Bechtel Power Corporation
Engineers – Constructors

Fifty Beale Street
San Francisco, California
Mail Address: P. O. Box 3965, San Francisco, CA 94119

May 19, 1980

Mr. R. Licciardo, Project Manager
Operating Reactors Branch #1
Division of Operating Reactors
United States
Nuclear Regulatory Commission
Washington, D. C. 20555

Re: Summary of Meeting on Masonry Wall and Pipe Support
Structural Interdisciplinary Coordination

Dear Mr. Licciardo:

We have reviewed the notes of the January 11, 1980 meeting between the NRC staff and representatives of Bechtel and licensees in whose plants Bechtel was involved in the design process. We believe there are sufficient inaccurate descriptions of statements and commitments made by Bechtel representatives to warrant submitting clarifications on these notes. In addition, we would like to make a correction to one of the Bechtel handouts. The clarifications noted below are keyed to notations on the enclosed copy of the notes.

1. Correction to Bechtel Handout Attachment 4

The entry for Dresden 1 (56) should read as follows: DATA AVAILABLE; NOT REVIEWED BY BECHTEL PRIOR TO MEETING. Information was made available to Bechtel just prior to January 11, but was not reviewed before the meeting.

2. General Comments on Summary Notes

The notes state in a few instances that Bechtel representatives committed to submit additional data and/or to make further investigations. Our representatives do not recall making any such commitments; it certainly was not their intent to do so. Since I&E Bulletin 80-11 has been issued relating to the subject, we believe that matters relating to analytical techniques should be handled on a case-by-case basis in a licensee's response to the Bulletin.

X6011

C 8006270352

3. Specific Clarifications

Pages 1 and 2 - none

Page 3: revise to read:

A. "D. W. Halligan stated that these circumstances and criteria were often discussed with the staff during the licensing of each plant."

B. We do not recall any commitment to submit additional data. See our general comment, Section 2.

C. The points stressed by T. E. Johnson should read as follows:

- o "The criteria, including load combinations used, were conservative, i.e., seismic loads were high, damping values were low and linear response was used."
- o "Almost all block walls are inside and not subject to tornado and external missile loads."
- o "UBC provides a safety factor of 3."
- o "Comments on linear vs. non-linear response (after cracking and yielding, there is much lower seismic response)."
- o "Many loads are self-limiting and only result in additional strain with minor effect on strength, such as thermal and inter-story drift."

Page 4:

D. The two points on the top of Page 4 were made by D. W. Halligan rather than T. E. Johnson.

E. D. W. Halligan's last point should read as follows: "In some cases, Bechtel designers did miss the fact that large pipes were attached; where this was not so, the design was based on the designer's judgment of the available design margin and the relative importance of the pipe load to other loads on the wall."

F. Bechtel recalls no commitment to review tests by Sandia or EPRI. See Section 2.

G. The concrete standard cited by Ted Johnson is ACI 318.

Page 5:

H. No commitment was made by Bechtel to provide analyses to Professor Colville or to the NRC. See Section 2.

Page 6:

I. The meaning and context of this comment are not clear. It may refer to NRC staff statements regarding as-built conditions not conforming to design drawings, e.g., a Duane Arnold incident regarding a pipe support attached to a concrete block wall whereas the vendor prepared hanger design drawing showed an attachment to reinforced concrete. Please clarify.

It is hoped that you will be able to issue revised notes or an equivalent commentary. If you have questions, contact the undersigned on (415) 768-7989 or Alan Appleford on (415) 768-7987.

If, in the future, the NRC desires to contact Bechtel Power Corporation regarding generic design practices or policies, it would be preferable if initial inquiries were made with the undersigned or Dr. S. A. Bernsen, Manager of Nuclear Engineering.

Sincerely,

S. A. Bernsen for

A. L. Cahn
Manager of Engineering
Thermal Power Organization

cc: D. G. Eisenhut
C. C. Trammell

Attachment

Attachment

Appleford

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

Docket Nos. (see Attachment No. 1)

LICENSEES: (see Attachment No. 1)

FACILITIES: (see Attachment No. 1)

SUMMARY OF MEETING ON MASONRY WALL AND PIPE SUPPORT STRUCTURAL INTER-DISCIPLINARY COORDINATION

Introduction

On January 11, 1980, the NRC staff met with representatives of Bechtel and licensees whose plants were designed in whole or part by Bechtel to discuss matters related to masonry walls and pipe supports in light of the Trojan plant design problems. See Attachment 1 for a list of these plants, licensees and docket numbers. A list of attendees is provided in Attachment 2. The topics discussed were presented in a January 7, 1980 NRC letter to Bechtel from Darrell G. Eisenhut, Acting Director of the Division of Operating Reactors. A copy of the meeting agenda followed is provided as Attachment 3.

Introduction & Background - NRC

Ken Herring of NRC summarized our experience in dealing with the Trojan plant's masonry walls including apparent inadequacies in the QA/QC of their design and construction.

Ken Buchert of Bechtel responded to this.

Introduction - Bechtel

D. W. Halligan briefly outlined the intended scope of Bechtel's presentations for the meeting.

Presentation of Summary Matrix

Block Wall Summary

A summary of block walls used at Trojan and other nuclear plants designed by Bechtel was given by Ken Buchert. The presentation concentrated on the dates designs started and the total number of masonry shear walls used. Trojan was said to be unique in its use of a large number of masonry shear walls required to carry seismic loads. Pilgrim 1 and San Onofre 1 are the only other plants with masonry shear walls.

Alan Appleford of Bechtel addressed the currently available information on equipment and piping supported on block walls as summarized in columns 3 and 4 of Attachment 4. He stressed the limited and preliminary nature of the information which could be made available in the limited time available before the meeting.

Construction Specifications and Practices

John Stull and D. B. Hardie presented information and positions on construction specifications and practices used in the plants under consideration.

Construction details of the walls (including the use of either mortar, grout or concrete) are summarized in Attachment 4. Quality standards for block masonry and grout are presented in Attachment 5. Where the particular quality standards listed incorporate others by reference, these "others" are not separately referenced on the tabulations provided.

The different levels of responsibility by Bechtel in the various plants under consideration are presented in summary form in Attachment 6. The types of contracts and the related specifications did not require detailed documentation of block walls. Therefore, the written records of their construction and quality are sparse or virtually nonexistent. Quality is ensured in the "modus operandi" generally employed by Bechtel in the selection of contractors - which is generally undertaken from a client's listing, the use of affiliated unions and related block workmen. A preconstruction meeting is generally held at which price and approach are discussed. Coordination and administration of the actual work on the site is by Bechtel field engineers who also inspect. Many of the field engineers used on the plants under discussion are long term employees of Bechtel and are therefore available to provide information as may be recalled. The field engineer is required to sign off on billings.

The only plants listed on Attachment 1 that have a full set of specifications are those with a relatively late start, starting with Davis-Besse in 1969, and ANO-2 (1970). For these plants, every wall is identified, specifications were required for each, and daily inspection records were called for.

The particular responsibilities for construction specifications and records needs to be identified for each plant by checking the prime contract and subcontracts used to complete the block walls at each plant.

Block walls, both complete and partial, are used to facilitate the access of equipment and piping into interior rooms and especially during construction. They are also used for shielding purposes.

----Bechtel Clarification, see letter

Design Criteria

Design criteria used in the plants were discussed by Ken Buchert, Ken Lee and Ted Johnson of Bechtel. A summary by plant is presented in Attachment 7. Due to lack of time to prepare for this meeting, Attachment 7 does not show all load combinations for all of the plants. It was stated that tornado loads and external missile loads generally do not affect these walls.

The Uniform Building Code (UBC) was generally used when these walls were designed. No specific analysis was made for dead loads (D) operating basis earthquake loads (E) safe shutdown earthquake loads (E') or temperature gradient loads (T) in a number of these plants. Different positions were taken on other plants.

(A) D. W. Halligan stated that these circumstances and criteria were discussed with the staff during the licensing of each plant.

Dr. Ken Lee discussed the extent of potential cracking or fracture under seismic conditions. Bechtel has no particular position at this time.

Bechtel stated that preliminary reviews indicated that generally single wythe block walls have been designed to withstand the loads by themselves. They are then assembled into multiple wythe walls by adding concrete mortar or grout filler. It has been assumed that the resulting composite is of more conservative design than the single wythe wall.

Bechtel believes that the damping values used are conservative. Block walls were not meant to support large pipes. Bechtel believes that in the majority of cases (based on a sample audit) that the block walls support only light elements, with pipes 2 inches in diameter or smaller, and electrical equipment. The weight of such items is estimated by Bechtel to be no greater than 10% of the wall weight (based on the sample audit), and to add no more than 20% to wall stress. Bechtel will provide the technical data which support these estimates.

(B)

T. E. Johnson presented an overall view stressing:

(C)

- o Available criteria including load combinations used, governed the wall design
- o Almost all block walls are inside-not subject to tornado and external missile loads
- o Low damping coefficients were used
- o UBS provides a safety factor of 3
- o Comments on linear vs. non-linear response

(D) o The block walls in the plants were "structurally prudent" for the time, especially within the California experience, in allowing for seismic events.

(E) o In some cases, Bechtel did miss the fact that large pipes were attached; where this was not so, the design was based on the designers judgment of the overall situation.

A discussion was held between J. Coleville, NRC consultant, and Ken Lee and Ken Buchert of Bechtel regarding "cracked I," the moment of inertia under cracked conditions, the validity of ACI cracked I calculations, and the significance of the small effective I. Bechtel used judgment in these matters after discussions with Newmark. It was indicated that recent data is available from SANDIA Labs and from EPRI sponsored Tornado building test in which the 1/2 (Ig + Ic) approach was tested against the resulting displacements from the test. Bechtel has committed to review this work.

(F)

J. Coleville and Ken Herring commented that tests on concrete walls (as for the EPRI tornado building tests) are not necessarily valid for block walls. Bechtel made its first tests with missiles on concrete walls five or six years ago. Bechtel indicated that they had to rely on UBC criteria then and that such design has been shown to have adequate safety. The staff questioned the general applicability of the UBC; they further indicated that Bechtel should not take two different approaches to determine values of parameters under seismic conditions to justify the safety of the designs.

Ted Johnson spoke of the "added" load combinations, embedments and missiles, and the basic allowances which have been made based on concrete standards 314-319, and indicated that he believed these adequately address the problems and that the plants are safe with respect to these walls.

(G)

Ken Herring indicated that the concrete codes do not apply to block walls and that our basic concern is whether the walls are safe - not whether they comply with a particular FSAR commitment.

Bechtel maintained that, in general, the walls are only supporting small loads and that there are only a small number of plants where these walls are otherwise loaded. Further, Bechtel indicated, the block walls are not generally used as structural elements in the overall plant design, but, rather, are used as "fillers" and "blockouts."

J. Coleville observed that one cannot identify the critical block walls at this time without reference to the structural elements themselves.

Bechtel pointed out that on Duane Arnold, for example, concrete block walls were discussed with the staff 5 - 10 years ago.

The discussion then was focused on what the allowable shear strength should be for block walls. References were made to a few papers and particularly Author Clay Hegemier and the Proceedings of the North American Conference held in Colorado in 1978.

Substantial disagreement exists between all parties on the shear strength of bed joints over the range of 26 to 54 psi. Collar joints and vertical joints were also discussed.

The staff's consultant, J. Coleville, indicated that the problems of non-shear walls are not necessarily insignificant and that the collar mortar joints would do well if they could sustain 12 - 20 psi loads with 80% voids. Dr. Lee restated Bechtel's design philosphy - that the block walls were designed as single wythe walls and then combined into multiple wythe walls. He said this means no credit was taken for any strength in collar joints. J. Coleville indicated he would like to see an analysis supporting this assertion. (H)

Bechtel then presented available design information for the double wythe walls at Turkey Point 3 and 4, including reinforcement and ties. Similar information was provided for Millstone 2. Bechtel considers its design approach to be satisfactory on the basis that a single wyth could take the lateral load and that the amount of reinforcing was consistant between jobs.

Discussion centered on the validity of the design approach including considerations of the amount of reinforcing used. The assumption of end wall restraints varies between plants based on the structural designer's perception of the rigidity of the particular local wall conditions.

It was concluded at the meeting that there is substantial disagreement between Bechtel and the NRC staff as to what constitutes an adequate approach to the design bases and related stresses on single wythe walls, the validity of the simplified extension to the integrity of composite walls, and considerations of the resulting reactions upon the principal structural elements of the buildings under seismic conditions.

Ted Johnson proposed that a safety margin of 3 for working stress and a safety margin of 2 for ultimate strength calculations are satisfactory if one has significant test information upon which all could agree.

San Onofre 1

This plant was described as having a single story, single room building of block construction in which the loadings on the building are extremely small.

Pilgrim 1

A cursory survey of the affected building was insufficient to permit a conclusive judgment due to lack of information on the response characteristics of the surrounding structure.

General Summary Review

The staff believes that there may have been a lack of adequate control and supervision during the initial design with respect to block walls at these plants. Especially for the older plants, it appears that designs were based on judgments with a lack of substantive justification.

(I) Earlier Bechtel submissions on particular details of existing installations were not confirmed by subsequent NRC inspections.

Criteria initially used for the Trojan block walls were not approved.

Charles Trammell pointed out that not only the seismic qualification of the block walls and all systems attached thereto (not only Category 1 piping) are of concern, but also of concern is the integrity of the essential safety systems in close proximity which could be impacted by the failure of such a wall. The integrity of the wall when subjected to all possible loads such as high energy line breaks and internal plant missiles also needs to be addressed.

Mr. Trammell requested that the licensee representatives at the meeting discuss with their management the lessons learned to date, from the Trojan experience and this meeting. Also, he asked that they have further discussions with their Architect Engineer (Bechtel) to determine the safety of their plants in this area. He stated that it is to be expected that the staff will pursue this matter directly with each licensee, however, the licensees were encouraged to form an owners group to enable a detailed treatment of this matter in the most efficient way. The staff also indicated that it is possible that an I&E Bulletin similar to 79-02 and 79-14 will be issued.

The basic outstanding issues are:

- o Define the problem at each plant in terms of plant safety should the wall or attachments fail,
- o Establish acceptable criteria for the design of the safety related walls and attachments and,
- o Ensure all structural elements have been designed to resist appropriate piping and equipment support reactions.

R. Licciardo

R. Licciardo, Project Manger
Operating Reactors Branch #1
Division of Operating Reactors

Attachments:
1. List of Dockets, Licensees and Facilities
2. List of Attendees
3. Agenda
4. Table 1
5. Table 2
6. Table 3
7. Table 4

Meeting Summary for

Docket Files
NRC PDR
Local PDR
ORb1 Reading
NRR Reading
H. Denton
E. Case
D. Eisenhut
R. Tedesco
G. Zech
B. Grimes
W. Gammill
L. Shao
J. Miller
R. Vollmer
T. J. Carter
A. Schwencer
D. Ziemann
P. Check
G. Lainas
D. Crutchfield
B. Grimes
T. Ippolito
R. Reid
V. Noonan
G. Knighton
D. Brinkman
Project Manager
OELD
OI&E (3)
C. Parrish/P. Kreutzer
ACRS (16)
NRC Participants
NSIC
TERA
Licensee
Short Service List

Attachment 1

Docket No.	LICENSEE	FACILITY
50-344	Portland General Electric	Trojan
50-010	Commonwealth Edison	Dresden 1
50-155	Consumers Power	Big Rock Pt.
50-206	Southern California Edison	San Onofre 1
50-250	Florida Power and Light	Turkey Pt. 3
50-251	Florida Power and Light	Turkey Pt. 4
50-255	Consumers Power	Palisades
50-263	Northern States Power	Monticello
50-266	Wisconsin Electric Power	Point Beach 1
50-301	Wisconsin Electric Power	Point Beach 2
50-277	Philadelphia Electric	Peach Bottom 2
50-278	Philadelphia Electric	Peach Botton 3
50-209	Duke Power	Oconee 1
50-270	Duke Power	Oconee 2
50-287	Duke Power	Oconee 3
50-312	Sacramento Municipal Utility District	Rancho Seco 1
50-293	Boston Edison	Pilgrim 1
50-313	Arkansas Power & Light	ANO-1
50-368	Arkansas Power & Light	ANO-2
50-317	Baltimore Gas & Electric	Calvert Cliffs 1
50-318	Baltimore Gas & Electric	Calvert Cliffs 2
50-366	Georgia Power	Hatch 2
50-336	Northeast Nuclear Energy	Millstone 2
50-346	Toledo Edison	Davis-Besse 1
50-331	Iowa Electric Power & Light	Duane Arnold
50-348	Alabama Power	Farley 1

Attachment 2

LIST OF ATTENDEES

NAME	AFFILIATION
Charles Trammell	NRC
Ken Herring	NRC
B. D. Liaw	NRC
Robert Licciardo	NRC
Drew Persinko	NRC
Jim Coleville	Univ. Md/Consult. to NRC
Monte Conner	NRR/ORB-4
Jack Spraul	NRC/QAB
J. F. Fair	NRC/DOR
N. H. Williams	Boston Edison Co.
Ken Buchert	Bechtel
D. W. Halligan	Bechtel
T. E. Johnson	Bechtel
S. L. Sobkowski	Bechtel
F. Schauer	NRC/SEB
D. B. Hardie	Bechtel
Man Applefood	Bechtel
John Stull	Bechtel
Del Raasch	SMHD
W. A. Brandes	Bechtel
Kenneth Lee	Bechtel
Roger Huston	Consumers Power Co.
Thomas Cheng	NRC/DOR/SEPB
Henry Lee	NRC/DOR/SEPB
William Brittle	Bechtel
Nabil Awadalla	Duke Power Co.
Steve Hammer	Northern States Power
James F. Costello	NRC/RES
V. Noonan	NRC
David Saunders	Arkansas Power & Light
Mike White	Arkansas Power & Light
John Amaral	Bechtel
Dennis Mominee	Toledo Edison Company
J. A. DeMastry	Florida Power & Light
D. W. Jones	Florida Power & Light
G. D. Whittier	Florida Power & Light
H. A. Wilber	NRC/I&E
L. A. Silva	Philadelphia Electric
D. Marano	Philadelphia Electric

LIST OF ATTENDEES

NAME	AFFILIATION
G. K. Wang	Bechtel
J. W. Fay	Bechtel
A. L. Reimer	Wisconsin Electric
M. P. Cass	Northeast Utilities
D. T. Ward	Baltimore Gas & Electric
B. K. Kanga	Bechtel
A. J. Arnold	Bechtel
David C. Jeng	NRC/SEB
John O'Neill	Shaw, Pittman for Wisconsin Electric
C. W. Burger	NRC/RES
Kanti Gandhi	Bechtel
Gaffour A. Kosi	Bechtel
Paul W. Koss	Bechtel
F. M. Linn	PSE&G
R. A. Williams	Bechtel
John S. Ma	NRC/SEB
J. W. Brothers	Bechtel
R. H. Stone	Bechtel

ATTACHMENT 3

AGENDA

MEETING NRC - JANUARY 11, 1980

1. Introduction & Background - NRC

2. Introduction - Bechtel (D. W. Halligan)

3. Presentation of Summary Matrix

   a. Block Wall Summary (K. P. Buchert)

   b. Equipment & Piping Supported on Block Walls (Alan Appleford)

   c. Construction Specifications and Practices (John Stull & D.B. Hardie)

   d. Design Criteria (K. P. Buchert, Ken Lee & T. E. Johnson)

4. General Conclusions (D. W. Halligan)

5. Questions & Discussion

PROJECT NAME	TOTAL NO. OF SHEAR WALLS	TOTAL NO. OF NON-SHEAR WALLS	NO. WALLS SUPPORT. CAT. I PIPE	NO. WALLS SUPPORT. CAT. I SYSTEMS EXCLUD. PIPE	TOTAL NO. OF SINGLE WYTHE WALLS	TOTAL NO. OF MULTI. WYTHE WALLS WITH MORTAR	TOTAL NO. OF CONCRETE OR GROUT CORE WALLS	TOTAL NO. OF OTHER TYPE WALLS
Trojan (66)	96	406	117	10**	58	218	226	0
Dresden 1 (56)	NOT AVAILABLE TO BECHTEL							
Big Rock Pt. 1 (59)	0	5	2	2	3	0	0	2
San Onofre 1 (63)	4	26	0	*	30	0	0	0
Turkey Pt.3&4 (65)	0	107	0****	*	97	10***		0
Palisades (66)	0	28	7****	21	20	0	0	8
Monticello (66)	0	114	3	111**	49	10	0	55
Pt. Beach 1&2 (66)	0	66	13	25	15	7	0	16
Peach Btm. 2&3 (66)	0	89	1	27	47	9	33	0
Oconee 1,2,3 (66)	0	0	0	0	0	0	0	0
Rancho Seco (67)	0	0	0	0	0	0	0	0
Pilgrim 1 (67)	13	141	6	82	94	60***		0
Arkansas 1 (67)	0	131	3**	*	53	78***		0
Calvert Clfs.1&2 (67)	0	141	0****	*	141	0	0	0
Hatch 2 (67)	0	5	0****	*	5	0	0	0
Millstone 2 (68)	0	205	4****	*	154	51***		0
Davis-Besse 1 (69)	0	223	23****	*	199	0	24	0
Duane Arnold (69)	0	211	11**	92**	113	98***		0
Farley 1 (69)	0	30	1****	*	30	0	0	0
Arkansas 2 (70)	0	174	0****	*	65	109***		0

← Correction 1

* Not available
** Upper bound
*** Design allowed alternate (to constructor)
**** Large pipe
( ) Year design work started

1/11/80

ATTACHMENT 4

ATTACHMENT 5

MASONRY WALL QUALITY STANDARDS
(BLOCK MASONRY GROUT ONLY)

	ACI 318	ASTM A82	ASTM A615	ASTM C33	ASTM C55	ASTM C90	ASTM C91	ASTM C129	ASTM C140	ASTM C144	ASTM C145	ASTM C150	ASTM C270	ASTM C404	ASTM C476	Certifications	Tests of Block
Dresden 1	Not Available At This Time																
Big Rock Point			x	x		x				x		x	x				
San Onofre 1			x	x		x				x		x	x				
Turkey Pt. 3 & 4		x	x	x		x				x		x	x			x	
Monticello		x	x	x		x				x		x	x			x	x
Oconee 1	No Masonry Walls in Bechtel Scope																
Oconee 2	No Masonry Walls in Bechtel Scope																
Oconee 3	No Masonry Walls in Bechtel Scope																
Palisades		x	x	x		x				x		x	x	x		x	x
Peachbottom 2 & 3			x	x	x	x				x		x	x	x		x	x
Pt. Beach 1 & 2			x			x				x		x	x	x		x	x
Trojan		x	x			x								x	x		
Arkansas 1		x	x			x								x	x	x	
Calvert Cliffs 1 & 2			x	x		x		x		x		x	x			x	x
Hatch 2		x	x			x			x							x	x
Pilgrim 1		x	x	x		x			x	x	x	x		x	x	x	x
Rancho Seco	Not Applicable																
Millstone 2			x	x		x		x		x	x	x	x			x	
Davis Besse		x	x			x	x					x		x	x	x	x
Duane Arnold		x	x			x								x	x	x	x
Farley 1		x				x					x			x	x		
Arkansas 2	x	x	x			x		x	x					x	x	x	x

ATTACHMENT 6

PROJECT NAME	TYPE OF BECHTEL CONTRACT	CONSTRUCTION BY BECHTEL CONTRACTOR OR SUBCONTRACTOR	REMARKS
Arkansas 1	EPC	S/C	Inspection Reports by S/C Engr
Arkansas 2	EPC	S/C	Insp Rpts & MTRs-Q by S/C Engr
Big Rock Point 1	EPC	S/C	S/D with Contr Admin Daily Report
Calvert Cliffs 1&2	EPC	S/C	S/D w/audit of completed work last 10% by Bechtel
Davis-Besse	EPCM	C	Q S/C w/daily insp S/D w/insp rpts & audits
Dresden 1	EPC	S/C	S/D w/Contr Admin Daily Report
Duane Arnold	EPC	B	S/D with Wall release card
Farley 1	E	-	
Hatch 2	E	-	
Millstone 2	EPC	B	S/D w/Release for Grout No Records
Monticello	EPC	S/C	S/D
Oconee 1	E	-	
Oconee 2	E	-	
Oconee 3	E	-	
Palisades	EPC	S/C	S/D
Peach Bottom 2&3	EPC	S/C	S/D
Pilgrim	EPC	S/C	S/D
S. Beach 1&2	EPC	S/C	S/D with Contr Admin Diary
Rancho Seco	EPCM	C	
San Onofre 1	EPC	S/C	
Trojan	EPCM	C	S/D with Documentation for "Q" work
Turkey Pt. 3&4	EPC	S/C	Specs & Dwgs to Construct - No Reqrmt for Insp

Abbreviations as noted below:

S/D - Surveillance by field engineers with specifications and drawings used for acceptance; no formal records kept.

EPC - Engineering, Procurement and Construction by Bechtel as Prime Contractor

EPCM- Engineering, Procurement and Construction Management by Bechtel as Prime Contractor

E - Engineering Only by Bechtel

B - Bechtel

C - Owner let Contract Administered by Bechtel

S/C - Subcontractor

PROJECT NAME	MAJOR GOVERNING LOAD COMBINATIONS	CRITERIA
Trojan (66)	D+E+To D+E'+To	UBC-working stress, 1.33 stress factor-OBE, 1.50 SF-SSE, Frequency Calc. -uncracked.
Dresden 1 (56)	-	UBC-working stress
Big Rock Pt. 1 (59)	D+E	UBC-working stress
San Onofre 1 (63)	D+E	UBC-working stress, 1.33 stress factor-OBE
Turkey Pt. 3&4 (65)	-	UBC-working stress
Palisades (66)	-	Unavailable at this time
Monticello (66)	-	UBC-working stress
Pt. Beach 1&2 (66)	-	UBC-working stress
Peach Bottom 2&3 (66)	D+E, D+E'	UBC-working stress, 1.0 stress factor-OBE, 1.33 stress factor-SSE, Frequency Calc. -uncracked
Oconee 1, 2, 3 (66)		Not required
Rancho Seco (67)	D+E'	UBC-working stress, 1.33 stress factor-SSE
Pilgrim 1 (67)	D+E	UBC-working stress, 1.0 stress factor, Frequency calculation-uncracked.
Arkansas 1 (67)	D+E	UBC-working stress, 1.0 stress factor, Frequency calculation-uncracked
Calvert Cliffs 1&2 (67)	-	UBC-working stress
Hatch 2 (67)	D+L+E	Concrete Design Manual - working stress, 1.0 SF-OBE, 1.5 SF-SSE, Frequency calculation-uncracked
Millstone 2 (68)	D+E	UBC-working stress, 1.0 SF-OBE, 1.5 SF-SSE, Frequency calc. -uncracked
Davis-Besse 1 (69)	D+E, D+E'	UBC-working stress, 1.33 SF-OBE, 1.50 SF-SSE, Frequency calc. -uncracked
Duane Arnold (69)	D+E, D+E'	UBC-working stress, 1.0 SF-OBE, 1.5 SF-SSE (1.50 given in FSAR response to question 12.5), Frequency calculation-$1/2(I_g+I_c)$.
Farley 1 (69)	D+E	UBC-working stress, 1.0 SF-OBE, 1.5 SF-SSE, Frequency calc. -uncracked
Arkansas 2 (70)	D+E'	UBC-working stress, 1.0 stress factor, Frequency calculation-uncracked

E' - Safe Shutdown Earthquake Load

E - Operating Basis Earthquake Load

To - Load Due to Temperature Gradient Across Wall

ATTACHMENT 7