the model. (Criteria for "significance" judged on case-by-case basis.)

\- or -

BC-TOP-4, SWESSAP
Section 3D.2 Appendix 3D

L. BURIED PIPING AND TUNNELS (3.7.3.12) 3.7-14

The initial effects due to earthquakes are considered on the analysis using the procedures established in "Fundamentals of Earthquake Engineering" or Newmark's paper on "Earthquake Response Analysis of Reactor Structures" in NE and D, vol 20, pp. 303-322.

- and -

The static resistance of surrounding soil is considered using "Beams on Elastic Foundation"

- and -

The effects of local soil arching and settlement are considered.

- or -

BC-TOP-4, SWESSAP
Section 3D.4 of Appendix 3D

M. INTERACTION OF CATEGORY I AND NON-CATEGORY I PIPING (3.7.3.13) 3.7-14

Non-Category I piping is designed to be isolated from Category I piping or analyzed according to Category I seismic criteria.

- or -

SWESSAP
Section 3.4 BP-TOP-1

N. CRITERIA FOR SEISMIC ANALYSIS OF REACTOR INTERNALS (3.7.3.14) 3.7-14

Dynamic analysis is employed with procedures equivalent to those established for seismic systems. The three components of earthquake motion are considered in a manner analogous to that used for seismic systems.

B&W TOP Report 1-0008 1-0035

O. DYNAMIC ANALYSIS DAMPING SYNTHESIS PROCEDURES (3.7.3.15) 3.7-15

The procedures of 3.7.2 are applied as indicated in 3.7.2, item H

- or -

BC-TOP-4A SWESSAP
Section 3.7.1 Except
Damping Values as per Section 3.7.1.3

SECTION 3.7.4 SEISMIC INSTRUMENTATION

A. ADHERANCE TO REGULATORY GUIDE 1.12 (3.7.4.1) 3.7-15

The seismic instrumentation is in compliance with AEC RG 1.12. Revision 1 April 1974

- or -

SWESSAR Discussed in Appendix 3L

B. INSTRUMENT LOCATION AND DESCRIPTION (CP) (3.7.4.3) 3.7-15

A triaxial time history accelograph will be installed in the free field or on the containment foundation; a seismic switch with control room readout will be installed on the containment foundation or free field; a triaxial response spectrum recorder with remote control room readout will be installed on the containment foundation; and, in addition, additional instrumentation will be provided at other locations.

- or -

SWESSAR

C. SEISMIC INSTRUMENTATION PLAN (OL) (3.7.4.2) 3.7-15&16

A detailed plan that includes a description of instrumentation locations and how these locations are related to output vibratory motion is provided.

- or -

SWESSAR

D. OPERATOR NOTIFICATION (3.7.4.3) 3.7-17

The seismic switch located on the foundation of the containment is connected to event indicators in the control room in such a manner that a signal is given when the preset threshold level (OBE) acceleration) is exceeded

- and -

The triaxial time history monitor will readout peak acceleration in the control room

- and -

The response spectrum recorder will readout values at discrete frequencies

- or -

SWESSAR

SECTION 3.8.1 CONCRETE CONTAINMENT

A. CONTAINMENT GENERAL DESCRIPTION (3.8.1.1) 3.8-1

The description includes plans and sections of the containment and adjacent and ajoining structures, systems and components; details of the base slab; and details of the containment wall and domes.

- or -

SWESSAR, RC-TOP-5

B. APPLICABLE CODES, STANDARDS AND SPECIFICATIONS (3.8.1.2) 3.8-2

The following are employed:

ACI/ASME 359; RG 1.10, 1.15, 1.18, 1.19, 1.35, 1.55.

- or -

SWESSAR

Codes used as Reference - ACI 359

ASTM

Topicals as identified in Section 1.6

C. LOADS AND LOADING COMBINATIONS (3.8.1.3) 3.8-4

The loads and loading combinations are as specified in ACI-359. Where post-LOCA flooding is a design consideration 1.0D + 1.0L + 1.0Feco is also applied

- or -

SWESSAR

How about the Pressure Test Equation

D. DESIGN AND ANALYSIS PROCEDURES (3.8.1.4) 3.8-7

3.8-61 The design and analysis procedures are as established in ACI-ASME 359, Article CC-3000. Winter 1975 By Comparison

- or -

For boundary conditions using foundation finite elements, a further extension would not affect results by more than fifteen (15 percent). For boundary conditions not using foundation finite elements, the foundation slab is used as a boundary with appropriate soil spring representation.

The effects of non-axisymmetric loads such as those induced by wind, tornado, earthquakes and pipe rupture are considered.

For localized and transient loads, the overall behavior is determined first and the localized load is superimposed.

For creep, shrinkage and cracking, appropriate procedures are employed.

For computer programs, the program is a recognized program; or the program has been checked against a recognized program; or it has been valided against classical solutions and experimental tests and a summary comparison of all validations are provided.

For tangential shear the provisions of Article CC-3000 are applied.

For physical material properties variations, upper and lower bound values are used.
For thickened penetrations, local effect considerations apply.
For steel liner and anchors, CC-3600 applies.
For steel penetrations, section NE applies.

- or -

SWESSAP

FINEL ASHSD

BC-TOP-7A ; -8 Rev1 ; -1 Rev1 ; 9A ; 5A Sect 4.5.9 & DE-2

E. STRUCTURAL ACCEPTANCE CRITERIA (3.8.1.5) 3.8-12

For containment shell acceptance, the stress and strain limits are in accordance with CC-3400 provisions, except that for section CC-3411.5, the tangential shear stress carried by concrete, V_c, is limited to 40 psi and 60 psi for the 7th and 8th combinations of Table CC-3200-1.

- and -

For liner plant acceptance, the stress and strain allowables of TAbles CC-3700-1 and CC-3700-2 are applied.

- or - ?

SWESSAP, BC-TOP-5 ← Why not used for the construction

ACI-318-71(?) w/ some Exceptions

F. MATERIALS, QUALITY CONTROL AND CONSTRUCTION TECHNIQUES (3.8.1.6) 3.8-19

The material provisions of Article CC-2000 of ACI-359 are being followed. The construction and quality control provisions of ACI-359 are being followed.

- or -

SWESSAP

ASTM ACI AWS

G. TESTING AND INSERVICE SURVEILLANCE (3.8.1.7) 3.8-40

The provisions of Article CC-6000 of ACI-359 are being followed as augment by the provisions of RG 1.18. For prestressed containments, the inservice surveillance requirements of RG 1.35 (ungrouted tendons) or RG 1.___ (grouted tendons) are followed as applicable.

- or -

SWESSAP, (BC-TOP-5A) Rev 3

Reg Guide 1.18 as discussed in Appendix 3A

TEST [illegible]

SECTION 3.8.2 STEEL CONTAINMENT SYSTEM N.A.

A. CONTAINMENT GENERAL DESCRIPTION (3.8.2.1)

General information pertaining to the containment shell is provided on (1) the bottom of the steel containment, (2) the cylindrical wall, (3) the dome of the steel shell and (4) major penetrations.

B. ACCEPTABLE CODES, STANDARDS AND SPECIFICATIONS (3.8.2.2)

Subsection NE of the ASME, Section III Division 1 and Regulatory Guide 1.57 are employed.

B. ACCEPTABLE CODES, STANDARDS AND SPECIFICATIONS (3.8.2.2)

Subsection NE of the ASME Section III Division 1 and Regulatory Guide 1.57 are employed.

C. LOADS AND LOADING COMBINATIONS (3.8.2.3)

The loads are as specified in Subsection NE, Section III of the ASME Code and R.G. 1.57. The load combinations employed are: (1) $D+L+P_t+T_t$, (2) $D+L+T_o P_o$, (3) $D+L+T_o P_o+E$, (4) $D+L+T_e+R_e+P_e+E'$; (7) $D+L+T_e+R_e+P_e+E'$; (8) $D+L+T_a+R_a+P_a+Y_r+Y_j Y_m+E'$; and (9) $D+L+F+L+E$

D. DESIGN AND ANALYSIS PROCEDURES (3.8.2.4)

The design and analysis procedures are indicated as in compliance with article NE-3000 of the ASME Code Section III Division I and R.G. 1.57. Specific treatment of axisymmetric and non-axisymmetric loads and treatment of transient and localized loads is indicated. Computer codes used in the analysis are described and indicated.

E. STRUCTURAL ACCEPTANCE CRITERIA (3.8.2.5)

The stress allowables are indicated as in compliance with Subsection NE, Section III of the ASME Code as interpreted by Table 3.8.2-1 on page 3.8.2-8 of the Standard Review Plan.

F. MATERIALS, QUALITY CONTROL AND SPECIAL CONSTRUCTION TECHNIQUES (3.8.26)

The provisions of Article NE-2000 of the ASME Code Section III Division 1 are followed and the Q/A program is in accordance with Articles NE-4000 and NE-5000 of the ASME Code Section III Division 1. Special construction techniques used are discussed and justified.

G. TESTING AND INSERVICE SURVEILLANCE REQUIREMENTS (3.8.2.7)

The preoperational structural proof test is indicated as following Article NE-6000 of ASME Section III Division 1.

SECTION 3.8.3 CONCRETE AND STRUCTURAL STEEL INTERNAL STRUCTURES OF STEEL OR CONCRETE CONTAINMENTS

A. DESCRIPTION OF INTERNAL STRUCTURES (3.8.3.1) 3.8-41

For PWR dry containments the description includes reactor supports, steam generator supports, reactor coolant pump supports, primary and secondary shield walls, floors and polar crane structures. For PWR ice condensor containments the description includes, in addition, the divider barrier and ice condenser. For BWR containments the description includes the dry-wall, weir-wall, refueling pool, operatin floor, reactor and recirculatory pump supports, reactor pedestal, reactor sheidl and miscallaneous platforms.

- or -

SWESSAR

____

____

B. APPLICABLE CODES, STANDARDS AND SPECIFICATIONS (3.8.3.2) 3.8-46

The following are employed:

ACI 318; ACI 359; ASME B&PV Code, Section III, Division 1, Subsections NE and NF; AISC Specifications; ANSI N45.2.5; RG 1.10; RG 1.15; RG 1.55.

- or -

SWESSAR

Subsection 3.8.6.2 p.3.8-60 to p.3.8-70

C. LOADS AND LOAD COMBINATIONS (3.8.3.3) See Subsection 3.8.6 3.8-46

Except for divider-barrier and ice-condenser elements of PWRs, the drywell of BWR Mark III containments, and linear steel supports of the reactor coolant system, the following apply:

Service Load Conditions:

Concrete and Steel for WSD: (S)

D+L, D+L+E and, if thermal stress is present, (1.3SS-Concrete) (1.50S-Steel)

D+L+To + PO, D+L+To + Po + E

Concrete for USD: (U)

1.4D + 1.7L, 1.4D + 1.7L + 1.9E

and where thermal stress is present; (U)

(.75) (1.4D + 1.7L + 1.7To + 1.7C Po)

(.75) (1.4D + 1.7L + 1.9E + 1.7To + 1.7Po)

Steel for Plastic Design:

1.7D + 1.7L, 1.7D + 1.7L + 1.7E

and where thermal stress is present: (Y)

1.3 (D+L + To + Po)

1.3 (D+L + E+To + Po)

Factored Load Conditions:

Steel for WSD (1.6S)

D+L+To+Po+E', D+L+Ta+Ra+Pa,

D+L+Ta+Pa+Pa+ Y + F
D+L+Ta+Pa+Pa+ Y + E'

Steel for Plastic Design and concrete for USD: (1.7S) (.9Y)

D+L+To+Po+E', D+L+Ta + Ra + 1.5Pa,
D+L+Ta+1.25 Pa + Y + 1.25 E,
D+L+Ta+Pa+Pa + Y + e'

For the divider barrier and Mark III drywell the loads, load combinations and stress limits of CC-3000 apply.

For ice condenser elements the following apply: (S)

Service Load Conditions:

Steel for WSD:
D+L, D+L+E

Steel for Plastic Design: (Y)
1.7D + 1.7L, 1.7D+1.7L+1.7E

Steel for test verification: (c)
1.9D+1.9L+1.9E

Where thermal stresses are present, the procedures of NF-3221.1 are applied.

F. MATERIALS QUALITY CONTROL AND SPECIAL CONSTRUCTION TECHNIQUES (3.8.4.6) 3.8-51

Compliance with ACI 318-71 for concrete, AISC-69 for steel, ASME NF for linear supports (Category I components), ANSI N45.2.5 for general quality control, and ACI-359 for reparing bar welding.

- or -

SWESSAR

Subsection 3.8.1.6

G. TESTING AND INSERVICE SURVEILLANCE (3.8.4.7) 3.8-51

No specific requirements

SECTION 3.8.5 FOUNDATIONS

A. DESCRIPTION OF FOUNDATIONS (3.8.5.1) 3.8-57

For foundations, the descriptive information consists of plans and sections for each Category I foundation and method of separation between foundations. For containment base slab, the general arrangement and method of shear transfer is described.

- or -

SWESSAP

Fig 3.8-30-31 Anchorage; -15 [illegible]; -41 Aux Bldg; -55 Diesel Bldg; -56 Service Water Bldg; etc.

B. APPLICABLE CODES, STANDARDS AND SPECIFICATIONS (3.8.5.2) 3.8-58

The following are employed:
ACI 318, ACI 359; ASME B&PV Code, Section III, Div 1, Subsections NE and NF; AISC; ANSI N45.2.5; RG 1.10; RG 1.15, RG 1.55

- or -

SWESSAP

Subsection 3.8.1.2 For Containment
" 3.8.3.2 For Internal Structures
" 3.8.4.2 For Other Cat I Bldgs

[illegible]

C. LOADS AND LOAD COMBINATIONS (3.8.5.3) 3.8-59 3.8-75

Load combinations and stress limits of 3.8.4 apply.
Additional load combinations of sliding and overturning are

	Sliding	Overturning	Floatation
D+H+E, D+H+W,	1.5	1.5	-
D+H+E', D+H+W_t	1.1	1.1	-
D+F'	-	-	1.5

else 1.1

- or -

SWESSAP

Subsections 3.8.1.3 Containment
" 3.8.6 Other Cat. I Structures

D. DESIGN AND ANALYSIS PROCEDURES (3.8.5.4) 3.8.59 Table 3.8-23

For concrete structures, ACI 318-71 is utilized. For steel structures, AISC specifications are utilized.

- or -

SWESSAP

Subsection 3.8.1.4 for Containment
See Appendix 3C for Specific Assumptions
Subsection 3.8.4.4 for Other Cat. I Structures
Table 3.8-23 S.F for SLIDING OVERTURNING

E. STRUCTURAL ACCEPTANCE CRITERIA (3.8.5.5) 3.8-59 Table 3.8-23

The limits tabulated opposite the load equations apply.

- or -

SWESSAP

Subsections 3.8.1.5; 3.8.3.5; 3.8.4.5; Table 3.8-24

Settlement Fig. 2.5-48; Table 3.8-24

3-41

A2

F. MATERIALS, QUALITY CONTROL AND SPECIAL CONSTRUCTION TECHNIQUES (3.8.5.6) 3.8-59

C The procedures and methods for the Category I containment structures are applied for containment base slab. No special acceptance standards apply to others.

- or -

SWESSAR

LOAD COMBINATIONS (3.8.3.3) 3.8-4

Factored Load Conditions: (1.3S) NA

Steel for WSD:

D+L+E', D+L+Pa, D+L+Pa+E' (1.6S) (Y)

Steel for Plastic Design:

1.3D+ 1.3L + 1.3E', 1.3D+1.3L+1.3Pa,

1.2D + 1.2L + 1.2Pa+1.2E' (C)

Steel for test verification:

1.4D+1.4L + 1.4E', 1.4D+1.4L+1.4Pa

1.3D + 1.3L + 1.3Pa + 1.3E'

2 For reactor coolant linear steel supports, the following apply:

(Limit of XIII-1100, NF)

For WSD;

D+L+E (X 1.0), D+L+E' (X 1.e), D+L+E' + Pa + Y (X 1.6) (.91)

For Plastic Design:

1.7 (D+L+E)

1.3 (D+L+E')

1.0 (D+L+E' + Pa + Y)

- or -

C SWESSAR

D. DESIGN AND ANALYSIS PROCEDURES (3.8.3.4) 3.8-47

For PWR Dry Containments the design and analysis procedures for linear reactor coolant supports are in accordance with Subsection NF. The primary shield wall, secondary shield wall, other interior structures and the reactor cavity design and analysis procedures are in accordance with ACI 318-71.

2 For PWR ice-condenser divider barriers and BWR drywells, design and analysis procedures are in accordance with those delineated in section CC-3000 of ACI-359 for concrete elements and subsection NE for steel elements. For BWR steel drywell elements the design and analysis acceptance criteria of Section 3.8.2 apply.

- or -

SWESSAR

WSM steel

USM Concrete

C BN-TOP-2 & BC-TOP-9A (Pipes Break Effects)

3.8-57

E. STRUCTURAL ACCEPTANCE CRITERIA (3.8.3.5)

With the exception of the divider-barrier and ice condenser elements of PWR containments; the drywell of the Mark III; and the linear steel supports of the reactor coolant system; the stress limits tabulate opposite the load equations apply where s = the acquired section strength based on WSD allowables of ACI-318 and the AISC specifications, Part I; U = the required section ultimate strength, Y = the AISC specification allowables, Part II, and C + tested collapse strength. For the PWR divider barrier and BWR dry well, concrete CC-3400 applies.

For the PWR divider-barrier and BWR drywell steel, Subsection NE applies.

\- or -

SWESSAR

Subsection 3.8.6.5 Tables 3.8-29 & -30

3.8-51

F. MATERIALS, QUALITY CONTROL AND SPECIAL CONSTRUCTION TECHNIQUES (3.8.3.6)

Compliance with ACI 318-71 for concrete, AISC-69 for steel, ASME NF for reactor coolant system supports, ANSI N45.2.5 for general quality control and ACI-359 for reinforcing bar welding.

As Subsection 3.8.1.6

SECTION 3.8.4 OTHER CATEGORY I STRUCTURES

A. DESCRIPTION OF OTHER CATEGORY I STRUCTURES (3.8.4.1) 3.8-51

For other Category I structures the description includes the containment enclosure building, auxiliary building, fuel storage building, control building, diesel generator building, and miscellaneous Seismic Category I structures. Service Water Bldg. - or - Service Water Structures

SWESSAR

____

____

B. APPLICABLE CODES, STANDARDS AND SPECIFICATIONS (3.8.4.2) 3.8-53

The following are employed:

ACI 318; ACI 359; ASME BSPV Code Section III, Div. 1, Subsections NE and NF; AISC; ANSI 45.2.5; RG 1.10; RG 1.15; RG 1.55

Subsection 3.8.6.2 Plus Specific Details

____

C. LOADS AND LOAD COMBINATIONS (3.8.4.3) 3.8-54

The following load combinations apply

Service Load Conditions:

Concrete and Steel for WSD: (S)

D+L, D+L+E, D+L+W

and if thermal stress is present (1.3S-Concrete 1.5S-steel)

D+L + To + Ro, D+L+To+Ro+E

D+L+To+Ro+W

Concrete for USD;

1.4D+1, 1.4D+L+1.9E,

1.4D-1.7L+1.7W

and if thermal stress is present (U)

(.75) (1.4D+1.7L+1.7To+1.7Ro)

(.75) (1.4D+1.7L+1.9E+1.7To+1.7Ro)

(.75) (1.4D+1.7L+1.7W+1.7To+1.7Ro)

Steel for Plastic Design: (Y)

1.7D+1.7L, 1.7D+1.7L+1.7E,

1.7D+1.7L+1.7W

Factored Load Conditions:

Steel for WSD: (1.6S)

D+L+To+Ro+E' and W_T, D+L+Ta+Ra+Pa

D+L+Ta-Ra+Pa+Y+E

Steel for plastic design and concrete for USD: (1.7S) .9Y

D+L+To+Ro+E' and W_T, D+L+Ta+Ra+1.5+a

D+L+Ta+1.25Pa+Y+1.25E,

D+L+Ta+Pa+Pa+Y+E'

- or -

SWESSAR

____

____

12 39

D. DESIGN AND ANALYSIS PROCEDURES (3.8.4.4) 3.8-55

For concrete structures ACI 318-71 is utilized. For steel STRUCTURES, AISC specifications are utilized.

\- or -

SWESSAR

Subsection 3.8.6 States specifies on ACI & AISC Code Requirements

E. STRUCTURAL ACCEPTANCE CRITERIA (3.8.4.5) 3.8-56

The stress limits tabulated opposite the load equations apply.

\- or -

SWESSAR

Subsection 3.8.6.5

Tables 3.8-19 to -22 ; 27; 28 ; 31

KINAHL

MIDLAND NPP — RG COMPLIANCE

RG 1.10 — MECHANICAL (CADWELD) SPLICES IN REINFORCING BARS OF
(INCLUDES) CATEGORY I CONCRETE STRUCTURES (Rev 1) (1-2-73)

RG 1.12 — INSTRUMENTATION FOR EARTHQUAKES (Rev 1) (4-74)
(EXCEPTION) Accepted NRC Letter 6-8-76
Modified position as per Q 130.19

RG 1.15 — TESTING OF REINFORCING BARS FOR CAT. I CONCRETE
(EXCEPTIONS) STRUCTURES (Rev. 1) (12-28-72)
Problem w/ Alternate use of reported material cert
with the project Engineer approval

RG 1.18 — STRUCTURAL ACCEPTANCE TEST FOR CONCRETE PRIMARY
(EXCEPTION) REACTOR CONTAINMENTS (Rev. 1) (12-28-72)
Accepted NRC Letter 6-8-76

RG 1.19 — NONDESTRUCTIVE EXAMINATION OF PRIMARY CONTAINMENT
(EXCEPTION) LINER WELDS (Rev. 1) (8-11-72)
Accepted NRC Letter 6-8-76

RG 1.35 — INSERVICE INSPECTION OF UNGROUTED TENDONS IN
(BC-TOP-5A) PRESTRESSED CONCRETE CONTAINMENT STRUCTURES
(Rev 1) (A/74)
BC-TOP-5A Rev 3 (2/75)
NRC Letter 6-8-76

RG 1.55 — CONCRETE PLACEMENT IN CAT. I STRUCTURES
(COMPLIES)

(over)

RG 1.57 — DESIGN LIMITS AND LOADING COMBINATIONS FOR (N.A.) METAL PRIMARY REACTOR CONTAINMENT SYSTEM COMPONENTS (6/73)

RG 1.59 — DESIGN BASIS FLOOD FOR NPP (Rev. 0)
(EXCEPTIONS) Sand Engineering
Consideration for Qualification of Well-Systems

RG 1.60 — DESIGN RESPONSE SPECTRA FOR SEISMIC DESIGN
(EXCEPTIONS) OF NPP (Rev 1) (12/73)
Plant Design prior to RG 1.60 Issuance
NRC Letter 6-8-76
Buried Pipes BC-TOP-4A
Four Earthquakes & moderate distance from
Epicenters AEC TID-7024

RG 1.61 — DAMPING VALUES FOR SEISMIC DESIGN OF NPP
(EXCEPTIONS) (Rev. 0) (10/73)
NRC Letter 6-8-76

R.G 1.90 — INSERVICE INSPECTION OF PRESTRESSED CONCRETE
(NA) CONTAINMENT STRUCTURE WITH GROUTED TENDONS
(11/74)
NRC Letter 6-8-76

C RG 1.92 — COMBINATION OF MODES & SPATIAL COMPONENTS
(EXCEPT...) IN SEISMIC RESPONSE ANALYSIS (Rev 1) (2/7..

RG 1.102 — FLOOD PROTECTION FOR NPP (Rev. 1) (9/76)
COMPLIES WITH RG 1.59

RG 1.103 — POST-TENSIONED PRESTRESSING SYSTEMS FOR CONCRETE
(COMPLIES) REACTOR VESSELS AND CONTAINMENTS (Rev. 1) (10/..

RG 1.107 — QUALIFICATION OF CEMENT GROUTING FOR
(NA) PRESTRESSING TENDONS IN CONTAINMENT STRUCTURES
(11/75)

C RG 1.122 — DEVELOPMENT OF FLOOR RESPONSE SPECTRA FOR
(COMPLIES) SEISMIC DESIGN OF FLOOR SUPPORTED EQUIPMENT
OR COMPONENTS (Rev. 1) (2/78)

RG 1.127 — INSPECTION OF WATER CONTROL STRUCTURES
(COMPLIES) ASSOCIATED WITH NPP (Rev 1) (3/78)

RG 1.142 ENDORSEMENT OF ACI 349 w/EXCEPTIO..
(NOT COMPLETE)

C

RINACT.

MIDLAND NPP — COMPUTER PROGRAMS

APPENDIX-3C

Purpose: to verify computer programs used for Midland NPP against other Acceptable Programs or Conventional Methods of Calculation

3C.1 — AXISYMMETRIC SHELL AND SOLID COMPUTER PROGRAM (ASHSD) p. 3C-

- ELASTIC
- STATIC or DYNAMIC
- AXISYMMETRIC SHELL or SOLIDS

Original Code developed @ University of Calif., Berkeley — Current Code modified for NPP use

- Finite Element Shell w/ interaction stiffness that allows Analysis of Layered Shells
- Bonded or Unbonded Layers ie Liner Unbonded
- Isotropic or Orthotropic Elastic Constants
- Non-Uniform Thermal Gradient thru Wall
- Programs Computes Eigenvalues/vectors
- Dynamic-Loading — Uncoupled (Modal) Coupled (Direct Integration)
- Response Spectrum Modal Analysis for { ABS. SUM; SRSS

DISPLACEMENT & STRESSES

- Time History allows Arbitrary Damping Matrix
- Stiffness & Mass Matrices obtained from other program

3C.2 FINITE ELEMENT COMPUTER PROGRAM (FINEL) p 3C-[illegible]

2-D STATIC ANALYSIS STRESS/STRAINS [illegible]

FOR AXISYMMETRIC STRUCTURES

BILINEARITY IN COMPRESSION

" " TENSION FOR CRACKING CONDITI[illegible]

AUTO-MESH GENERATOR

DISPLACEMENTS OF CORNERS OF ELEMENTS

STRESS/STRAIN FOR EACH ELEMENT

3C.3 BECHTEL STRUCTURE ANALYSIS PROGRAM p [illegible]

(BSAP)

Original SAP 69 Univ. of California, Berkeley

Used in Design/Analysis Work

Finite Element for Structural Analysis of Systems subject to Static/Dynamic & Thermal Loads C

3C.4 PLATE BENDING - p 3C-167

Linear Elastic Analysis Stiffener Beams

Arbitrary Shape & Supports Elastic Foundation

See p 3C-169-170 for Assumptions & Limitations

3C.5 BUILDING DEPRESSURIZATION p-3C-18[illegible]

Compute Change in Pressure in Compartment

TORNADO APPLICATION: Time dependent atmospheric pressure change to a partially vented Bldg & Calculate Differential pressure histories across Internal and External walls {One-dimensional Quasi-Static; for flow thru Openings} C

3C.6 SPECTRA p 3C-229

Computes Response Spectra from Time Histories (Max Values are selected)

3C.7 MODAL ANALYSIS OF PLANE FRAMES p 3C-240

- Computes: FREQUENCIES, MODE SHAPES, GENERALIZED MASSES, PARTICIPATION FACTORS, MODAL DAMPING for a given stiffness. The program can also compute or accept a REDUCED STIFFNESS MATRIX

3C.8 SPECTRAL RESPONSE OF PLANE FRAMES p 3C-25[illegible]

Modal Response of plane frames/Trusses Absolute Sum or SRSS output available

3C.9 TIME HISTORY ANALYSIS p 3C-263

responses as: displacement velocity acceleration TIME HIST.

3C.10 RESPONSE SPECTRA p 3C-280

Response Spectra computed from an Acceleration Time History

3C.11 COMPOSITE DAMPING OF SOIL-STRUCTURE SYSTEM p 3C-2[illegible]

Frequency, Mode Shapes, Composite Modal Damping of a lumped soil-structure system for Lateral & Vertical seismic analysis. Applies for structures on common [illegible]

3C.12 BSAP POST-PROCESSOR PROGRAM OPTCON MODULE 3C-30[illegible]

given force determines prestressing steel & section [illegible] liner plate consideration possible

Optimizes steel for a given design.

QUESTIONS AND OPEN ITEMS

Q1. The Tornado Missile Spectra does not fully comply with the current NRC Tornado Missile criteria. Specifically, the applicant has not considered the three steel pipe missiles (3" dia., 6" dia., 12" dia.). From a structural point of view, the 12" diameter steel pipe controls the design of the concrete barriers. Therefore, further evaluation for this Tornado Missile is required. In addition, the applicant should demonstrate that the vents used to reduce the differential pressure in other category I structures, are adequate to resist the missile impact.

Q2. The applicant has not established the effectiveness of the ground-water well-system. These wells are needed to control the ground water level and prevent soil-liquefaction. The proposed dewatering system should be categorized in its entirely or in part, as per determination of the system evaluation and geo-science personnel, as Category I systems and should be designed and constructed to resist the loads of OBE/SSE and other pertinent soil loads.

Q3. Due to settlement and inadequate compaction in the plant fill area, the applicant has agreed to re-run the seismic analyses of all Category I structures in this area. In addition, we require as necessary, the revision of structural analyses of all Category I structures affected.

Q4. Because of the strengthening measure to the backfill with caissons or piles, the foundation of structure will be different from that of the original. Such a change will require a re-run of seismic analysis.

The floor response spectra for the diesel generator building were generated on the assumption that the shear wave velocity would not be lower than 500 FPS. We recommend that the surveillance of the soil properties be conducted throughout the entire period of consolidation of the building to verify the validity of this assumption.

Q5. Some areas of the fill material under the Nothern part of the service water pump structure have not been sufficiently compacted. The portion of the structure over the fill material is being supported by the rest of the structure founded on natural material through cantilever action. A static analysis of the structure by the applicant indicated that the total design loads cannot be supported by the main structure through cantilever action. The corrective action stated in MCAR 24 (issued 9/7/78) Interim Report 6, consist of placing pilings under the North wall of the structure.

Two questions regarding this corrective action of concern to NRC should be addressed by the applicant. They are listed below.

(1) The method of attaching the corbels by using long longitudinal bolts through the walls would require the bolts to resist bending. This is not an effective way of utilizing bolts. Other methods should be considered and compared.

(2) In the proposed re-analysis of the survice water pump structure for seismic loading, it is not clear how the piling will be treated. The vertical piling cannot resist horizontal forces unless proper bracing is provided. Will the piling still be effective to support vertical load after an earthquake?

Q6. The reactor vessel support system is under review because of the failure of some anchor bolts under pretension load. A new design has been proposed by the applicant. Provide the final design and analysis.

DUE TO DIFFERENTIAL SETTLEMENT THE FOUNDATION SUPPORTING THE BUILDING IN THE PLANT FILL AREA HAS BECOME DRASTICALLY DIFFERENT FROM THE ORIGINAL DESIGN. CONSEQUENTLY QUITE A DIFFERENT STRUCTURAL SYSTEM THAN ORIGINALLY USED NOW EXISTS. THIS NEW STRUCTURAL SYSTEM SHOULD BE REANALYZED TO SATISFY ALL THE DESIGN LOADS AND LOAD COMBINATIONS.

Q7. In the response to question 15 of NRC requests regarding plant fill, the applicant has stated that "differential settlement primarily induces additional strain, which is a self-limiting effect and does not affect the ultimate strength of the structural members." Additional clarification of this statement is needed.

Q8. The applicant responses to questions 14, 28, and 29 of NRC request regarding the causes of cracks due to settlement of plant fill, the significance of the extent of cracks and the consequences of cracking gives us a better insight of the existing condition of the category I structures. We further recommend that the following information be given.

a. Provide the tension field data, if any under the design load combinations at all crack locations for each Category I structure.

b. Provide analysis to show the limiting tension field condition in which a crack will not enlarge or propagate.

c. Show that the existing cracks shall not propagate further due to settlement and inadequate compaction problem.

d. Show the corrective plans in regards to the adverse effects of corrosion of the reinforcing bars in the crack areas.

QI1. Because the fill was replaced by other material such as lean concrete in case of the auxilliary building and the feedwater valve pits, the soil properties of the foundation material will be changed. We recommend that the new properties of this new foundation material be thoroughly investigated. The new soil properties (e.g. damping valves and shear modulus) should be used in the revised seismic analysis to determine the structural adequacy of the affected structures. Pertinent soil-structure interaction methods should be used in the revised analysis. Structural analysis should be conducted using the revised seismic loading and current NRC criteria so that margins of safety can be determined against current standards. This analysis should include the effects of settlement and revised load combination equations that are appropriate for the structure.

QT2. Since a majority of the containment design was completed by 1973, the load combinations used and presented in the FSAR do not agree with those in the U.S. Atomic Energy Commission Standard Review Plan (SRP) 3.8.1. Also, the applicant has not demonstrated the degree of conservation used in the midland design, with respect to the load combinations and the related acceptance criteria. Is it equivalent to that which would have resulted if the NRC Standard Review Plan Acceptance criteria had been used?

QI3. Since the design of other Category I and internal concrete structures were completed before 1973, the load combinations presented in the FSAR are not in accordance with the current NRC requirements. Specifically, the staff uses as the Acceptable Reference ACI-349, modified as per Regulatory Guide (RG) 1.142. The applicant has not demonstrated the degree of conservatism used in the midland design, with respect to the load combination and the related acceptance criteria. Is it equivalent to that which would have resulted if the current NRC acceptance criteria had been used?

NAVY

1. REQUESTED BY (NAME, CODE, EXT.)	3. DATE	3.	4.	5. REQUEST NO
JOHN P. MATRA JR 6403 X41615	6-6-80	☒ PROCURE ☐ TURN-IN	PAGE 1 OF 1	

6. ROUTING	7. ADP/DIPEC NO	8. DATE REQUIRED	9. DATE FUNDS EXPIRE	10. JOB ORDER NO
				OG98VAM: 1

11. DELIVER TO (NAME, CODE, BLDG, ROOM NO, EXT.)	12. ECC	13. (a) PRIORITY NO (b) AUTHORIZING DOCUMENT

14. SUPPLIER (a) (Suggested)	(b) Selected	BUS SIZE / COMP SS	15. REQUEST AUTHORIZED (Signature)
BUTLER ANALYSES 932 BEAVERBANK CIRCLE TOWSON MD 21204			

16. SCREENING (a) SUPPLY (b) EXCESS / DATE	17. BUYER	18. DATE ORDERED	19. DELIVERY DATE	20. CONTRACT/ORDER/REQUISITION NO	BPA CALL N

21. (a) APPROPRIATION/SUBHEAD	(b) B.C.N.	(c) SUB-ALLOT	(d) A.A.A.	(e) T.T.	(f) STOREROOM	(g) E.E.	(h) CAT	(i) OBJ	(j) ESTIMATED AMOUNT
									$5,000

22. ITEM NO. (a)	NATIONAL/LOCAL STOCK NUMBER AND DESCRIPTION OF MATERIALS AND SERVICES (INCLUDE MANUFACTURER'S PART, MODEL AND SERIAL NUMBERS) (b)	QUANTITY (c)	UNIT OF ISSUE (d)	UNIT PRICE ESTIMATE ☐ CATALOG ☐ (e)	UNIT PRICE (f)	EXTENSION (g)
1	STATEMENT OF WORK PREPARE A PRE-PROCESSOR PROGRAM TO CONVERT AN ACCELERATION TIME HISTORY ON A RIGID BASE TO A FORCING TIME HISTORY DISTRIBUTED OVER A CYLINDER, MODELED TWO WAYS; FIRST AS A SHELL, THEN AS A STICK MODEL. DELIVER A SET OF ROTE (USERS INSTRUCTIONS) INSTRUCTIONS AND AN EXECUTABLE PROGRAM TESTED ON NSWC COMPUTER. ALL COMPUTING TIME AND COST WILL BE GOVERNMENT FURNISHED. TASK TO BE COMPLETED APPROX 45 DAYS AFTER GO AHEAD. BUTLER ANALYSES % TOM BUTLER 932 BEAVERBANK CIRCLE TOWSON MD 21204 PHONE 301-823-2918					

Matra Depo Ex 4
1-7-81 CKS

23. TURN-IN CONDITION	24. RECEIVED BY	DATE	25. INSPECTED BY	DATE	26. GRAND TOTAL

27. DO NOT INCLUDE CLASSIFIED MATERIAL ON THIS DOCUMENT	28. ACCEPTED BY	DATE
☐ CLASSIFIED INFORMATION ATTACHED (UNCLASSIFIED WHEN REMOVED)		

FROM G402 (HUANG)
TO

{ VIA (1) G40

SUBJ: NEGOTIATION OF A CONTRACT WITH BUTLER ANALYSES ON A SOLE SOURCE BASIS; REQUEST FOR

ENCL: (1) REQUISTION/TURN-IN DOCUMENT

1. IT IS REQUESTED THAT A CONTRACT BE NEGOTIATED WITH BUTLER ANALYSES DEVELOP A PRE-PROCESSOR PROGRAM CAPABLE OF CONVERTING ACCELERATION TIME HISTORY ON A RIGID BASE TO A FORCING TIME HISTORY DISTRIBUTED OVER A CYLINDER

2. BUTLER ANALYSES IS UNIQUELY QUALIFIED TO PERFORM THIS STUDY FOR THE FOLLOWING REASONS.

(a) THESE CODE CHANGES ARE TO BE INCORPORATED INTO THE NASTRAN PROGRAM; A CODE WHICH BUTLER ANALYSES IS THOROUGHLY FAMILIAR WITH.

(b) THE COST OF MODIFYING THE EXISTING NASTRAN CODE TO ACCEPT THE PRE-PROCESSOR WOULD BE MUCH LESS THAN THE COST TO DEVELOP OR MODIFY A NEW CODE.

3. NO OTHER COMPANY IN THE UNITED STATES HAS TO THE BEST OF MY KNOWLEDGE, THIS UNIQUE COMBINATION OF TALENTS, PROGRAM AND DATA BASE NECESSARY TO THE PERFORMANCE OF THIS CONTRACT

4. I CERTIFY THAT THE FACTS AND REPRESENTATIONS UNDER MY COGNIZANCE WHICH ARE INCLUDED IN THE ABOVE SOLE SOURCE JUSTIFICATION ARE ACCURATE TO THE BEST OF MY KNOWLEDGE AND BELIEF.

P.C. HUANG

J.P. MATRA JR

COPY TO
640
6402
(6402 (MATRA)

KANE X492-8162

(1) OUR INTEREST IS WHAT IS THE DESIGN INPUT TO THE STRUCTURE. SINCE THE DESIGN IS BASED ON AN EFFECTIVE DEWATERING SYSTEM AND WITH ASSURANCE THAT THE BACK UP SYSTEM WILL GUARANTEE THE VALIDITY OF THE DESIGN INPUTS; WE WOULD LIKE TO KNOW THE RELIANCE OF THE COMPLETE SYSTEM.

(2) SEISMIC RE-ANALYSIS OF ALL CATEGORY I STRUCTURES DUE TO PLANT FILL CONDITIONS ARE REQUIRED.