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

MAR 23 1981

Docket Nos.: 50-454/455
and 50-456/457

MEMORANDUM FOR: B. J. Youngblood, Chief, Licensing Branch No. 1, DL

FROM: R. Auluck, Project Manager, Licensing Branch No. 1, DL
C. Moon, Project Manager, Licensing Branch No. 1, DL

SUBJECT: SUMMARY OF MEETING WITH COMMONWEALTH EDISON COMPANY TO DISCUSS METHODOLOGY FOR SEISMIC ANALYSIS OF THE BYRON AND BRAIDWOOD STATIONS (FEBRUARY 18, 1981)

A meeting was held in Bethesda, Maryland on February 18, 1981 with Commonwealth Edison Company to discuss the criteria used in the analysis for seismic input at the foundation levels and evaluation of the acceptability of the designs of structural components. An attendance list and a copy of the meeting handouts are attached.

Background

The Byron/Braidwood PSAR was docketed on September 20, 1973. In the PSAR Commonwealth Edison proposed a Safe Shutdown Earthquake (SSE) of 0.12g based on an intensity VII seismic event. During our review, we took the position that an intensity VII event was not conservative. We subsequently, agreed to an SSE of 0.2g with deconvolution of design spectra from the ground surface to the bedrock-till interface.

After the completion of the Byron/Braidwood review, Standard Review Plan 3.7.1 was issued with certain restrictions on deconvolution such as variaton of soil properties and limitations of the deconvolved design response spectra to 60% of Regulatory Guide 1.60. In a letter dated September 2, 1976, we requested Commonwealth Edison to document that the overall margin of safety in their seismic design is not significantly affected by this change in criteria. In a meeting held on November 16, 1976, the applicant provided a preliminary response to our request entitled, "Areas of Conservatism in Seismic Analysis/Design."

Subsequently, NRC staff determined that for sites involving rock foundations with shallow soil overburden, deconvolution from the free surface of R.G. 1.60 response spectrum, as permitted by SRP 3.7.1, is not appropriate and previously reviewed plants employing deconvolution procedures will require reevaluation to determine whether an adequate margin of conservatism exists.

Commonwealth Edison Presentation

Mr. Jim Abel discussed the agenda items and purpose of the meeting and stated that some agreement must be reached for the reevaluation methods which will provide an assessment of the adequacy of the Byron and Braidwood seismic design and resolve the NRC backfit position concerning deconvolution. Mr. Abel further stated that Byron/Braidwood design level spectra exceeds the R.G. 1.60 requirements in most frequency ranges and local areas where R.G.1.60 exceeds the Byron/Braidwood curves is more than compensated for by the conservatism in earthquake levels and conservatism in design.

Mr. Jim Westermeier explained the background summary of events from the docketing of PSAR in September 1973 to the present stage. The present Byron/Braidwood design is based on the 1974 NRC seismic criteria and meets the CP requirements and further when NRC changed its position on deconvolution in May 1979, the plant construction was complete and any resulting field changes should be treated as backfit requirements. Complete reanalysis to a variation in sesmic input will delay the plant operating date by three years at a cost of 67.5 million dollars for Byron Unit 1 only.

Mr. O. Zaben described the equivalence of Marble Hill design and the Byron/Braidwood design. At Marble Hill, R.G. 1.60 response spectra was applied at the foundation level. The impact of R.G. 1.60 spectra at the foundation level on structures at Byron/Braidwood will be severe and will result in a complete reanalysis of containment, auxiliary building and fuel handling building.

Mr. A. K. Singh described the areas of conservatism in Byron/Braidwood design and stressed that, current regulatory pratice provides additional margins of safety. The margins associated with Byron/Braidwood design were quantified in our response to Q 130.06 to show that the increase in seismic response by not considering deconvolution is fully compensated for by other effects.

To close out NRC staff concerns in the Byron/Braidwood seismic design Commonwealth Edison will agree to reevaluate and backfit the plant based on the following criteria:

A. 0.2g wide band response spectra at foundation elevation,
B. Evaluation to be limited to SSE only,
C. Vertical spectra 2/3 of horizontal as per NUREG-0098, SEP plant reevaluation criteria,
D. Damping values as per NUREG-0098,
E. Limited inelastic action for cable tray hangers, and
F. Conservatively account for wave passage effects.

The above criteria are consistent with

- The 1980 state-of-the-art,
- NRC SEP plant reevaluation criteria, and
- NRC consultants recommended revisions to SRP and Reg. Guides under TAP-40.

Mr. Abel concluded the Commonwealth Edison presentation by highlighting the points already presented earlier and stressed that any reevaluation should be based on criteria appropriate to the backfit nature of the NRC position. The Commonwealth Edison's proposed "Reevaluation Criteria" are consistent with NRC criteria for backfit seismic reevaluations of Operating Plants in the Systematic Evaluation Program. Mr. Abel further indicated that an immediate approval of the proposed reevaluation criteria is required to avoid any further delay of plant construction and that the complete package should be accepted as such.

Staff Comments

Staff concluded that the proposed approach as presented by Commonwealth Edison is not acceptable as a whole at the present time. Some of the criteria presented are not fully backed by documented facts or basis. The referenced NUREG reports are still under study and may or many not be adopted, in whole or in part, by the NRC staff.

P.M. Session

Mr. Abel, Mr. Westermeier and Mr. Singh summarized briefly the main points of Commonwealth Edison approach of resolving the problem. Mr. Cordell Reed also indicated that there was a great deal of conservatism in the design of Byron/Braidwood structures. Reevaluation without benefit of deconvolution or without consideration of the actual margins that exist on the as built plant would not produce results consistent with current licensing practice. A quick action from NRC is needed at this time to resolve this problem.

Mr. Vollmer suggested that he will discuss with his staff the various options for satisfactory resolution and will discuss with Commonwealth Edison at a later date.

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BYRON & BRAIDWOOD
SEISMIC DESIGN BASIS
NRC MEETING FEBRUARY 18, 1981

AGENDA

INTRODUCTION - ABEL

- PURPOSE
- AGENDA

NRC POSITION ON DECONVOLUTION - WESTERMEIER

- BACKGROUND
- LOAD COMPARISON TO MARBLE HILL DESIGN
- SCHEDULE AND COST IMPACT
- SUMMARY

REEVALUATION CRITERIA - SINGH

- PROPOSED CRITERIA AND BASES
- PROPOSED CRITERIA VS. NRC NUREG 0098 & NUREG 1161
- SUMMARY

CONCLUSIONS - REED

FEB. 13, 1981
JA/0Z-1

BYRON & BRAIDWOOD
SEISMIC DESIGN BASIS
NRC MEETING FEBRUARY 18, 1981

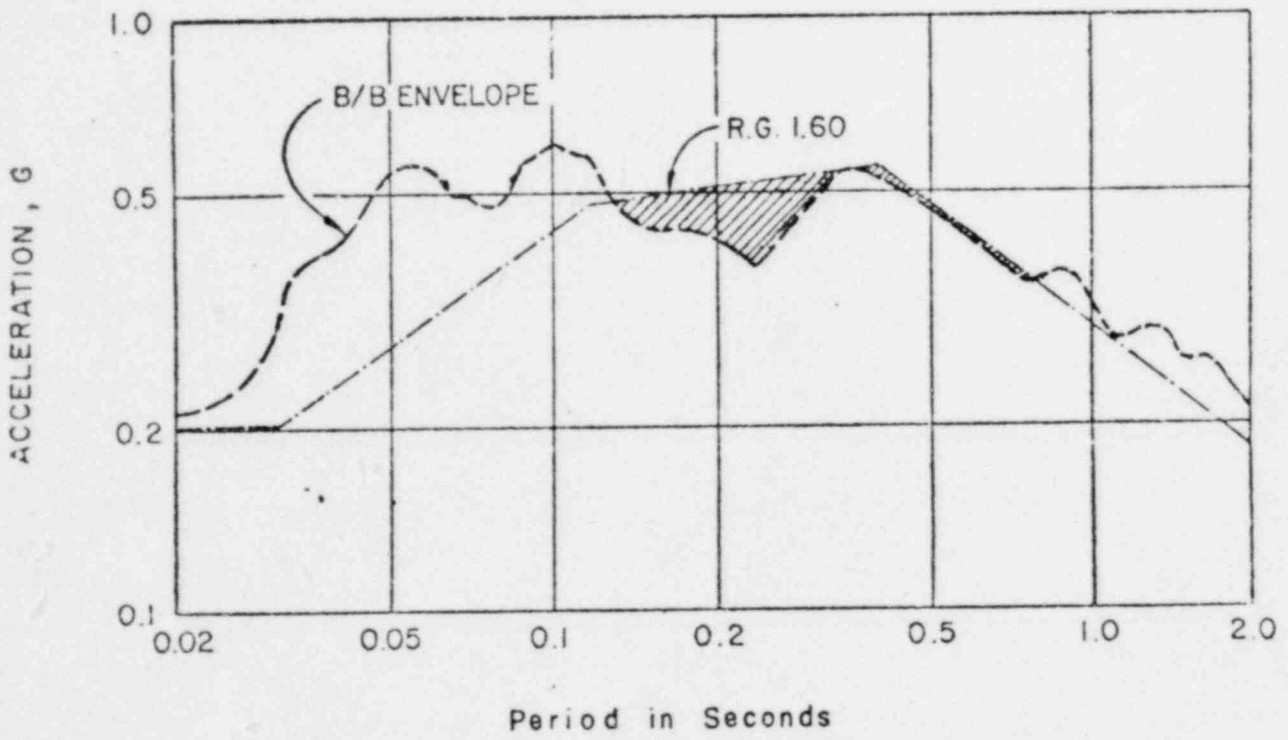
PURPOSE

AGREE TO REEVALUATION METHODS WHICH WILL PROVIDE AN ASSESSMENT OF THE ADEQUACY OF THE BYRON AND BRAIDWOOD SEISMIC DESIGN AND RESOLVE THE NRC BACKFIT POSITION CONCERNING DECONVOLUTION.

FEB. 18, 1981
JA/0Z-2

PURPOSE (CONTINUED)

B/B DESIGN LEVEL SPECTRA EXCEEDS THE RG 1.60 REQUIREMENTS IN MOST FREQUENCY RANGES. THE LOCAL AREAS WHERE RG 1.60 EXCEEDS THE B/B CURVES IS MORE THAN COMPENSATED FOR BY THE CONSERVATISM IN EARTHQUAKE LEVELS AND CONSERVATISM IN DESIGN.



COMPARISON RG 1.60 TO BY/BR DESIGN SPECTRA

FEB. 18, 1981
JA/OZ-3

BYRON/BRAIDWOOD - SEISMIC ANALYSIS
BACKGROUND SUMMARY OF EVENTS

PSAR SEISMIC LEVEL - DOCKETED SEPTEMBER 1973

- 0.06g OBE AND 0.12g SSE
- 1.4 LOAD FACTOR ON OBE

NRC REQUIRED IN JANUARY 1974

- 0.25g SSE
- 1.9 LOAD FACTOR ON OBE

NRC AGREED IN AN APPEAL MEETING - JUNE 12, 1974

- 0.09g OBE AND 0.20g SSE
- RG 1.60 AT SURFACE AND FOUNDATION SPECTRA FROM A DECONVOLUTION ANALYSIS USING MEAN SOIL PROPERTIES

DESIGN BASIS DOCUMENTED AND AGREED TO BY NRC

- CP ISSUED IN DECEMBER 1975 (See Fig. "Spectra Levels")

NRC CONSIDERED REOPENING CONCERN FOR SOIL PROPERTIES VARIATION IN MAY 1976

NRC LETTER - SEPTEMBER 2, 1976

- DECONVOLUTION ACCEPTABLE, BUT CONSIDER SOIL PROPERTIES VARIATION

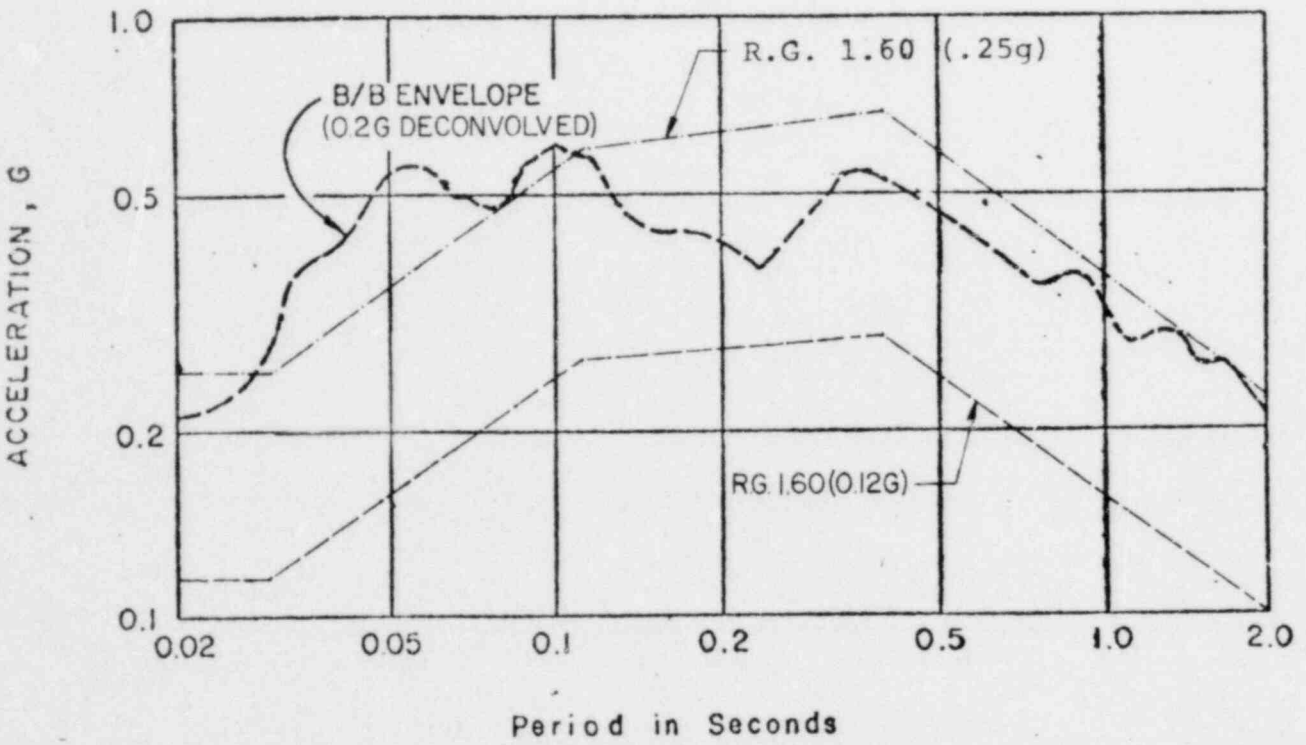
MEETING WITH NRC IN OCTOBER 1976

- SEISMIC LEVEL
- DECONVOLUTION - CONSIDERING SOIL PROPERTIES VARIATION
- CONSERVATISM IN DESIGN

FEB. 13, 1981
JW/0Z-4

BYRON/BRAIDWOOD - SEISMIC ANALYSIS

BACKGROUND/SUMMARY OF EVENTS (CONTINUED)



- The seismic level to which this plant should have been designed to is represented by the lower curve which represents RG 1.60 for an SSE level of .12g.
- In 1974 the NRC wanted to double the already conservative seismic level. This is represented by the upper RG 1.60 curve for an SSE level of .25g.
- B/B design spectra was an accepted resolution to the above controversy in June of 1974.

SPECTRA LEVELS

FEB. 18, 1981
JW/0Z-5

BYRON/BRAIDWOOD - SEISMIC ANALYSIS
BACKGROUND SUMMARY OF EVENTS (CONT.)

BYRON/BRAIDWOOD STRUCTURES REANALYZED IN 1976 AND INFORMATION SENT TO NRC IN DECEMBER 1976

- ADDRESSING:

  1. SELECTION OF "G" LEVEL 0.06 OBE, 0.12 SSE VS. 0.09 OBE, 0.20 SSE
  2. RESPONSE SPECTRA AND CONSISTENT TIME-HISTORY
  3. MODELING
  4. EFFECT OF FOUNDATION SIZE WAVE TRAVEL EFFECTS
  5. MATERIAL STRENGTH AND LOAD FACTORS

NRC QUESTION 130.06 TO FSAR IN MAY 1979

- DECONVOLUTION NO LONGER ACCEPTABLE

NRC MEETING OF OCTOBER 24, 1979

- DISCUSSED DECONVOLUTION AND SOIL PROPERTIES VARIATION AS IT AFFECTS STRUCTURE AND SYSTEMS
- RE-REVIEWED CONSERVATISMS IN DESIGN THAT HAVE BEEN ACCEPTED ON OTHER NUCLEAR PLANTS BY THE NRC

FEB. 13, 1981
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BYRON/BRAIDWOOD - SEISMIC ANALYSIS
BACKGROUND/SUMMARY OF EVENTS

CECo SUBMITTED RESPONSE TO NRC QUESTIONS 130.06 ON JANUARY 28, 1980

RESPONSE PRESENTED AN EXTENSIVE EVALUATION OF THE EFFECT OF APPLYING RG 1.60 SPECTRA AT THE FOUNDATION LEVEL ON DESIGN AND OUR REASONS WHY WE CONSIDER THE PLANT DESIGN ADEQUATE. THE DISCUSSION INCLUDED:

A. JUSTIFICATION OF A 0.12G SSE AND A COMPARISON OF DESIGN PARAMETERS (FORCES, MOMENTS AND SPECTRA) OBTAINED FROM THE APPLICATION 0.12G RG 1.60 AND THE BY/BR DESIGN BASIS SHOWING BY/BR RESPONSES ENVELOPE RG 1.60 RESPONSES.

B. QUANTIFICATION OF THE EFFECT OF WAVE PROPAGATION AND SHOWING THAT THE REDUCTION IN RESPONSE FULLY COMPENSATES FOR THE EFFECT OF DECONVOLUTION.

C. QUANTIFICATION OF OTHER SOURCES OR CONSERVATISM IN BY/BR DESIGN, SUCH AS, THREE EQUAL COMPONENTS OF EARTHQUAKE, LOWER DAMPING VALUES AND LOW DUCTILITY VALUES.

D. PRESENTED THE AVERAGE STRENGTH OBTAINED FOR THE IN-PLACE MATERIAL WHICH EXHIBITED HIGHER STRENGTH THAN THE MINIMUM SPECIFIED STRENGTH.

E. COMPARISON OF DESIGN PARAMETER (FORCES, MOMENT AND SPECTRA) OBTAINED BY THE APPLICATION OF RG 1.60 AT FOUNDATION TO THE BY/BR DESIGN.

NRC LETTER - JANUARY 13, 1981

- SECOND ROUND QUESTION REJECTING RESPONSE TO QUESTION 130.06

FEB. 18, 1981
JW/OZ-7

SUMMARY OF IMPACT OF RG 1.60 SPECTRA AT FOUNDATION LEVEL ON STRUCTURES*

- INCREASE IN OVERTURNING MOMENT AND TOTAL SHEAR
- CONTAINMENT MAT AND REACTOR CAVITY WALL ARE OVERSTRESSED
- INTERNAL CONTAINMENT STRUCTURAL STEEL MEMBERS ARE OVERSTRESSED
- SHEAR WALLS ARE OVERSTRESSED
- AUXILIARY BUILDING AND FUEL HANDLING BUILDING MAT, INTERNAL STEEL COLUMNS AND BEAMS ARE OVERSTRESSED

THE CHANGE IN THE SEISMIC LEVEL WILL THUS NECESSITATE:

- GENERATION OF NEW SPECTRA
- COMPLETE REANALYSIS OF CONTAINMENT, AUXILIARY BUILDING AND FUEL HANDLING BUILDING

*TABULATION OF INCREASES IN STRESS LEVELS AND IN DESIGN PARAMETERS IS PROVIDED IN HANDOUTS.

FEB. 18, 1981
JW/OZ-8

IMPACT OF RG 1.60 SPECTRA @ FOUNDATION LEVEL ON PIPING, EQUIPMENT AND ELECTRICAL SYSTEMS DESIGN*

- REANALYSIS OF OVER 800 LARGE BORE PIPING SUBSYSTEMS
- REVIEW OF OVER 18,000 LARGE BORE PIPING SYSTEM SUPPORTS
- REVIEW OF 5,300 CABLE TRAY HANGERS
- REVIEW OF 28,000 CONDUIT HANGERS
- REVIEW OF 2,600 HVAC HANGERS
- REVIEW OF SUPPORT STEEL FOR HANGERS OF ALL MECHANICAL AND ELECTRICAL SYSTEMS
- SEISMIC REQUALIFICATION OF MECHANICAL EQUIPMENT (60% OF EQUIPMENT NOT REPLICATED AT MARBLE HILL)
- SEISMIC REQUALIFICATION OF ELECTRICAL EQUIPMENT (40% OF EQUIPMENT NOT REPLICATED AT MARBLE HILL)
- REASSESSMENT OF EQUIPMENT FOUNDATION LOADS
- REVISED NSSS LOADS WILL HAVE TO BE OBTAINED FROM SUPPLIER AND IMPACT OF THESE LOADS WILL HAVE TO BE EVALUATED

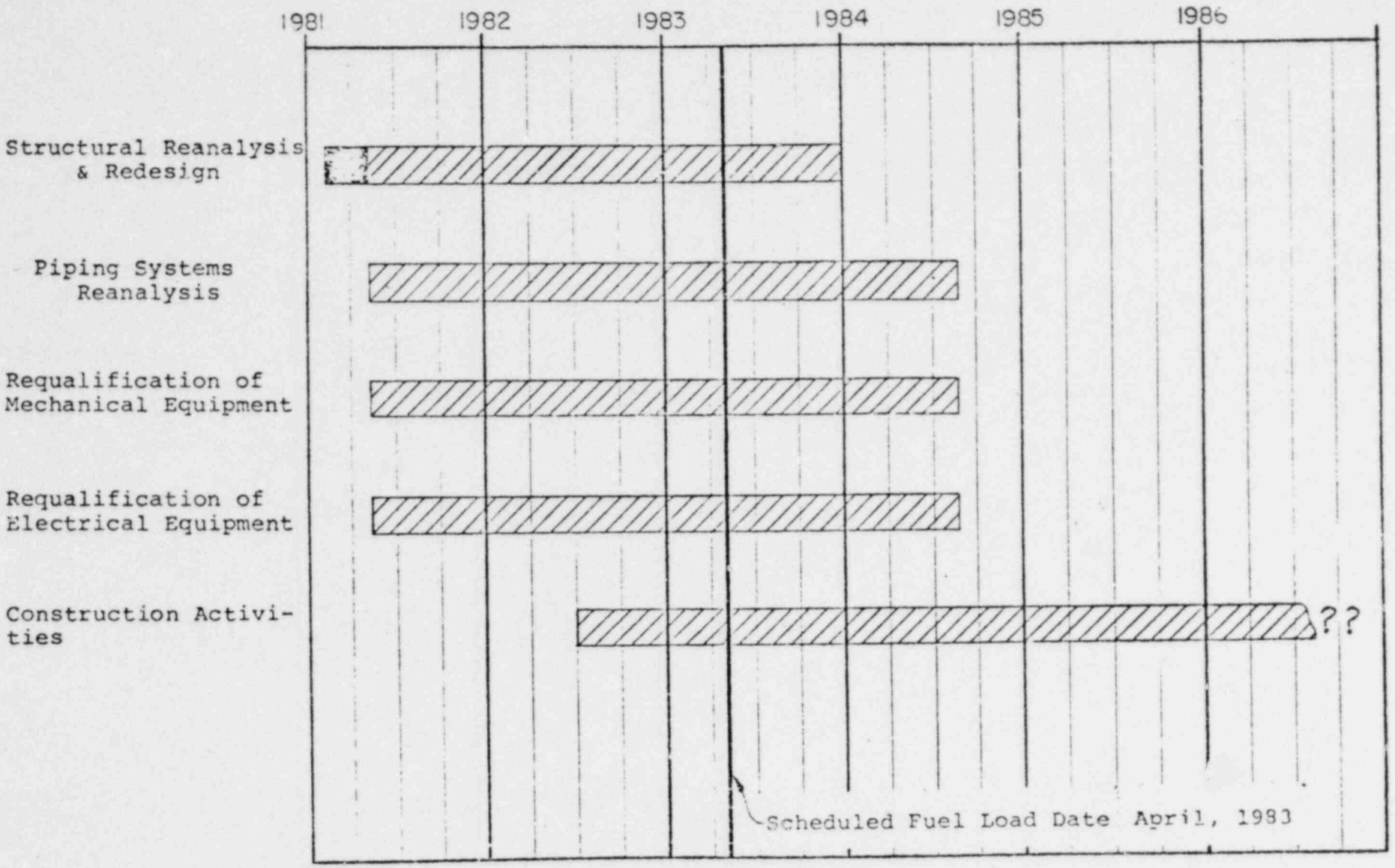
*QUANTITIES GIVEN ARE FOR ONE PLANT ONLY.

FEB. 13, 1981
JW/0Z-9

IMPACT OF REG. GUIDE 1.60

ON

ENGINEERING & CONSTRUCTION



FEB. 18, 1981

JW/OZ-10

SUMMARY

- THE PRESENT B/B DESIGN IS BASED ON THE 1974 NRC SEISMIC CRITERIA AND MEETS THE CP REQUIREMENTS.

- DECONVOLUTION WAS REVIEWED AGAIN IN DECEMBER 1976 AND WAS FOUND ACCEPTABLE BY THE NRC STAFF.

- IN MAY 1979 WHEN NRC CHANGED THEIR POSITION ON DECONVOLUTION, THE PLANT CONSTRUCTION WAS COMPLETE AND ANY RESULTING FIELD CHANGES SHOULD BE TREATED AS BACKFIT REQUIREMENTS.

- TO FORCE CECo TO BACKFIT TO THE MORE CONSERVATIVE ASPECTS OF THE 1974 AND THE 1980 CRITERIA WILL IMPOSE UNDUE HARDSHIP.

- ANTICIPATED THREE YEAR DELAY IN PLANT OPERATING DATE AT A COST OF 675 MILLION DOLLARS DUE TO THE INCREMENTAL COST OF REPLACEMENT ENERGY AND THE ADDITIONAL RETURN ON CAPITAL FOR CONSTRUCTION WORK IN PROGRESS INCLUDING ESCALATION ON DEFERRED EXPEDITURES. THIS COST IS FOR BYRON UNIT 1 ONLY AND DOES NOT INCLUDE COSTS FOR ENGINEERING, FOR CONSTRUCTION REWORK OR FOR ADDITIONAL OR REVISED EQUIPMENT AND MATERIALS.

- THIS COST DOES NOT INCREASE THE PRESENT HIGH LEVEL OF SAFETY INHERENT IN OUR PRESENT BYRON/BRAIDWOOD PLANTS DESIGN.

MARCH 2, 1981
REV. 1
JW/OZ-12

THE COMPARISON OF DESIGN PARAMETERS BASED ON THE ORIGINAL B/B DESIGN CRITERIA AND THOSE BASED ON THE LATEST NRC REQUIREMENT SHOWS THAT THE NEW REQUIREMENTS WILL RESULT IN SUBSTANTIAL REDESIGN AND FIELD CHANGES

REVIEW OF THE LATEST NRC REQUEST SHOWS THAT CECo IS BEING REQUIRED TO REDESIGN THE PLANT TO THE MORE CONSERVATIVE ASPECTS OF THE 1974 AND THE 1980 STATE OF THE ART

WE FEEL THAT THE PLANT SAFETY BE EVALUATED ON THE 1974 OR THE 1980 STATE OF THE ART AND NOT ON THE MORE CONSERVATIVE ASPECTS OF BOTH THE 1974 AND THE 1980 STATE OF THE ART

THE PRESENTATION WILL COVER

- AREAS OF CONSERVATISM IN B/B SEISMIC DESIGN
- B/B DESIGN CONSERVATISM QUANTIFIED IN RESPONSE TO Q130.06
- B/B REEVALUATION CRITERIA CONSISTENT WITH THE 1980 STATE OF THE ART, SEP PLANT CRITERIA AND THE NRC CONSULTANTS RECOMMENDED CHANGES TO SRP

AREAS OF CONSERVATISM IN B/B SEISMIC DESIGN

A. CONSERVATIVE SELECTION OF GROUND ACCELERATION LEVEL

B. NO CREDIT TAKEN FOR REDUCTION IN ACCELERATION WITH DEPTH

C. USE OF THREE EQUAL EARTHQUAKE COMPONENT

D. USE OF SYNTHETIC TIME HISTORY WHICH ENVELOPES THE DESIGN RESPONSE SPECTRA BY 0-20%

E. NO CREDIT TAKEN FOR WAVE PASSAGE EFFECTS

F. USE OF LOW DAMPING VALUES

G. METHOD FOR COMBINATION OF CLOSELY SPACED MODES

H. NO CREDIT TAKEN FOR REDUCTION IN RESPONSE DUE TO INELASTIC RESPONSE

I. WIDENING THE PEAKS OF FLOOR RESPONSE SPECTRA BY $\pm$15%

J. USE OF ENVELOPE RESPONSE SPECTRA TO ANALYZE PIPING AND TESTING EQUIPMENT

K. NO CREDIT TAKEN FOR SOIL-ROCK-STRUCTURE INTERACTION EFFECTS

L. NO CREDIT TAKEN FOR REDUCTION IN OVERTURNING MOMENTS DUE TO BASE MAT UPLIFT AND SIDE SOIL/ROCK EFFECT

M. COMBINATION OF LOCA AND SSE BY THE ABSOLUTE SUM RULE

N. USE OF MINIMUM SPECIFIED AND NOT THE HIGHER MEASURED STRENGTH IN DESIGN

O. USE OF A HIGH OBE LEVEL WHICH RESULTS IN OBE AND NOT THE SSE GOVERNING THE DESIGN

MANY OF THESE ASSUMPTIONS ARE REGULATORY REQUIREMENTS

THESE ASSUMPTIONS DO, HOWEVER PROVIDE ADDITIONAL MARGINS OF SAFETY

AKS-2

2-18-81

B/B DESIGN CONSERVATISM QUANTIFIED IN RESPONSE TO Q130.06

IN OUR RESPONSE TO Q130.06 THE MARGINS ASSOCIATED WITH THE B/B DESIGN WERE QUANTIFIED TO SHOW THAT THE INCREASE IN RESPONSE BY NOT CONSIDERING DECONVOLUTION IS FULLY COMPENSATED BY ANY ONE OF THE FOLLOWING EFFECTS

A. 0.12G SSE AND 0.06G OBE LEVEL CONSISTENT WITH EXPERTS EVALUATION FOR B/B SITES AND PROPOSED IN THE PSAR

B. WAVE PASSAGE EFFECTS AS CONSIDERED FOR THE DIABLO CANYON PLANT

C. CONSERVATISM ASSOCIATED WITH:
   - THREE EQUAL EARTHQUAKE COMPONENTS
   - CONSERVATIVE SYNTHETIC TIME HISTORY USED IN DESIGN
   - LOW DAMPING VALUES
   - REDUCTION IN RESPONSE DUE TO INELASTIC RESPONSE
   - USE OF MINIMUM SPECIFIED AND NOT THE ACTUAL MATERIAL STRENGTH IN DESIGN

IN JANUARY 81 THE STAFF INFORMED CECo THAT THE RESPONSE TO Q130.06 WAS NOT ACCEPTABLE EVEN THOUGH THE STAFF ALLUDED TO THE MERITS OF MANY OF THE ARGUMENTS PRESENTED IN OUR RESPONSE

AKS-3
2-18-81

B/B REEVALUATION CRITERIA CONSISTENT WITH THE 1980 STATE OF THE ART

TO CLOSE OUT STAFF CONCERNS ON THE B/B SEISMIC DESIGN WE WILL AGREE TO REEVALUATE AND BACKFIT THE PLANT BASED ON THE FOLLOWING CRITERIA

A. 0.2G WIDE BAND RESPONSE SPECTRA AT FOUNDATION ELEVATION

B. EVALUATION TO BE LIMITED TO SSE ONLY

C. VERTICAL SPECTRA 2/3 OF HORIZONTAL AS PER NUREG 0098, SEP PLANT REEVALUATION CRITERIA

D. DAMPING VALUES AS PER NUREG 0098

E. LIMITED INELASTIC ACTION FOR CABLE TRAY HANGERS

F. CONSERVATIVELY ACCOUNT FOR WAVE PASSAGE EFFECTS

THE ABOVE CRITERIA IS CONSISTENT WITH

- THE 1980 STATE OF THE ART
- NRC SEP PLANT REEVALUATION CRITERIA
- NRC CONSULTANTS RECOMMENDED REVISIONS TO SRP AND REG GUIDES

AKS-4

2-18-81

REEVALUATION SHOULD BE LIMITED TO THE SSE LOAD COMBINATION ONLY

- COMPONENT STRESSES UNDER THE OBE EXCITATION ARE WELL BELOW YIELD LEVELS AND THUS DO NOT AFFECT PLANT SAFETY

- THE PRESENT 0.09G OBE HAS A 2150 YEARS RETURN PERIOD WHICH IS VERY CONSERVATIVE

- SSE LEVEL ALONE DETERMINES THE PLANT SAFETY MARGINS THUS ANY SAFETY REEVALUATION SHOULD BE LIMITED TO THE SSE LOAD COMBINATIONS ONLY

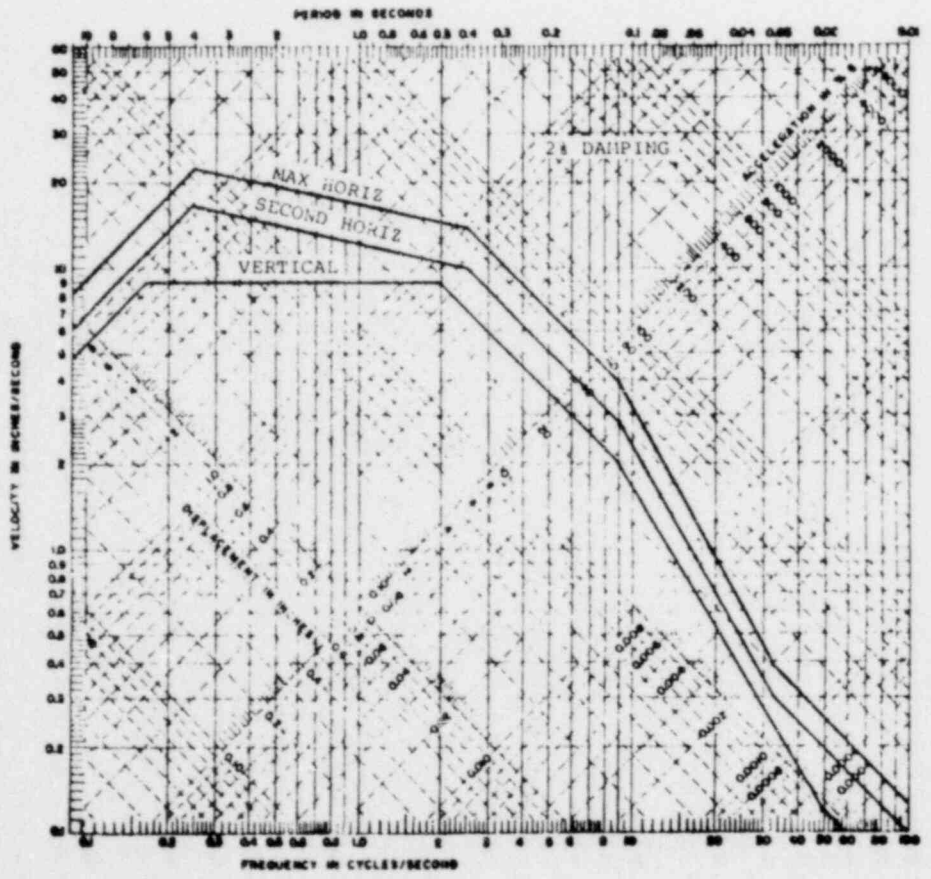
- THE PROPOSED APPROACH MITIGATES COSTS AND SCHEDULE DELAYS BY REDUCING REANALYSIS, REDESIGN AND FIELD MODIFICATIONS

NUREG 0098 VERTICAL SPECTRA SHOULD BE USED FOR REEVALUATION

- A VERTICAL ACCELERATION EQUAL TO 2/3 OF HORIZONTAL SHOULD BE USED FOR REEVALUATION AS RECOMMENDED IN NUREG 0098

- RECORDED MOTIONS SHOW THAT THREE COMPONENTS OF EARTHQUAKES DO NOT HAVE THE SAME ACCELERATIONS AS REQUIRED BY RG 1.60

- STUDY BY BARTU HAS SHOWN THAT A 1.0:0.8:0.5 RATIO FOR THE THREE COMPONENTS IS MORE APPROPRIATE



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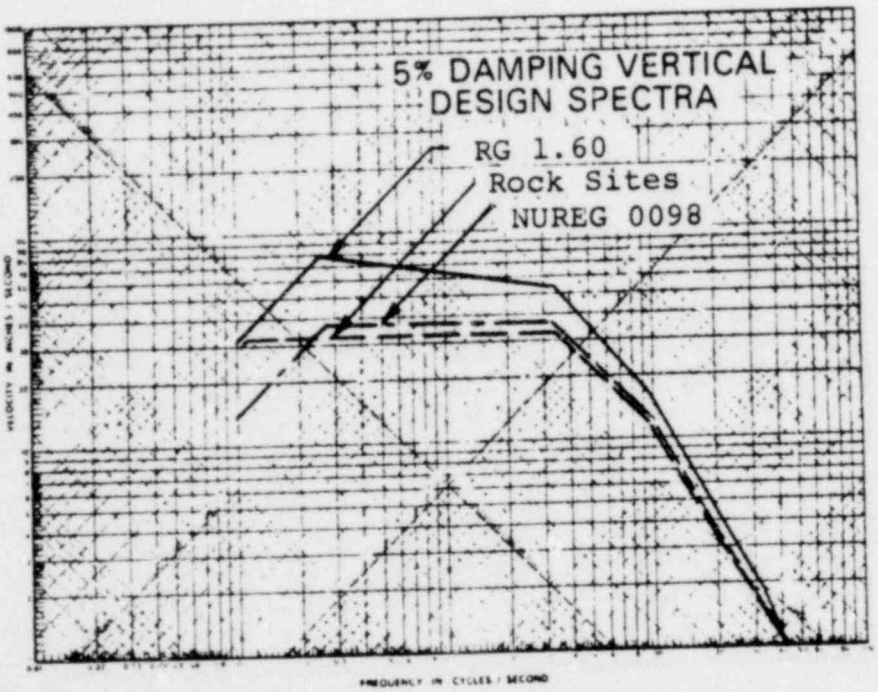
VERTICAL SPECTRA (CONTINUED)

- BOTH DR NEWMARK (NUREG 0003) AND NRC'S SEP PLANT REEVALUATION CRITERIA (NUREG 0098) RECOMMENDS THAT VERTICAL ACCELERATION BE 2/3 OF THE HORIZONTAL

- RIZZO STUDIED VERTICAL MOTIONS AT 30 ROCK SITES AND SHOWED THAT THE SITE SPECIFIC SPECTRA FOR ROCK SITES IS LOWER THAN THE NUREG 0098 SPECTRA



- BASED ON THE ABOVE WE FEEL THAT THE USE OF THE NUREG 0098 VERTICAL SPECTRA IS JUSTIFIED FOR REEVALUATION

DAMPING VALUES RECOMMENDED IN NUREG 0098 SHOULD BE USED IN REEVALUATION

- NEWMARK AND HALL (NUREG 0098) HAVE SUMMARIZED THE LEVELS OF DAMPING AS A FUNCTION OF THE TYPE OF STRUCTURE AND THE STRESS LEVEL OF INTEREST

- BASED ON THIS INFORMATION THE FOLLOWING DAMPING VALUES ARE RECOMMENDED FOR REEVALUATION

	USED IN DESIGN (RG 1.61)	RECOMMENDED FOR REEVALUATION (NUREG 0098)
REINFORCED CONC.	7	10
PRESTRESSED CONC.	5	7
WELDED STEEL	4	7
BOLTED STEEL	7	10
CABLE TRAY AND HVAC SUPPORTS SYSTEM	7	15*
PIPING	2	3

*BASED ON BECHTEL TESTS

- THESE VALUES ARE BEING USED FOR SEP PLANT EVALUATIONS AND SHOULD BE ACCEPTABLE FOR EVALUATION OF EXISTING STRUCTURES AT B/B

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2-18-81

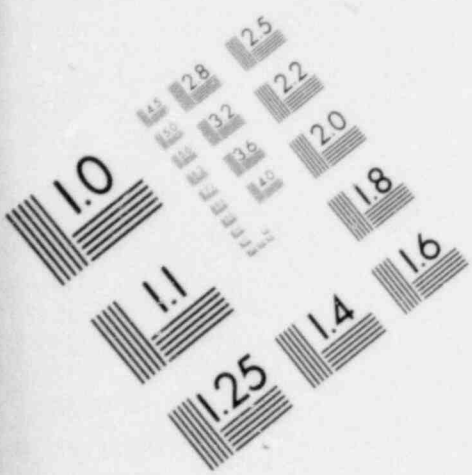
LIMITED INELASTIC ACTION FOR CABLE TRAY HANGERS

REDUCTION IN RESPONSE DUE TO INELASTIC ACTION WILL NOT BE CONSIDERED EXCEPT ON CABLE TRAY HANGERS

RECENT BECHTEL TEST HAVE SHOWN THAT CABLE TRAY HANGER SYSTEM HAVE CAPACITIES FAR IN EXCESS OF THEORITICAL COMPUTED CAPACITIES

CABLES CAN SUSTAIN DEFLECTIONS OF 6 INCHES WITHOUT LOSS OF FUNCTION

REEVALUATION WOULD BE BASED ON ALLOWING LIMITED INELASTIC DEFORMATION HOWEVER THE TOTAL DEFLECTION AT TIP NOT TO EXCEED 3 INCHES OR 3 TIMES THE ELASTIC DEFLECTION WHICHEVER IS LESS



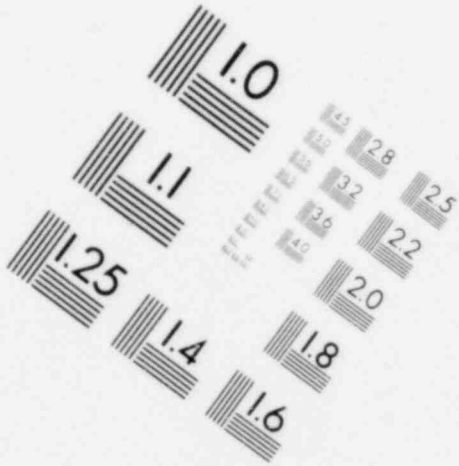
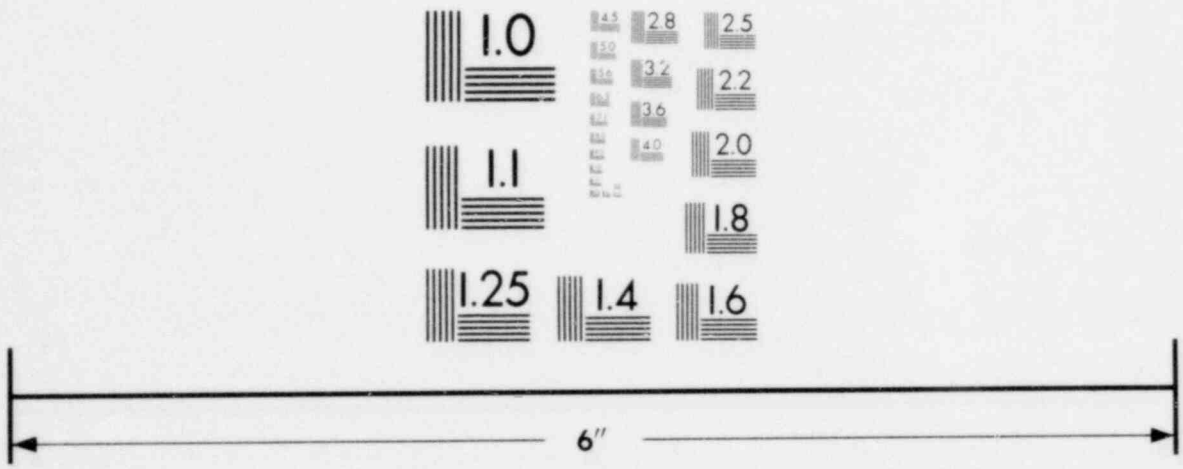
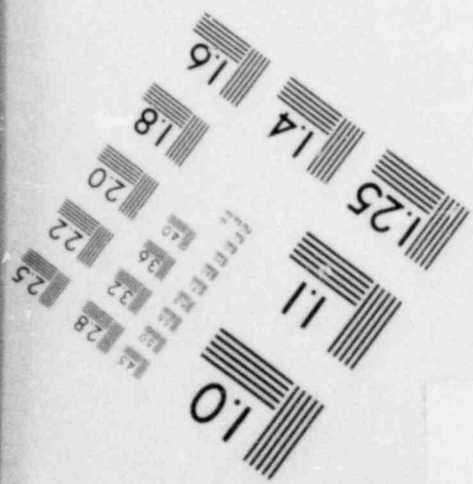
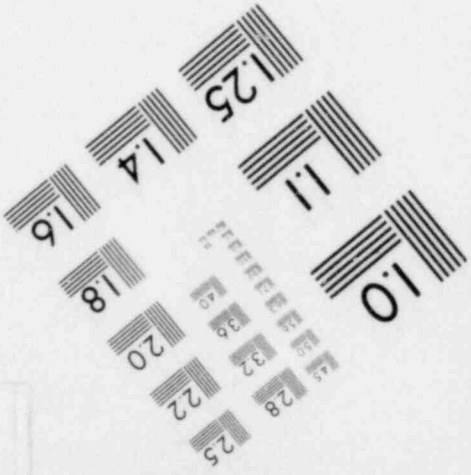
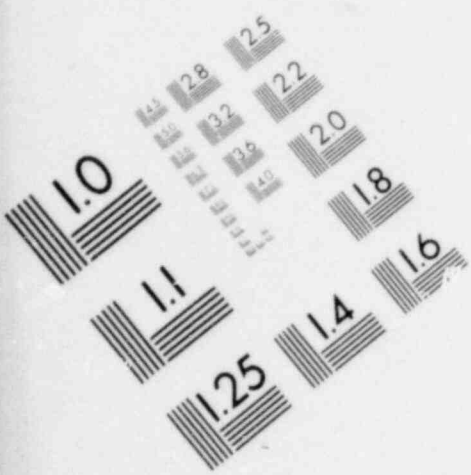


iMAGE EVALUATION
TEST TARGET (MT-3)









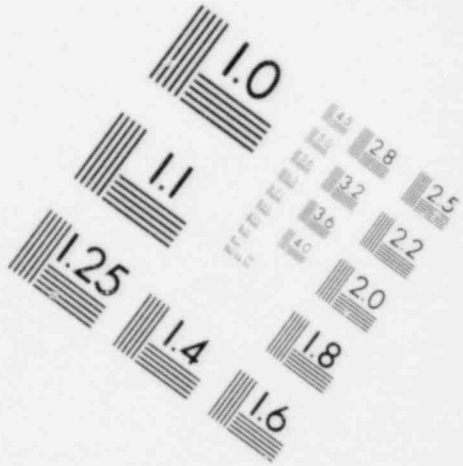
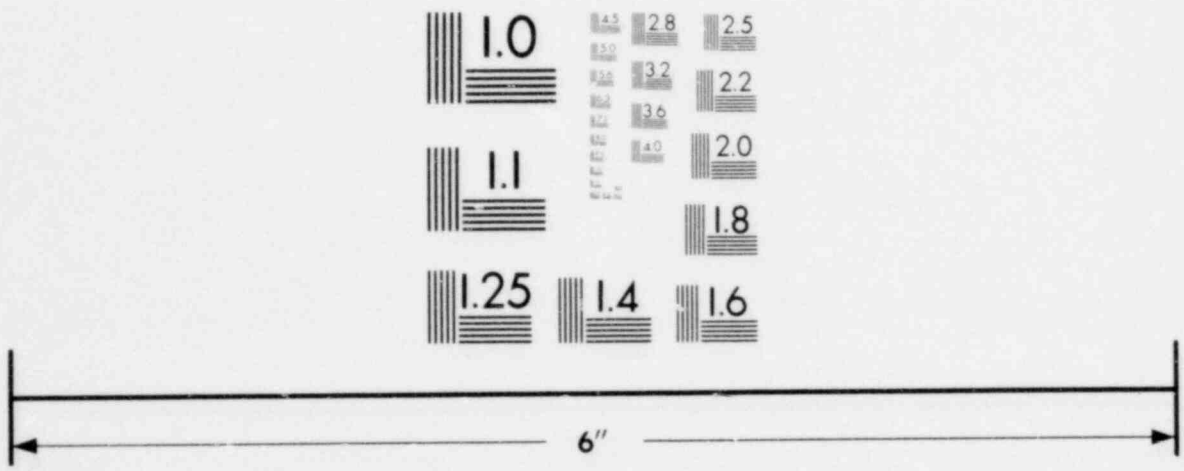
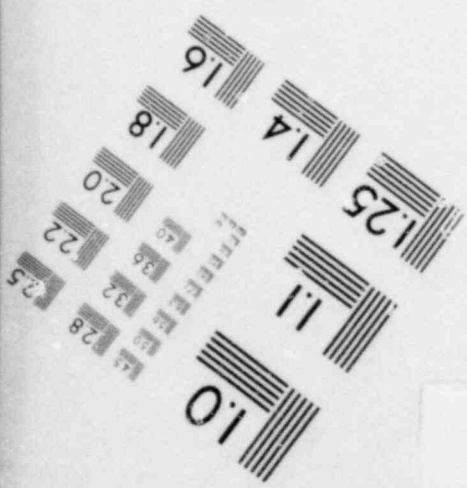
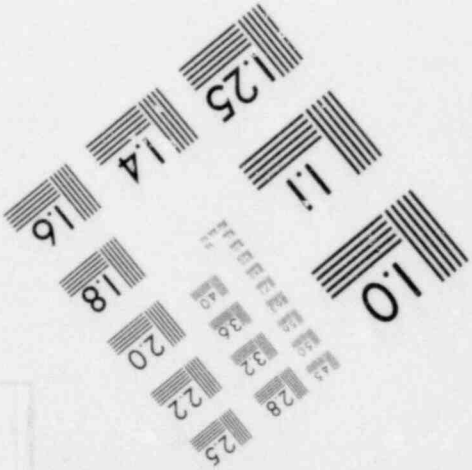


IMAGE EVALUATION TEST TARGET (MT-3)







REEVALUATION SHOULD CONSERVATIVELY ACCOUNT FOR THE WAVE PASSAGE EFFECTS

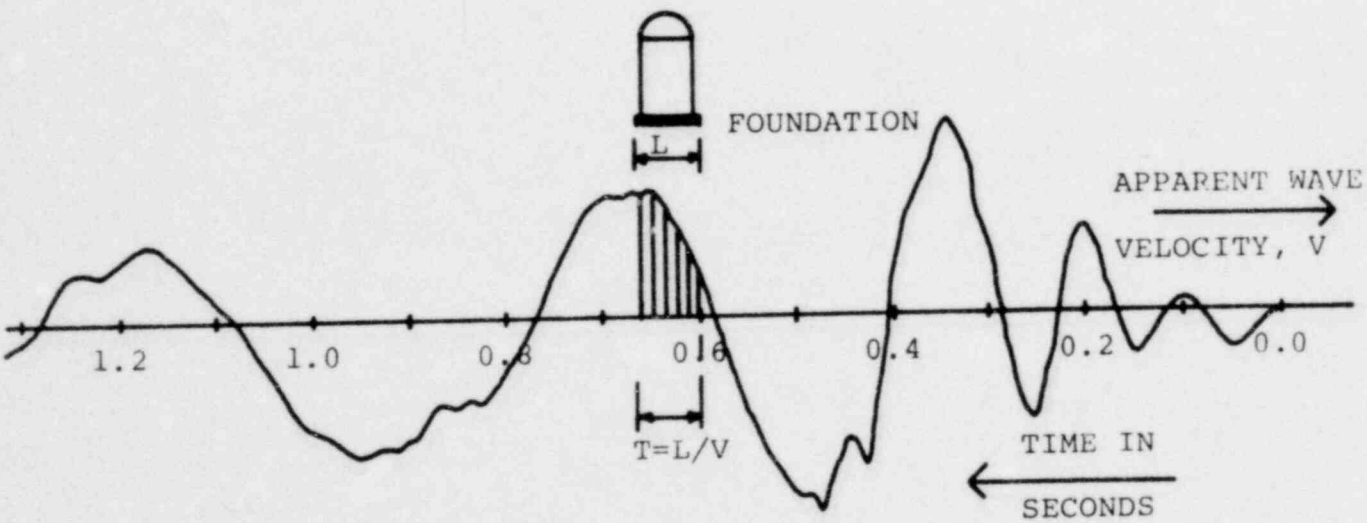
IN OUR RESPONSE TO Q130.06 WE COMPARED THE B/B DESIGN SPECTRA TO THOSE OBTAINED BY USING THE WAVE PASSAGE EFFECT DETERMINED BY DR NEWMARK FOR DIABLO CANYON PLANT. THIS WAS NOT ACCEPTABLE TO THE STAFF.

FOR THE REEVALUATION WE WILL USE A MECHANISTIC APPROACH USING A CONSERVATIVELY HIGH APPARENT WAVE VELOCITY TO ACCOUNT FOR THE WAVE PASSAGE EFFECT AT B/B.

WAVE PASSAGE EFFECTS (CONTINUED)

- EVALUATION OF PAST EARTHQUAKES SHOW THAT LARGE FOUNDATIONS RESPOND WITH LESS INTENSITY THAN DO SMALLER STRUCTURES

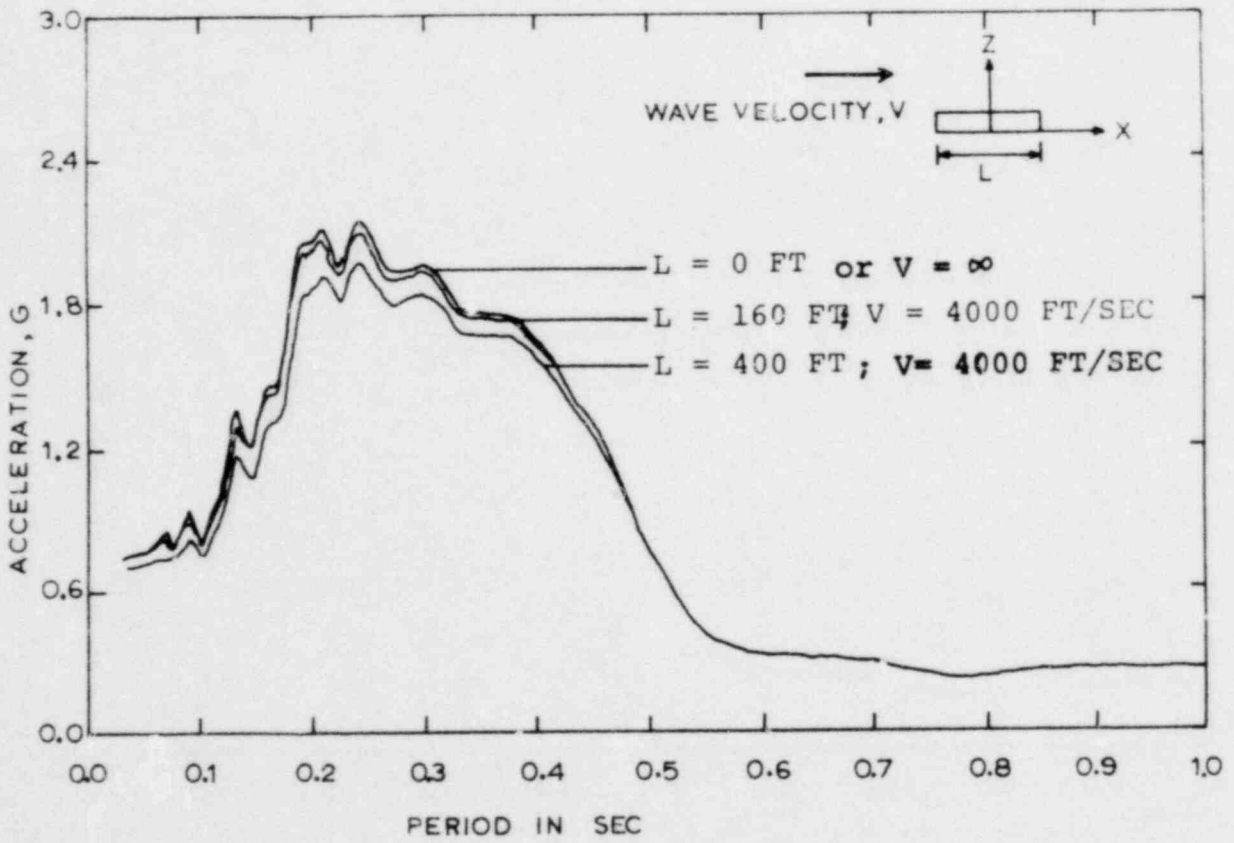
- RESEARCHERS HAVE CONCLUDED THAT DURING EARTHQUAKES ALL PARTICLES UNDER A LARGE FOUNDATION DO NOT DESCRIBE THE SAME MOTIONS SIMULTANEOUSLY; THUS THE RELATIVELY RIGID FOUNDATION AVERAGES THE GROUND MOTIONS RESULTING IN A REDUCED EFFECTIVE INPUT



WAVE PASSAGE EFFECTS (CONTINUED)

- THE EFFECT IS EQUALLY APPLICABLE TO SURFACE WAVES, BODY WAVES, NEAR FIELD EARTHQUAKES AND FAR FIELD EARTHQUAKES SO LONG AS THEIR FREQUENCY CONTENT IS THE SAME

- THE FOUNDATION SIZE, APPARENT SHEAR WAVE VELOCITY AND THE FREQUENCY CONTENT OF THE MOTION ARE THE ONLY PARAMETERS WHICH DEFINE THE REDUCTION



COMPARISON OF REEVALUATION CRITERIA TO SEP PLANT REEVALUATION CRITERIA AND TO RECOMMENDED REVISIONS TO NRC SEISMIC CRITERIA

	B/B REEVALUATION CRITERIA	SEP PLANT CRITERIA (NUREG 0098)	RECOMMENDED REVISIONS TO NRC SEISMIC CRITERIA (NUREG 1161)
VERTICAL ACCELERATION 2/3 OF HORIZONTAL	YES	YES	YES
NUREG 0098 DAMPING	YES	YES	YES
WAVE PASSAGE EFFECT	YES	YES	YES
INELASTIC RESPONSE	NOT* CONSIDERED	YES	YES
REDUCTION IN G DUE TO EMBEDMENT	NOT CONSIDERED	NO	YES BUT COULD NOT AGREE ON UPPER LIMIT 25% OR 40% REDUCTION

IT CAN BE OBSERVED THAT THE PROPOSED CRITERIA IS MORE CONSERVATIVE THAN NRC CONSULTANT'S RECOMMENDED REVISIONS TO NRC SEISMIC DESIGN CRITERIA AND THE NRC SEP PLANT CRITERIA

*EXCEPT FOR CABLE TRAY HANGERS

AKS-13

2-18-81

SUMMARY

TO CLOSE OUT STAFF CONCERNS ON THE B/B SEISMIC DESIGN CECo WILL AGREE TO REEVALUATE THE PLANT DESIGN BASED ON THE FOLLOWING CRITERIA

A. 0.2G WIDE BAND RESPONSE SPECTRA AT FOUNDATION ELEVATION
B. EVALUATION TO BE LIMITED TO SSE ONLY
C. VERTICAL SPECTRA 2/3 OF HORIZONTAL AS PER NUREG 0098, SEP PLANT REEVALUATION CRITERIA
D. DAMPING VALUES AS PER NUREG 0098
E. LIMITED INELASTIC ACTION FOR CABLE TRAY HANGERS
F. CONSERVATIVELY ACCOUNT FOR WAVE PASSAGE EFFECTS

THE ABOVE CRITERIA IS CONSISTENT WITH

- THE 1980 STATE OF THE ART
- NRC SEP PLANT REEVALUATION CRITERIA
- NRC CONSULTANTS RECOMMENDED REVISIONS TO SRP AND REG GUIDES UNDER TAP-40

AKS-14
2-18-81

BYRON AND BRAIDWOOD
SEISMIC DESIGN BASIS
NRC MEETING FEBRUARY 18, 1981

CONCLUSIONS

1. BYRON AND BRAIDWOOD CURRENT SEISMIC DESIGN INCLUDING USE OF DECONVOLUTION BASED ENTIRELY ON METHODS ACCEPTED BY NRC FOR CONSTRUCTION PERMIT.

2. POSTULATED UNCERTAINTIES RELATIVE TO USE OF DECONVOLUTION ARE NOT A SUBSTANTIAL SAFETY CONCERN BECAUSE THE CURRENT BYRON AND BRAIDWOOD SEISMIC DESIGN INCLUDES OTHER SUBSTANTIAL CONSERVATISMS.

3. NRC CURRENT POSITION ON BYRON AND BRAIDWOOD IS A BACKFIT OF LATER SEISMIC DESIGN CRITERIA RELATIVE TO DECONVOLUTION.

4. ANY REEVALUATION SHOULD BE BASED ON CRITERIA APPROPRIATE TO THE BACKFIT NATURE OF THE NRC POSITION.

5. WE HAVE PROPOSED "REEVALUATION CRITERIA" WHICH ARE CONSISTENT WITH NRC CRITERIA FOR BACKFIT SEISMIC REEVALUATIONS OF OPERATING PLANTS IN THE SYSTEMATIC EVALUATION PROGRAM.

6. THE PROPOSED "REEVALUATION CRITERIA" ARE EXPECTED TO SHOW THE ADEQUACY OF THE CURRENT BYRON AND BRAIDWOOD DESIGN BASIS RESPONSE SPECTRA.

7. COST AND SCHEDULE IMPACT OF NRC POSITION EXCESSIVE IN VIEW OF INSIGNIFICANT SAFETY CONSIDERATION.

8. IF YOU REQUIRE THE COMPLETE REANALYSIS ASSOCIATED WITH THE CURRENT NRC POSITION, THE INDUSTRY SHORTAGE OF QUALIFIED PIPING DESIGN AND EQUIPMENT QUALIFICATION MANPOWER WILL BE FURTHER AGGRAVATED.

FEB. 13, 1981

BYRON AND BRAIDWOOD
SEISMIC DESIGN BASIS
NRC MEETING FEBRUARY 18, 1981
CONCLUSIONS (CONT.)

9. IMMEDIATE APPROVAL OF THE PROPOSED REEVALUATION CRITERIA REQUIRED TO AVOID ANY FURTHER DELAY OF PLANT OPERATING.

BYRON/BRAIDWOOD

SEISMIC DESIGN BASIS

NRC MEETING ON FEBRUARY 18, 1981

HANDOUT MATERIAL

FEB 18, 1981
OZ-1

EQUIVALENCE OF MH AND B/B

MARBLE HILL GENERAL ARRANGEMENT REPLICATE OF BYRON/BRAIDWOOD

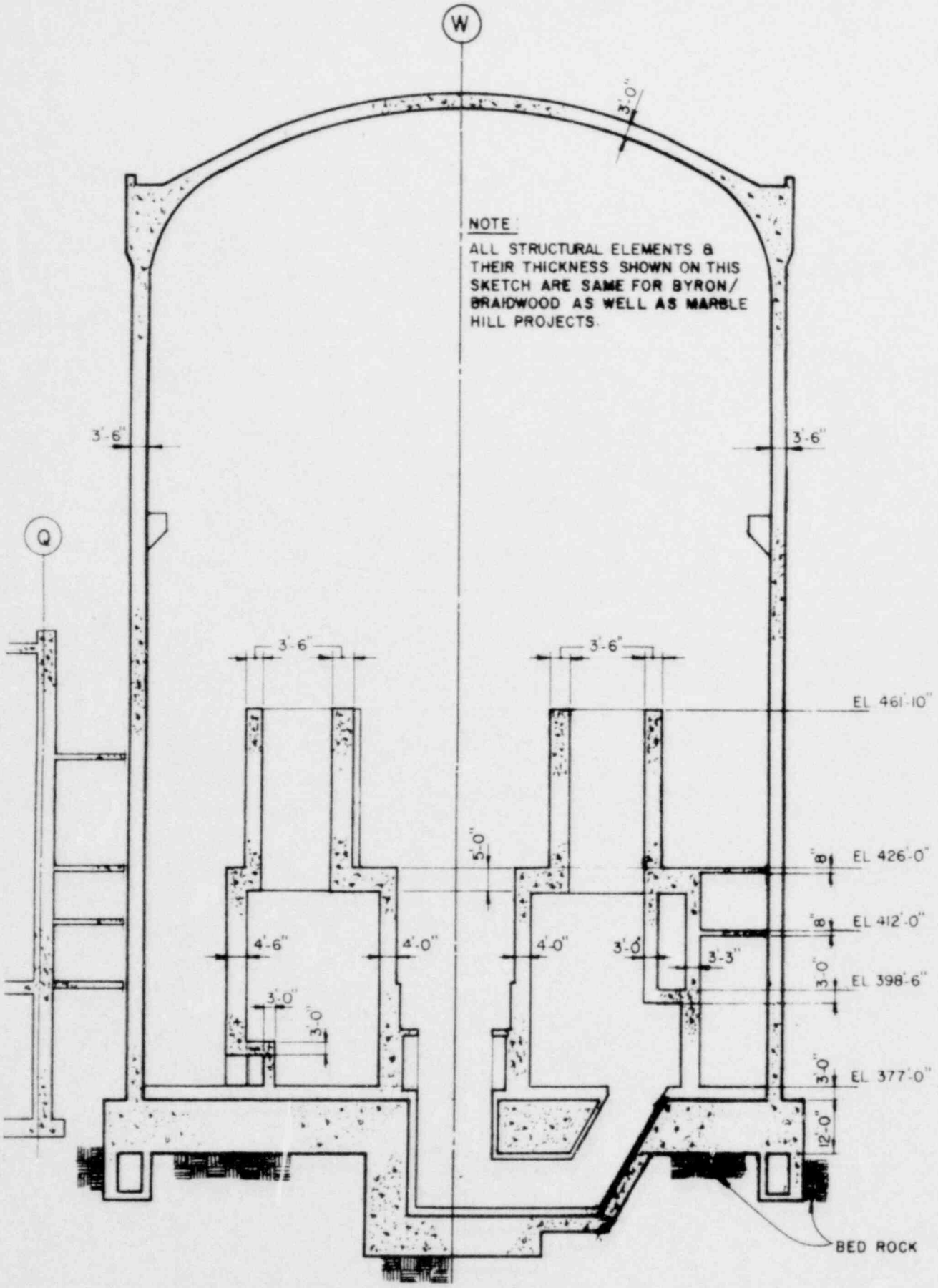
MARBLE HLL DETAIL DRAWINGS REPLICATE OR BYRON/BRAIDWOOD

BYRON/BRAIDWOOD AND MARBLE HILL HAVE THE SAME STRUCTURAL CONFIGURATION

MARBLE HILL IS DESIGNED FOR .20G SSE; BASED ON R.G. 1.60 APPLIED AT FOUNDATION LEVEL

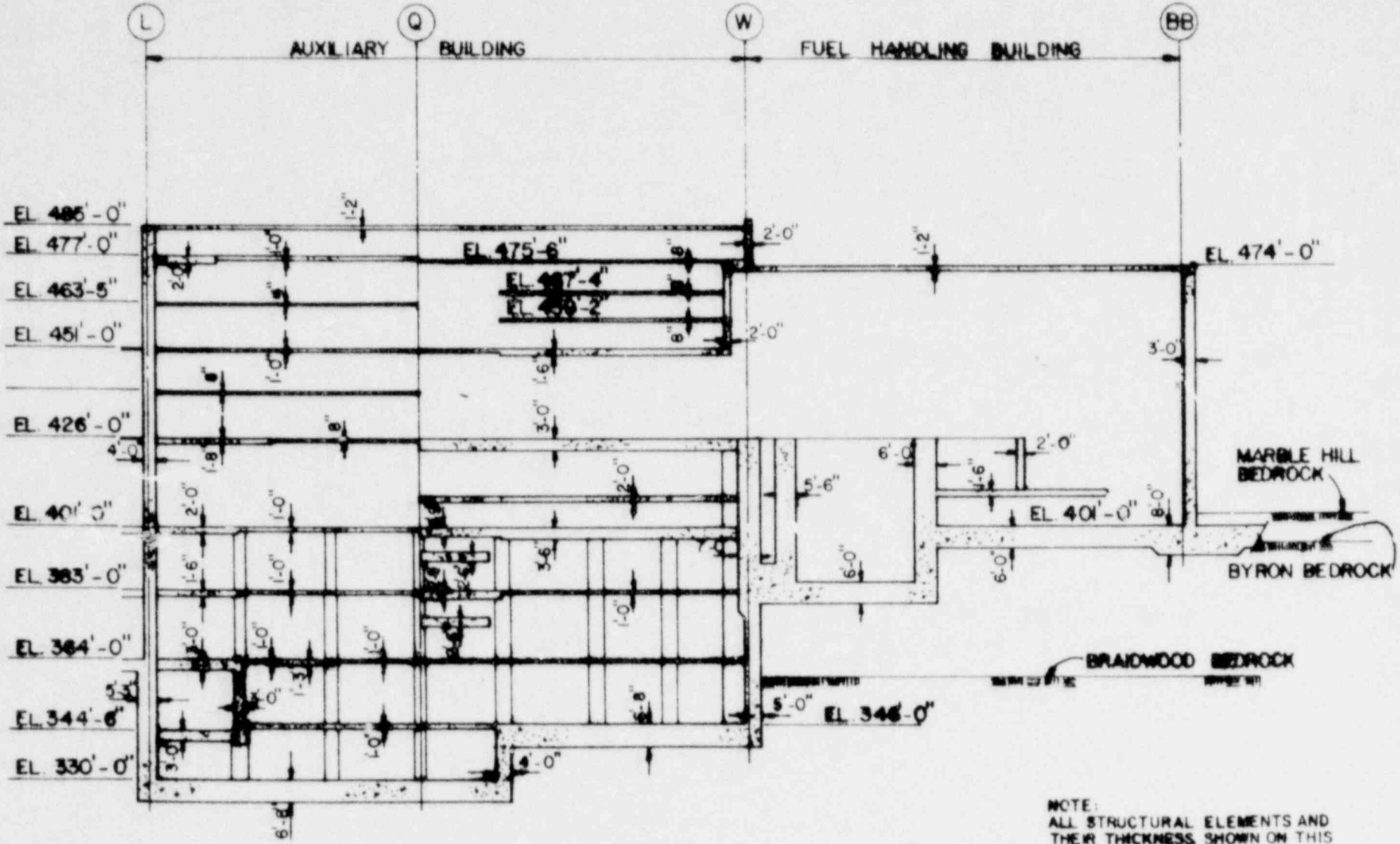
FEB. 18, 1981

OZ-2



CONTAINMENT BUILDING

FEB, 18, 1931
OZ-3



NOTE:
ALL STRUCTURAL ELEMENTS AND THEIR THICKNESS SHOWN ON THIS SKETCH ARE SAME FOR BYRON/BRAIDWOOD AS WELL AS MARBLE HILL PROJECTS

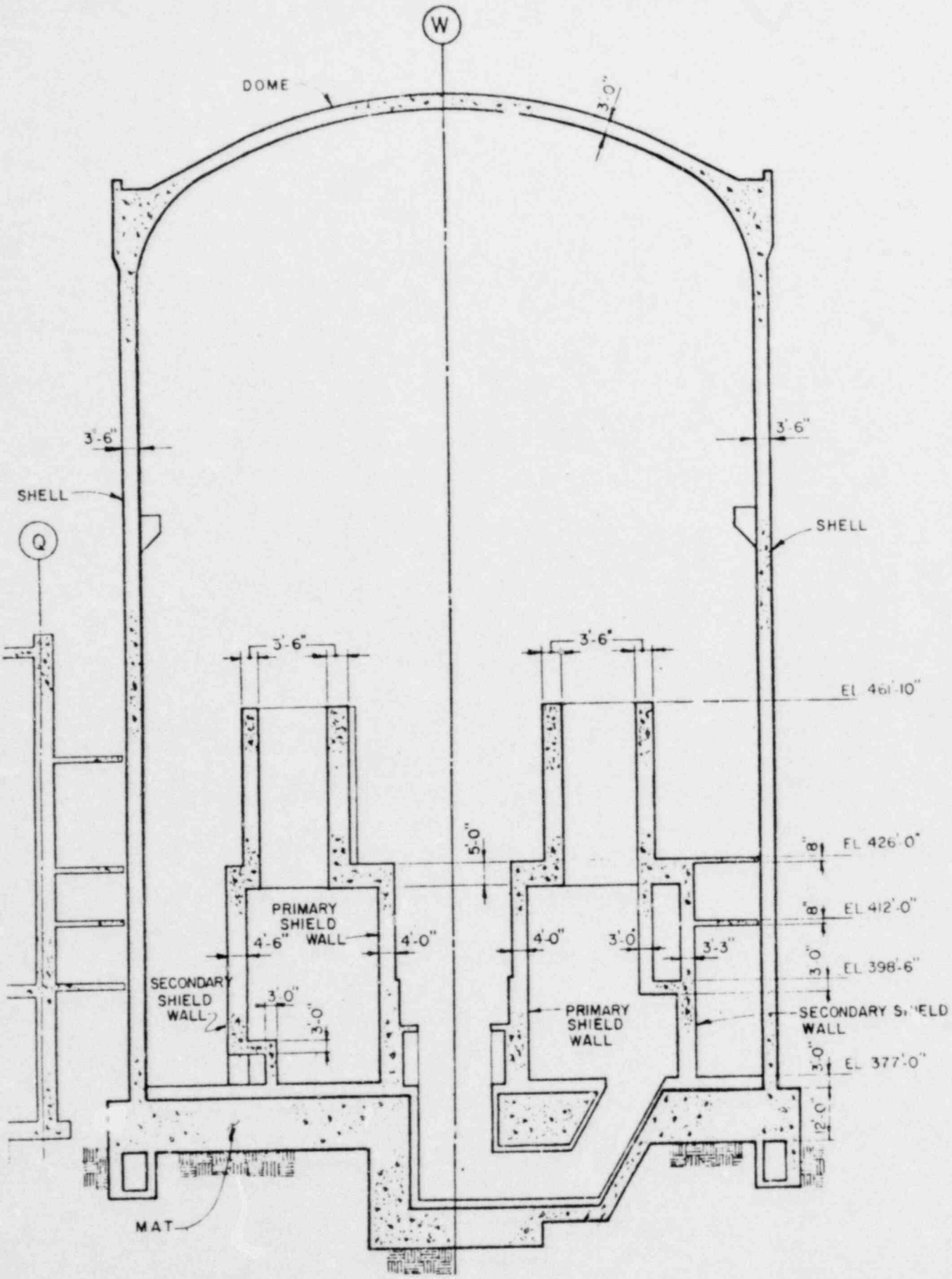
AUXILIARY AND FUEL HANDLING BUILDINGS

FEB. 13, 1931
OZ-4

BY/BR LOAD COMPARISON TO RG 1.60
CONTAINMENT BUILDING

ITEM	FORCE OR MOMENT (SSE) BY/BR DESIGN	RG 1.60
TOTAL OVERTURNING MOMENT AT BASE/SHELL	$4{,}500{,}000^{l\text{-}K}$	$5{,}260{,}000^{l\text{-}K}$
TOTAL SHEAR AT BASE/SHELL	$26{,}500^{K}$	$30{,}700^{K}$
NET TENSILE MEMBRANE FORCE IN SHELL	27 K/l	72 K/l
BENDING MOMENT IN BASEMAT	$6{,}650^{l\text{-}K/l}$	$9{,}513^{l\text{-}K/l}$
NET MEMBRANE TENSILE FORCE IN REACTOR CAVITY WALL	NA	1,335 K/l

FEB. 18, 1981
OZ-5



CONTAINMENT BUILDING

FEB. 18, 1981 OZ-6

BY/BR LOAD COMPARISON TO RG 1.60 SPECTRA
CONTAINMENT BUILDING
INTERNAL STRUCTURAL STEEL

% INCREASE IN DESIGN PARAMETER	NUMBER OF BEAMS OBE	SSE
0	84	88
0 - 10	12	8
10 - 20	4	8
20 - 30	-	4
30 - 40	8	-
40	-	-
TOTAL	108	108

NOTES:

1. ALL 108 BEAMS REVIEWED FOR EL. 426'-0".

FEB. 18, 1981
OZ-7

BY/BR STRESS COMPARISON TO RG 1.60
CONTAINMENT BUILDING (UNIT #1)
INTERNAL STRUCTURAL STEEL

BEAMS

*STRESS LEVEL	NUMBER OF BEAMS
0 - 1.0	671
1.0 - 1.1	32
1.1 - 1.2	15
1.2 - 1.3	12
1.3 - 1.4	5
1.4 -----	5
	740 TOTAL

*RATIO OF STRESS TO AISC ALLOWABLE

FEB. 18, 1981
OZ-8

BY/BR LOAD COMPARISON TO RG 1.60
AUXILIARY FUEL BUILDING COMPLEX
SHEAR WALLS

% INCREASE IN DESIGN PARAMETER	NUMBER OF SPRINGS OBE	SSE
0	122	153
0 - 10	25	51
10 - 20	19	30
20 - 30	8	7
30 - 40	50	8
40 - 50	33	6
50	15	17
TOTAL	272	272

FEB. 18, 1981
OZ-9

BY/BR LOAD COMPARISON TO RG 1.60
AUXILIARY FUEL HANDLING BUILDING COMPLEX
STEEL BEAMS

% INCREASE IN DESIGN PARAMETERS	NUMBER OF BEAMS OBE	SSE
0	148	132
0 - 10	61	85
10 - 20	16	7
20 - 30	5	6
30	-	-
TOTAL	230	230

NOTE

1. BEAMS LOCATED AT EL. 426'-0" AND 451'0" IN AUXILIARY BUILDING.

FEB. 18, 1981
OZ-10

BY/BR STRESS COMPARISON TO RG 1.60
AUXILIARY-FUEL HANDLING BUILDING COMPLEX
STRUCTURAL STEEL

BEAMS

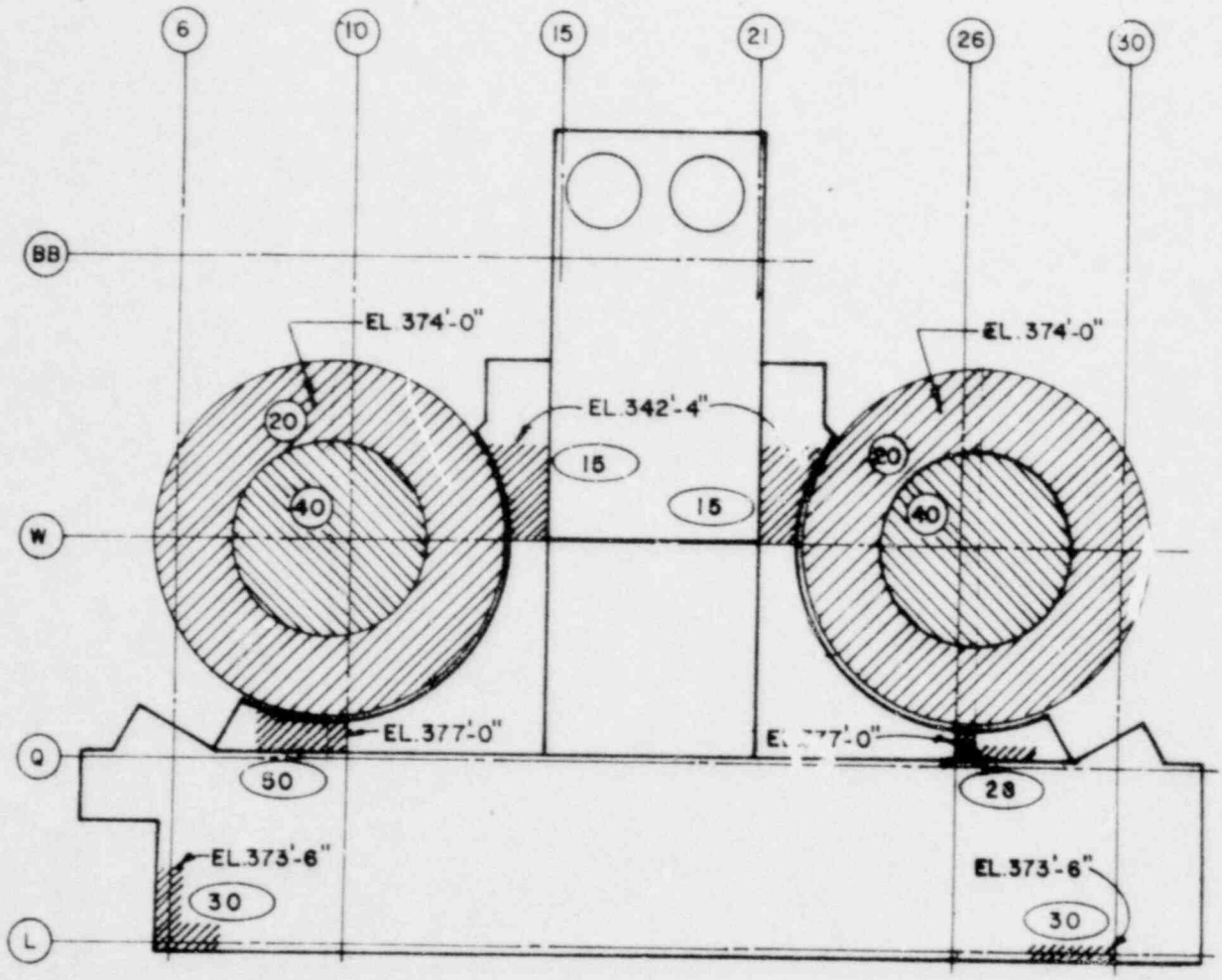
*STRESS LEVEL	NUMBER OF BEAMS
0 - 1.0	3,273
1.0 - 1.1	83
1.1 - 1.2	21
1.2 - 1.3	2
1.3 -----	21
	3,400 TOTAL

COLUMNS

*STRESS LEVEL	NUMBER OF COLUMNS
0 - 1.0	76
1.0 - 1.1	31
1.1 - 1.2	5
1.2 -----	0
	112 TOTAL

*RATIO OF STRESS TO AISC ALLOWABLE

FEB. 18, 1981
OZ-11



NOTES:

1. THE CHANGES IN THE FORCES ARE PRIMARILY DUE TO INCREASED UPLIFT OF THE MAT.
2. THE UPLIFT CALCULATIONS DO NOT ACCOUNT FOR THE SIDE SOIL/ROCK RESISTANCE WHICH WOULD BE MOBILIZED.

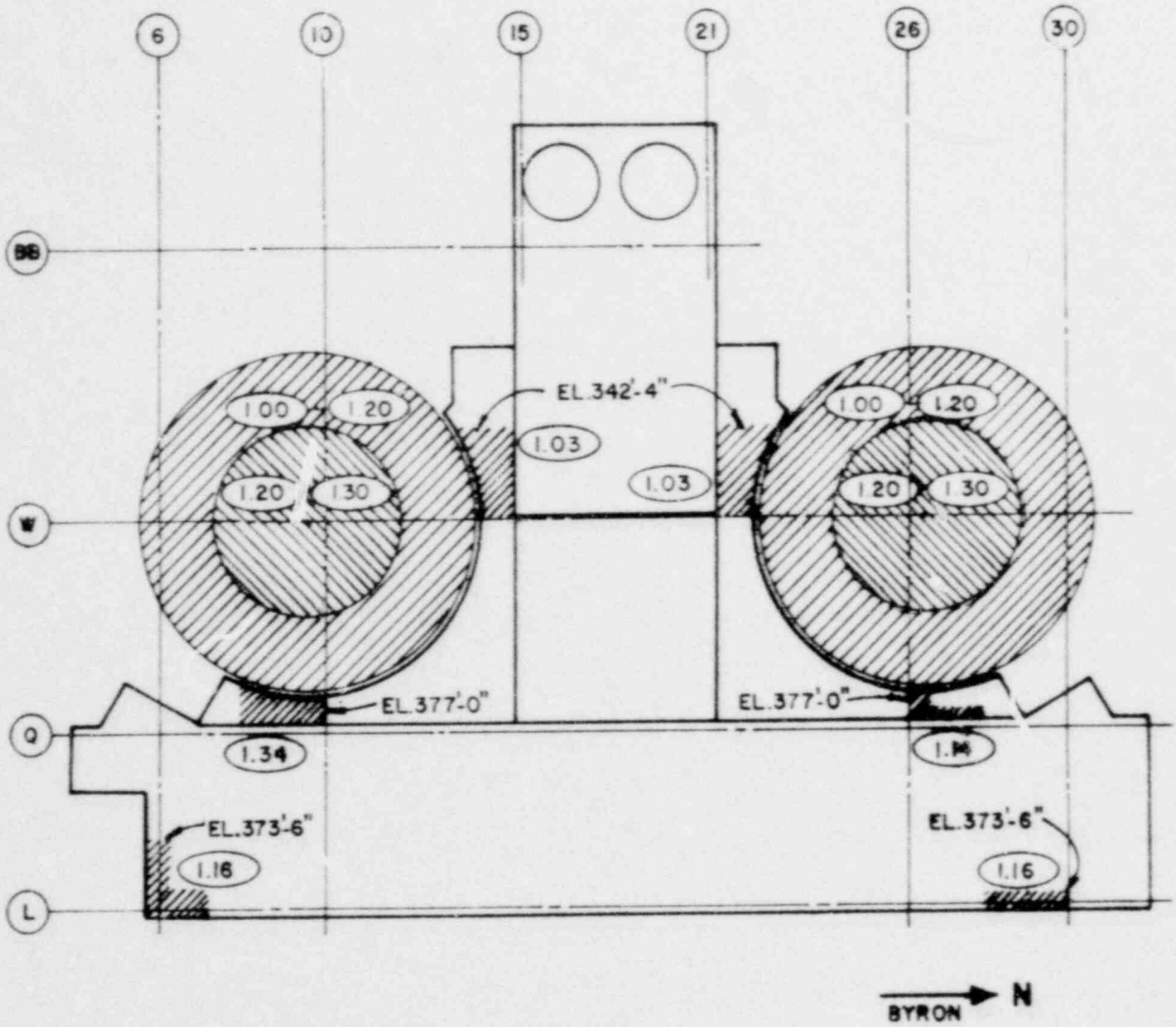
BYRON → N

LEGEND:

(oval) INDICATES AVERAGE % INCREASE IN SEISMIC FORCES IN BASE MAT.

////// INDICATES AFFECTED AREAS

FEB. 13, 1981
OZ-12



MAT PLAN

AUXILIARY-FUEL HANDLING BUILDING COMPLEX

LEGEND:

INDICATES AVERAGE STRESS LEVEL IN REINFOCING STEEL

INDICATES AFFECTED AREAS

FEB. 18, 1981
OZ-13

SUMMARY OF IMPACT OF RG 1.60 SPECTRA AT FOUNDATION LEVEL ON STRUCTURES*

- INCREASE IN OVERTURNING MOMENT AND TOTAL SHEAR
- CONTAINMENT MAT AND REACTOR CAVITY WALL ARE OVERSTRESSED
- INTERNAL CONTAINMENT STRUCTURAL STEEL MEMBERS ARE OVERSTRESSED
- SHEAR WALLS ARE OVERSTRESSED
- AUXILIARY BUILDING AND FUEL HANDLING BUILDING MAT, INTERNAL STEEL COLUMNS AND BEAMS ARE OVERSTRESSED

THE CHANGE IN THE SEISMIC LEVEL WILL THUS NECESSITATE:

- GENERATION OF NEW SPECTRA
- COMPLETE REANALYSIS OF CONTAINMENT, AUXILIARY BUILDING AND FUEL HANDLING BUILDING

*TABULATION OF INCREASES IN STRESS LEVELS AND IN DESIGN PARAMETERS IS PROVIDED IN HANDOUTS.

FEB. 18, 1981
OZ-14

IMPACT OF RG 1.60 SPECTRA @ FOUNDATION LEVEL ON PIPING, EQUIPMENT AND ELECTRICAL SYSTEMS DESIGN*

- REANALYSIS OF OVER 800 LARGE BORE PIPING SUBSYSTEMS
- REVIEW OF OVER 18,000 LARGE BORE PIPING SYSTEM SUPPORTS
- REVIEW OF 5,300 CABLE TRAY HANGERS
- REVIEW OF 28,000 CONDUIT HANGERS
- REVIEW OF 2,600 HVAC HANGERS
- REVIEW OF SUPPORT STEEL FOR HANGERS OF ALL MECHANICAL AND ELECTRICAL SYSTEMS
- SEISMIC REQUALIFICATION OF MECHANICAL EQUIPMENT (60% OF EQUIPMENT NOT REPLICATED AT MARBLE HILL)
- SEISMIC REQUALIFICATION OF ELECTRICAL EQUIPMENT (40% OF EQUIPMENT NOT REPLICATED AT MARBLE HILL)
- REASSESSMENT OF EQUIPMENT FOUNDATION LOADS
- REVISED NSSS LOADS WILL HAVE TO BE OBTAINED FROM SUPPLIER AND IMPACT OF THESE LOADS WILL HAVE TO BE EVALUATED

*QUANTITIES GIVEN ARE FOR ONE PLANT ONLY.

FEB. 18, 1981
OZ-95

MEETING SUMMARY DISTRIBUTION

Docket File
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Local PDR
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