June 3, 1992

Docket Nos. 50-325
and 50-324

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LICENSEE: CAROLINA POWER & LIGHT COMPANY

FACILITY: BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2

SUBJECT: SUMMARY OF MEETING WITH CAROLINA POWER & LIGHT COMPANY ON MASONRY WALL SEISMIC ISSUES

The staff met with the Brunswick Steam Electric Plant licensee, Carolina Power & Light Company (CP&L), on May 12, 1992, regarding the masonry wall seismic issues which caused the shutdown of both units since April 21, 1992. The meeting was requested by NRR in a letter dated April 27, 1992, to discuss CP&L's corrective action plans, schedules and the root cause of the identified deficiencies. NRR requested the meeting prior to the restart of either unit. The attendees of the meeting are listed in Enclosure 1.

CP&L's discussion during the meeting followed the viewgraphs closely (see Enclosure 2). CP&L's planned corrective actions include the restoration of the diesel building and control building walls to licensed seismic design requirements, confirmation of the service water pump operability and a walk-down of both units to identify and correct physical deficiencies.

Following the meeting, NRR requested that CP&L document and submit to the staff the planned corrective actions and their criteria. In addition, CP&L will provide a written response to address the staff's questions presented in the April 27, 1992 letter. The staff will review those responses prior to the restart of either unit.

Sincerely,

Original signed by

Ronnie Lo, Senior Project Manager
Project Directorate II-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Enclosures:
1. List of attendees
2. Licensee Viewgraphs

cc: See next page

LA:PD21:DRPE	PM:PD21:DRPE	D:PD21:DRPE	
PAnderson	RLo:dt	EAdensam	
6/3/92	6/3/92	6/3/92	/92

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Encl. 1

MEETING WITH CP&L ON BRUNSWICK

STRUCTURAL SEISMIC ISSUES

MAY 12, 1992

Name	Affiliation
Ronnie Lo	NRC - NRR
Goutam Bagchi	NRC-NRR-DET
Gus Lainas	NRC-NRR-DRPE
B. D. Liaw	NRC-NRR-DET
J. G. Partlow	NRC-NRR Assoc Dir
S. Varga	NRR-DRPE
J. L. Milhoan	NRC/RII/DRA
A. F. Gibson	NRC/RII/DRS
Lynn Eury	CP&L
R. A. Watson	CP&L
Jack Spencer	CP&L - BNP GM
Ashleigh Lucas	CP&L - MLR NEO
H. Lee Wineras	CP&L - Chief Civil Eng.
Randall Knott	CP&L Structural
E. A. Bishop	CP&L Chief Mechanical Eng.
R. E. Oliver	CP&L Manager Risk Assessment
Gary L. Miller	CP&L Risk Assessment
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R. L. Prevatte	NRC Senior Resident Inspector
Jerome J. Blake	NRC RII DRS
D. M. Verrelli	NRC RII DRP
D. C. McCarthy	CP&L NSO
R. K. Hoefling	NRC OGC
Jim Lieberman	NRC OE
Jose Ibarra	AEOD ROAB
Patrick Harris	SERCH Licensing
Roger Wr ıruff	NRR OEAB
J. Wech_berger	NRC EDO
Thomas A. Baxter	Shaw, Pittman, Potts & Trowbridge

ENCLOSURE 2

CAROLINA POWER & LIGHT COMPANY

BRUNSWICK NUCLEAR PROJECT

TECHNICAL PRESENTATION

TO THE NUCLEAR REGULATORY COMMISSION

MAY 12, 1992

TECHNICAL MEETING AGENDA

I.	INTRODUCTION	- JACK SPENCER
II.	DIESEL GENERATOR BUILDING WALLS - CHRONOLOGY - DESCRIPTION OF DEFICIENCY - CORRECTIVE ACTION	- LEE WILLIAMS
III.	SERVICE WATER PUMPS - CHRONOLOGY - FUTURE PLANS - SAFETY MARGIN	- AL BISHOP
IV.	SHORT-TERM STRUCTURAL CRITERIA - OVERVIEW - ITEMS THAT ARE SHORT-TERM QUALIFIED - TECHNICAL ISSUES	- LEE WILLIAMS
V.	SAFETY SIGNIFICANCE	- RUDY OLIVER
VI.	SUMMARY OF CORRECTIVE ACTIONS - PRIOR TO START-UP	- JACK SPENCER
VII.	CLOSING REMARKS	- JACK SPENCER

INTRODUCTION

THREE ISSUES

- DIESEL GENERATOR BUILDING WALLS

- SERVICE WATER PUMPS

- SHORT-TERM STRUCTURAL INTEGRITY ITEMS

INTRODUCTION

WALLS

- EXECUTED BROAD SCOPE REVIEW

- ISSUE LIMITED TO:

  -- DIESEL GENERATOR BUILDING WALL ANCHORAGE

  -- INTERNAL WALL DESIGN OVERSIGHT IN THE CONTROL ROOM HABITABILITY STUDY

- LONG-TERM QUALIFIED BEFORE RESTART

INTRODUCTION

SERVICE WATER (SW) PUMPS

- PRUDENT ATTENTION TO SERVICE WATER ISSUES

- PUMPS ARE OPERABLE

- PUMPS ARE SCHEDULED FOR REPLACEMENT

DBE = DESIGN BASIS EARTHQUAKE

INTRODUCTION

SHORT-TERM STRUCTURAL INTEGRITY ITEMS

- OPERABILITY DETERMINED
- ITEMIZED AND SCHEDULED
- STANDARD FOR RESOLUTION

- SCHEDULE FOR CLOSURE ACCELERATED

II. DIESEL GENERATOR BUILDING WALLS

DIESEL GENERATOR BUILDING WALLS

BLOCK / REINFORCED CONCRETE WALL STRUCTURAL ISSUE

- OVERVIEW
- CHRONOLOGY
- DEFICIENCIES
- EVALUATIONS
- OTHER INSPECTIONS
- SUMMARY

WALL STRUCTURAL ISSUES

- DEFICIENT ANCHOR BOLT INSTALLATION

- DEFICIENT THROUGH BOLT INSTALLATION

- PRESSURE BOUNDARY WALLS FOR CONTROL ROOM HABITABILITY

OVERVIEW
WALL STRUCTURAL ISSUFS

1. DEFICIENT ANCHOR INSTALLATION ISSUE CONFINED TO:

   - ORIGINAL CONSTRUCTION - JUNE-OCTOBER, 1973

   - ANCHOR WORK IN DIESEL GENERATOR BUILDING

2. CONTROL ROOM WALLS IDENTIFIED BY DBD ENGINEERS AS BEING RELATED TO CONTROL ROOM HABITABILITY REQUIREMENTS - NOT INCLUDED IN IEB 80-11 REVIEW

   - NO ORIGINAL WALL DESIGNATION IN CONSTRUCTION DRAWINGS

   - UFSAR STATES CONTROL BUILDING "SEISMICALLY DESIGNED"

   - DRAWINGS UPDATE POST-IEB 80-11

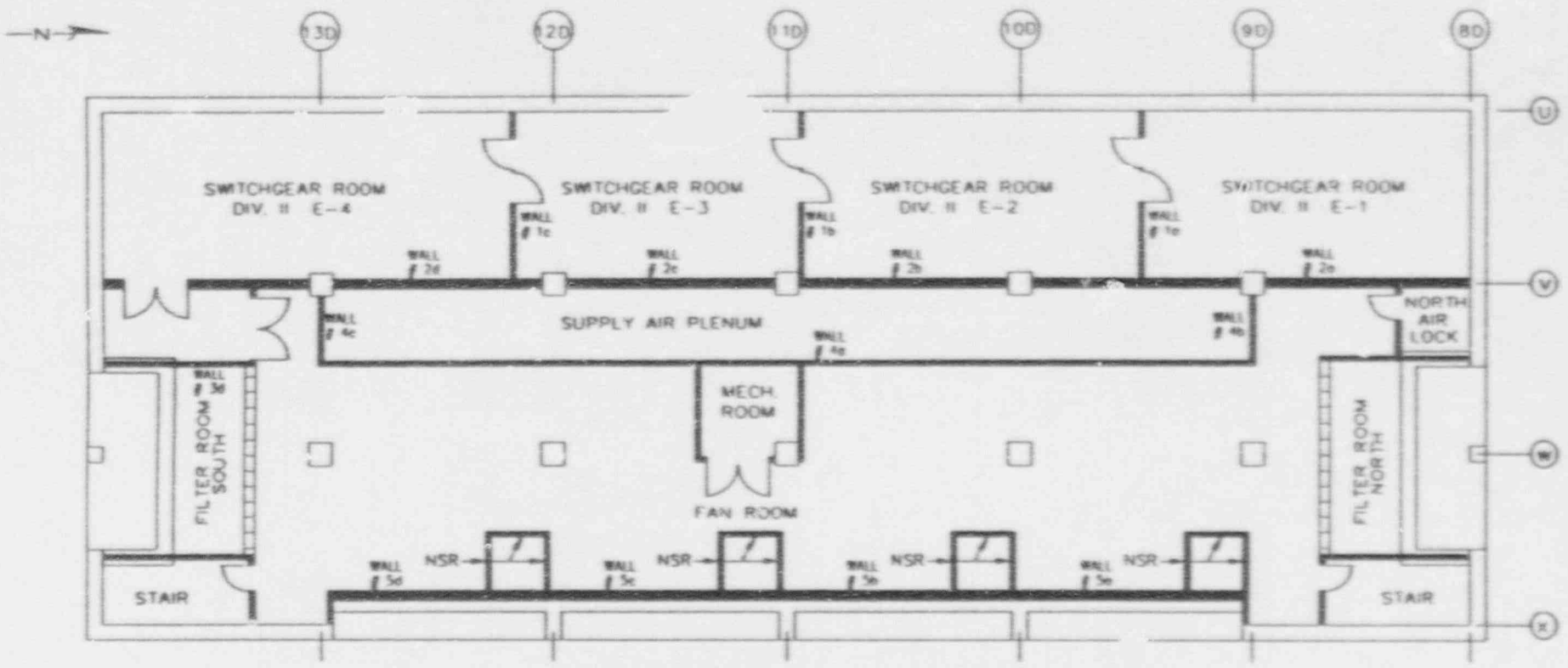
OVERVIEW

WALL STRUCTURAL ISSUES (CONT'D)

- CONSERVATIVE OPERABILITY DECISIONS MADE AS FIELD REVIEWS PROGRESSED

  (AFTER SIGNIFICANCE OF ISSUE RECOGNIZED)

- ALL WALL DESIGN MARGINS FULLY RESTORED PRIOR TO START-UP

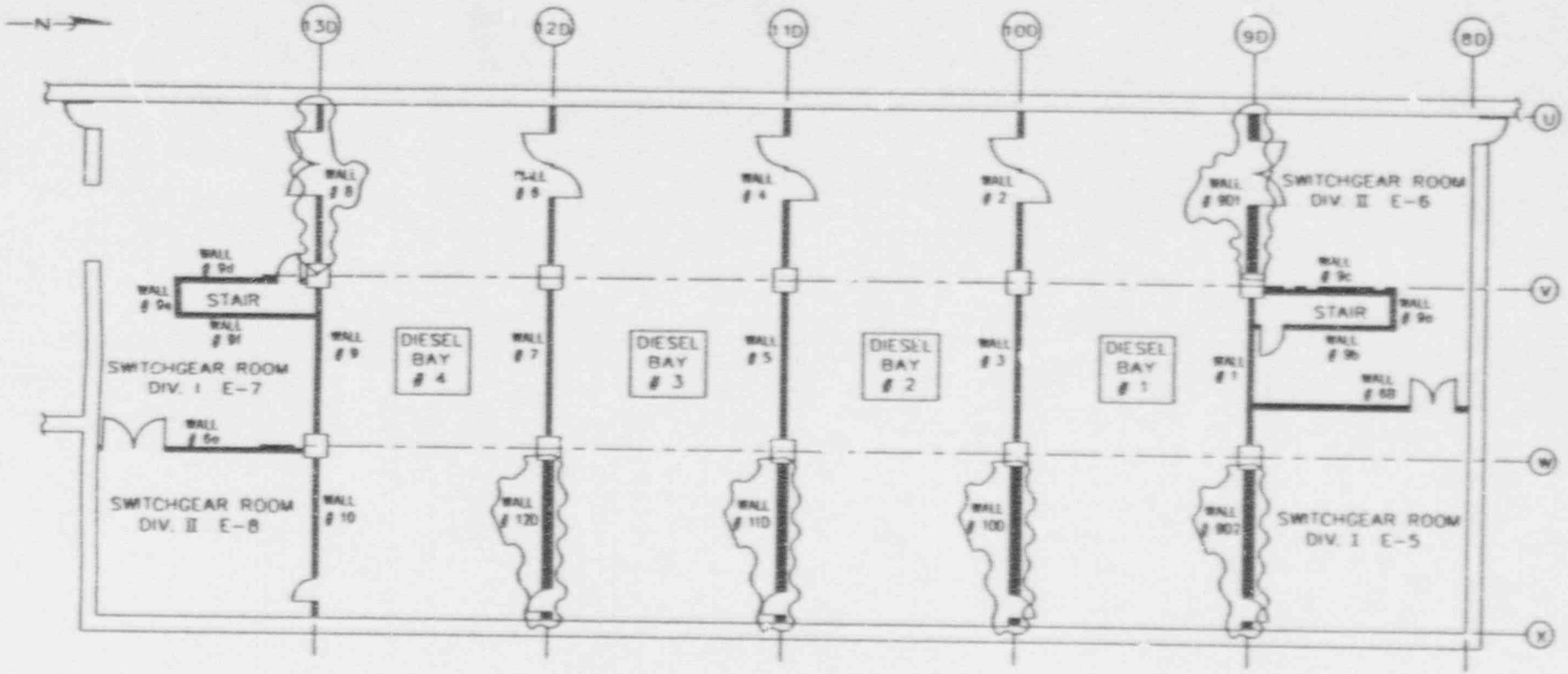


KEY PLAN

DIESEL GENERATOR BLDG.
(PARTIAL PLAN @ ELEV. 50'-0")

WALL LEGEND

- MASONRY
- MODIFIED UNDER 80-11



KEY PLAN

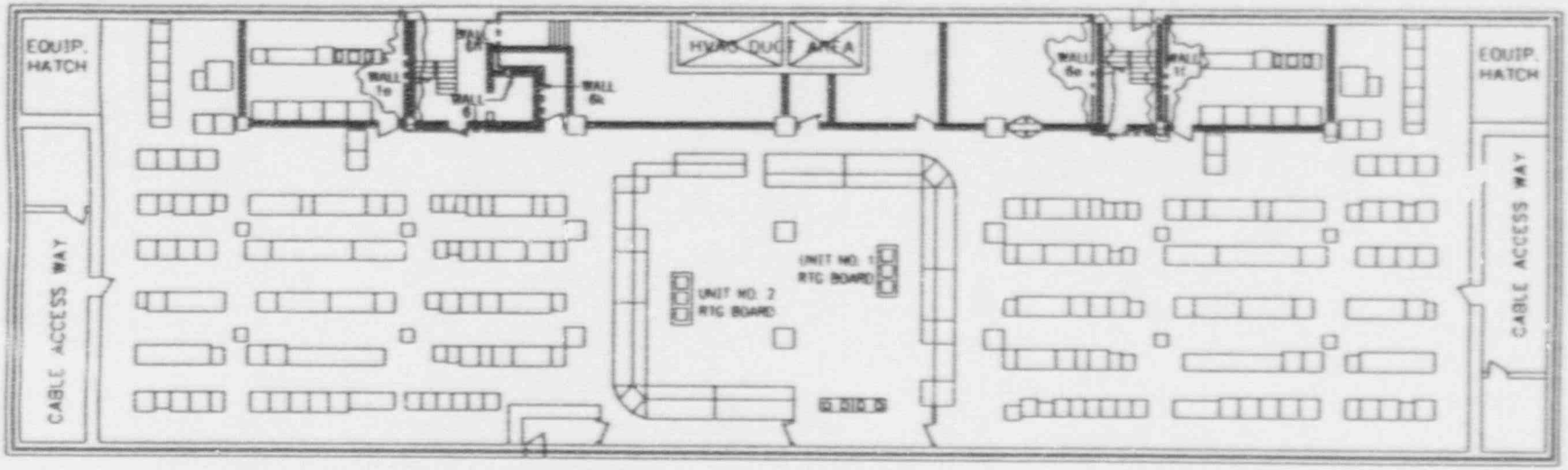
DIESEL GENERATOR BLDG.
(PARTIAL PLAN @ ELEV. 23'-0")

WALL LEGEND

- REINFORCED CONCRETE
- MASONRY W/STEEL PLATE
- MASONRY
- MODIFIED UNDER 80-11
- DECLARED INOPERABLE

N

WALLS 1a AND 1f REINFORCED
WALLS 6a, 6h, 6j, AND 6k UNREINFORCED



KEY PLAN

CONTROL ROOM
(PLAN @ ELEV. 49'-0")

WALL LEGEND

- MASONRY
- PRESSURE BOUNDARY FOR CONTROL ROOM HABITABILITY
- DECLARED INOPERABLE

WALL TYPES

- REINFORCED BLOCK

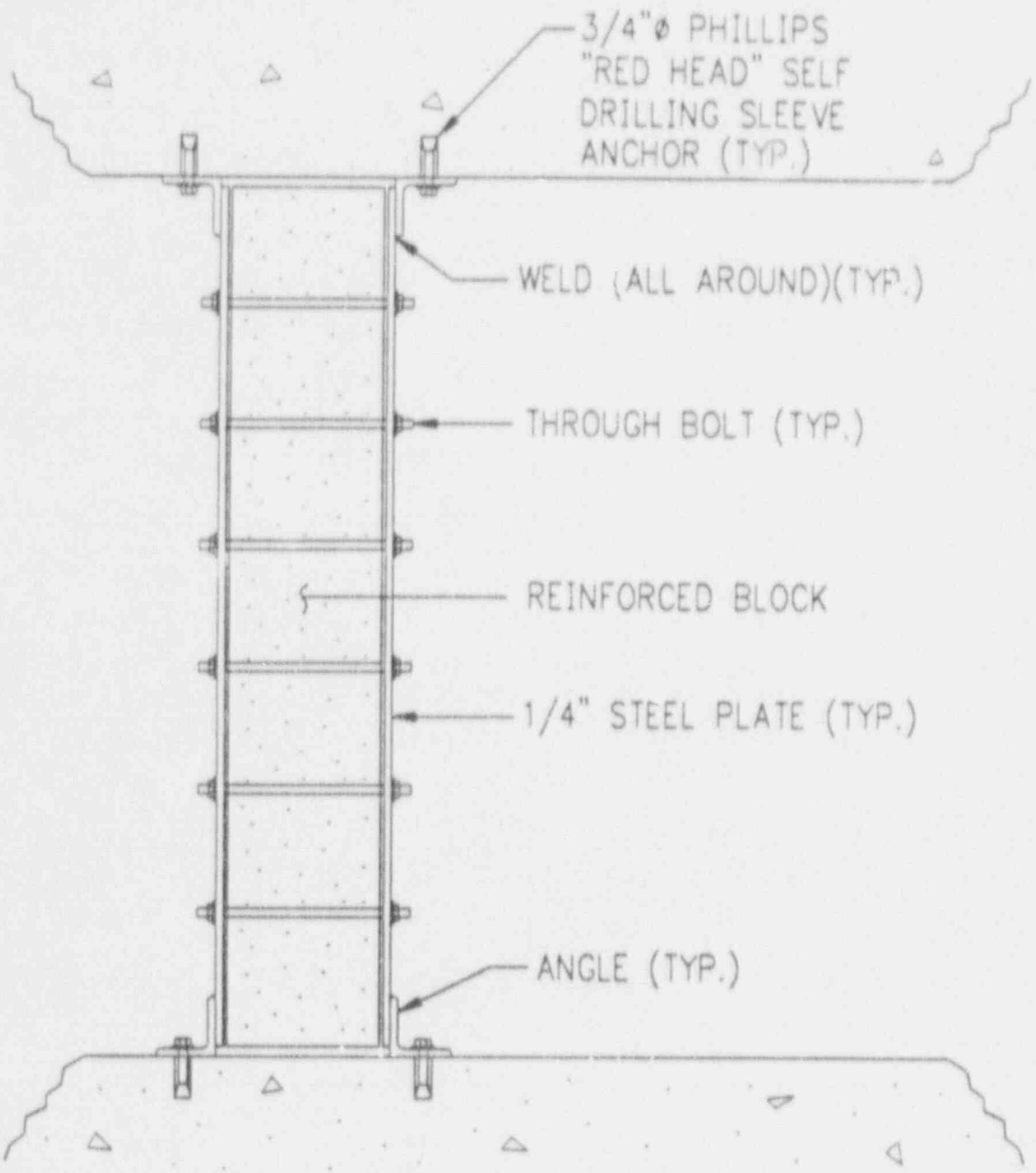
- REINFORCED BLOCK WITH STEEL PLATING

  10 WALLS (DIESEL GENERATOR BUILDING)

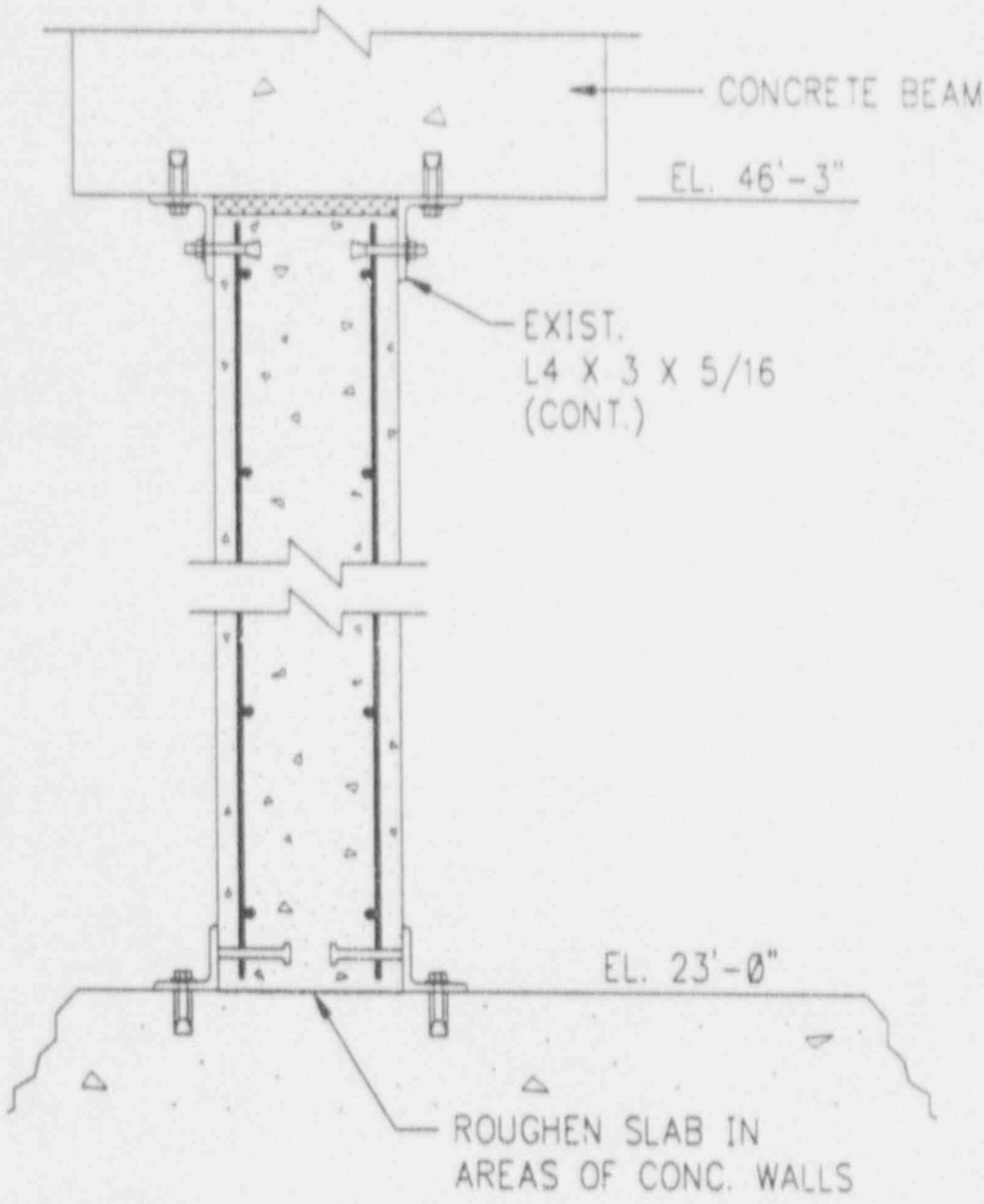
- UNREINFORCED BLOCK

- REINFORCED CONCRETE PANELS

  5 WALLS (DIESEL GENERATOR BUILDING)

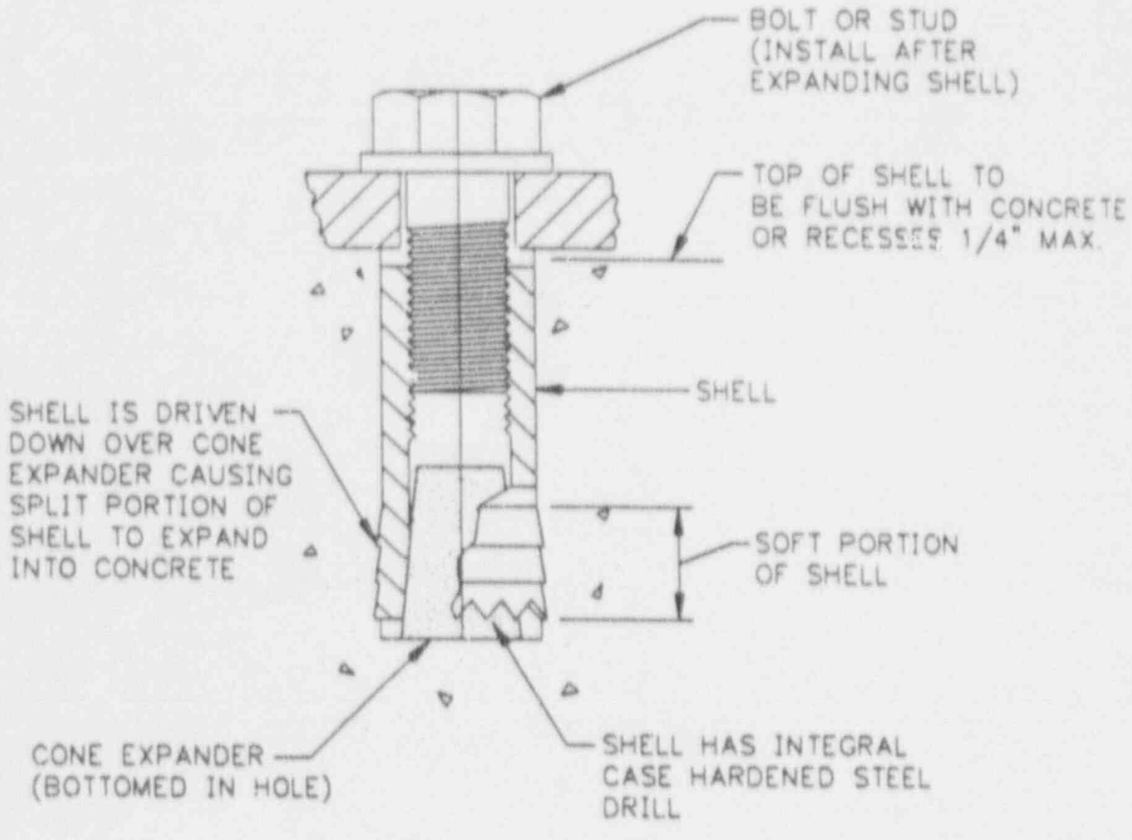


PLATED BLOCK WALLS



REINFORCED CONCRETE PANEL
(AS DESIGNED)

Expansion Anchors



SELF-DRILLING TYPE

DIESEL BUILDING WALLS

(CHRONOLOGY)

- 9/72: BLOCK WALL DETAILS ISSUED FOR CONSTRUCTION

- 8/73: ADDED STEEL PLATES AND ANGLES WITH DRILL-IN ANCHORS TO DESIGN DRAWINGS (MISSILE PROTECTION)

- 9/73: CONCRETE WALLS ADDED AS CONSTRUCTION OPTION TO BLOCK WALLS WITH PLATES AND DRILLED-IN ANCHORS

  - NO INSPECTION DOCUMENTATION
  - ORIGINAL CONSTRUCTION CONTRACTOR INSTALLED STEEL PLATES ON BLOCK WALLS AND ASSOCIATED DRILLED-IN ANCHORS IN THE AUGUST 1973 TIME FRAME

DIESEL BUILDING WALLS

(CHRONOLOGY) (CONT'D)

- 1980: IEB 80-11 ISSUED

- 2/87: TECHNICAL SUPPORT LEARNS OF BOLT PROBLEM FROM I&C TECHNICIANS; REQUESTS SITE ENGINEERING TO EVALUATE ACCEPTABILITY OF ANCHOR BOLTS ON THE ANGLE SUPPORT PIECES WHICH DO NOT PENETRATE THE CONCRETE WALL

- 4/88: SECOND TECHNICAL SUPPORT EVALUATION REQUEST, FOLLOWING EXCHANGES ON APPROPRIATE RESOURCES, SCOPE OF INSPECTION EFFORT

- 9/89: IDENTIFIED THAT APRIL 1988 REQUEST WAS LOST OR NOT RECEIVED BY ENGINEERING. THIRD REQUEST FOR EVALUATION MADE

DIESEL BUILDING WALLS

(CHRONOLOGY)

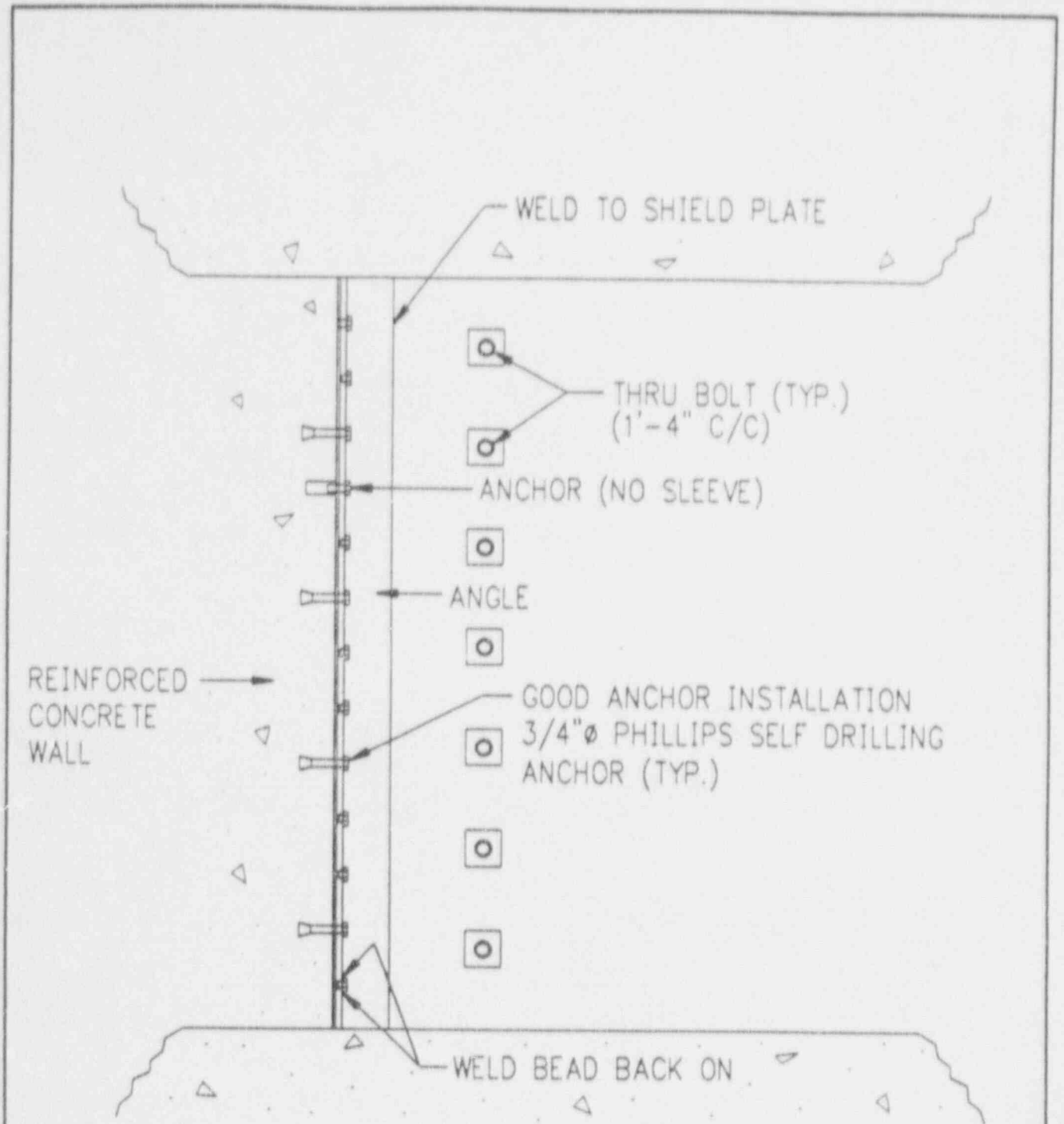
- 1990: BOLT EXISTENCE CHECKED BY FEELER GAGE TECHNIQUE AND OPERABILITY CALCULATIONS BASED ON THIS DATA; SUBSEQUENTLY SHOWN TO BE INACCURATE

- 4/92: NRC QUESTIONED ADEQUACY OF BOLT INSPECTIONS

  - REINSPECTION/ANALYSIS SHOWED 1 OF 10 WALLS PREVIOUSLY SHORT-TERM QUALIFIED TO BE INOPERABLE

- 4/92: CP&L INFORMED TWO OTHER UTILITIES AND ISSUED PART 21 REPORT

- 4/21/92: CP&L INITIATES DUAL-UNIT SHUTDOWN DUE TO SUSPECTED INOPERABILITY OF REINFORCED CONCRETE WALLS



PLATED BLOCK WALL DEFICIENCIES

DIESEL BUILDING WALLS
DEFICIENCIES

REINFORCED BLOCK WITH STEEL PLATE

- FIELD INSPECTION - 100 PERCENT ANCHOR BOLTS AND THROUGH BOLTS
  - ANCHOR BOLTS: REMOVED AND REINSTALLED
  - THROUGH BOLTS: CHECKED BY UT EXAMINATION

- DEFICIENCIES
  - THROUGH-WALL BOLTS (5 PERCENT DEFICIENT)
  - ANCHOR BOLTS (60 PERCENT DEFICIENT)

- RESULTS
  - 9 WALLS - "SHORT-TERM" QUALIFIED
  - 1 WALL - INOPERABLE (WALL 8)

FURTHER DIESEL BUILDING WALL REVIEWS

OTHER DIESEL BUILDING WALLS (UNPLATED)

- FIELD INSPECTION + DOCUMENTATION REVIEW
  - 100 PERCENT ANCHOR BOLTS NOT MODIFIED PER IEB 80-11
  - 12 WALLS MODIFIED
    - -- 8 WALLS FIELD INSPECTED
    - -- 4 WALLS QA RECORDS REVIEWED
- DEFICIENCIES
  - 2 WALLS 5/8" VS. 3/4" DIAMETER BOLTS (DGB EL. 50')
  - 1 WALL - MISSING ANCHOR BOLTS (DGB WALL 6B)

  "ALL WERE ORIGINAL CONSTRUCTION"
- RESULTS
  - 3 WALLS - "SHORT-TERM" QUALIFIED
  - 23 WALLS - "LONG-TERM" QUALIFIED

DGB = DIESEL GENERATOR BUILDING

FURTHER DIESEL BUILDING WALL REVIEWS

REINFORCED CONCRETE - 5 WALLS

- FIELD INSPECTION - 100 PERCENT ANCHOR BOLTS
  - REBAR INSPECTED BY MAGNETIC SCANNER
- DEFICIENCIES
  - DEFICIENT ANCHOR BOLTS (APPROXIMATELY 85 PERCENT)
- RESULTS
  - 5 WALLS INOPERABLE

CONTROL BUILDING AND REACTOR BUILDINGS MASONRY WALLS

SUMMARY OF OTHER INSPECTIONS, EVALUATIONS

- 140 TOTAL WALLS
  - 59 SEISMIC
    - -- 11 WITH ANCHOR BOLTS
      - . 6 - 100 PERCENT INSPECTED VS. 25 PERCENT
      - . 5 - QA RECORDS REVIEWED, MODIFIED TO MEET IEB 80-11

      NO DEFICIENCIES
  - 81 NONSEISMIC
    - -- CURRENTLY REVIEWING NONSEISMIC WALLS TO ENSURE NO EQUIPMENT OR REQUIRED WALL FUNCTION MISSED

CONTROL BUILDING AND REACTOR BUILDINGS MASONRY WALLS

- INCLUDED IN 140 TOTAL WALLS

  - 3 CONTROL ROOM STAIRWELL WALLS

    -- REINFORCED AND NONREINFORCED

    -- REVIEWED AND DETERMINED INOPERABLE

    -- SHOULD BE SEISMIC

    -- CONTROL ROOM HABITABILITY STUDY ASSUMED WALLS SEISMIC

DIESEL BUILDING WALLS

"LONG-TERM" REPAIRS PRIOR TO START-UP

- ACCEPTABLE ANCHOR BOLTS REPLACED WITH HIGH STRENGTH BOLTING (USE EXISTING SLEEVE)

- NONFUNCTIONAL THROUGH BOLTS WILL BE REMOVED, HOLES PLATED

- NEW WEDGE EXPANSION ANCHORS INSTALLED TO SUPPLEMENT

- STEEL FRAMING ON UNREINFORCED CONTROL BUILDING WALLS

- QC INSPECTED / VERIFIED INSTALLATIONS

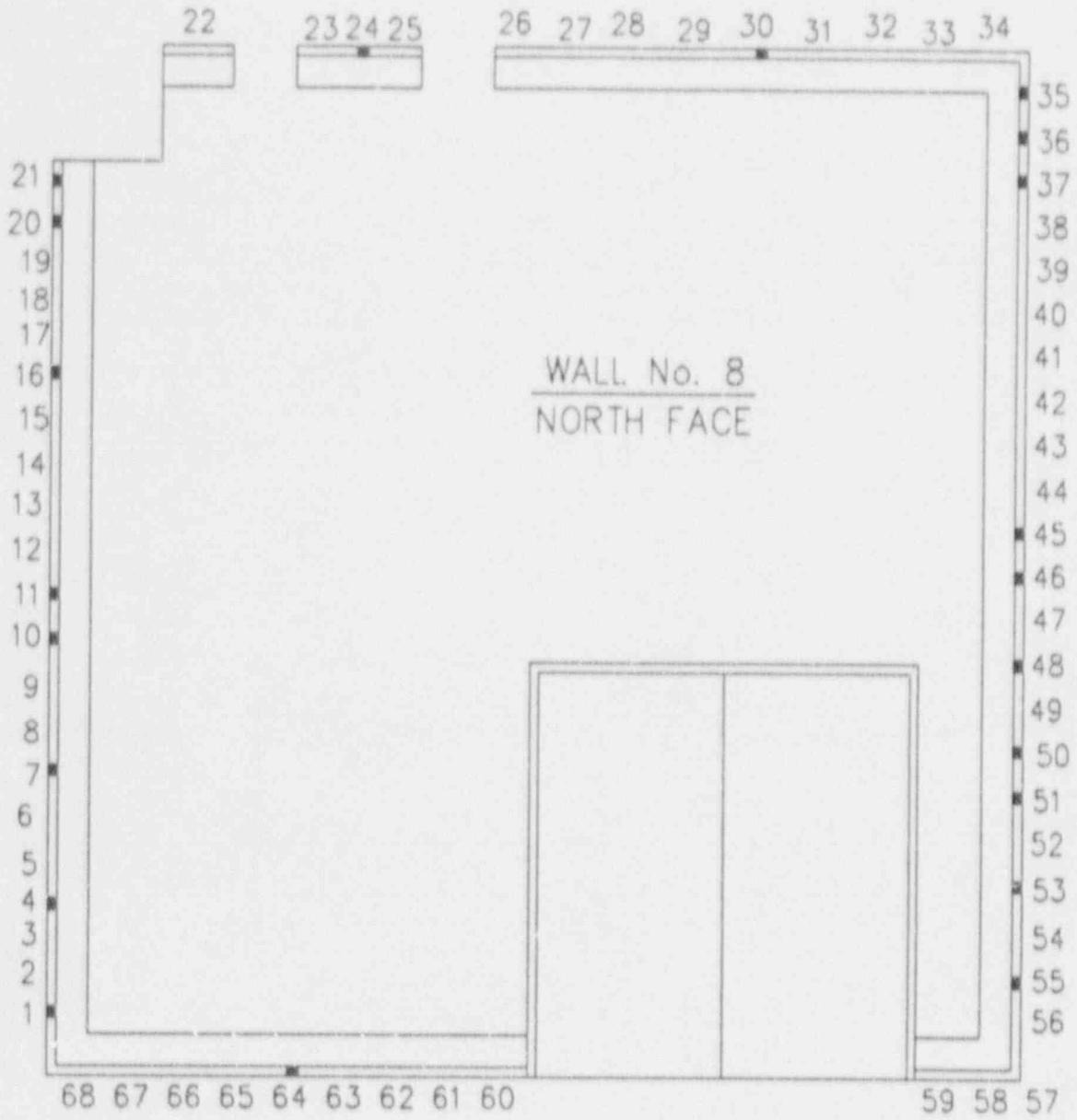
DIESEL BUILDING WALLS

CAUSAL FACTORS

- CORRECTIVE ACTION PROGRAM
- TECHNICAL SUPPORT AND ENGINEERING INTERFACE
- SCOPE AND IMPACT
- RESOURCES

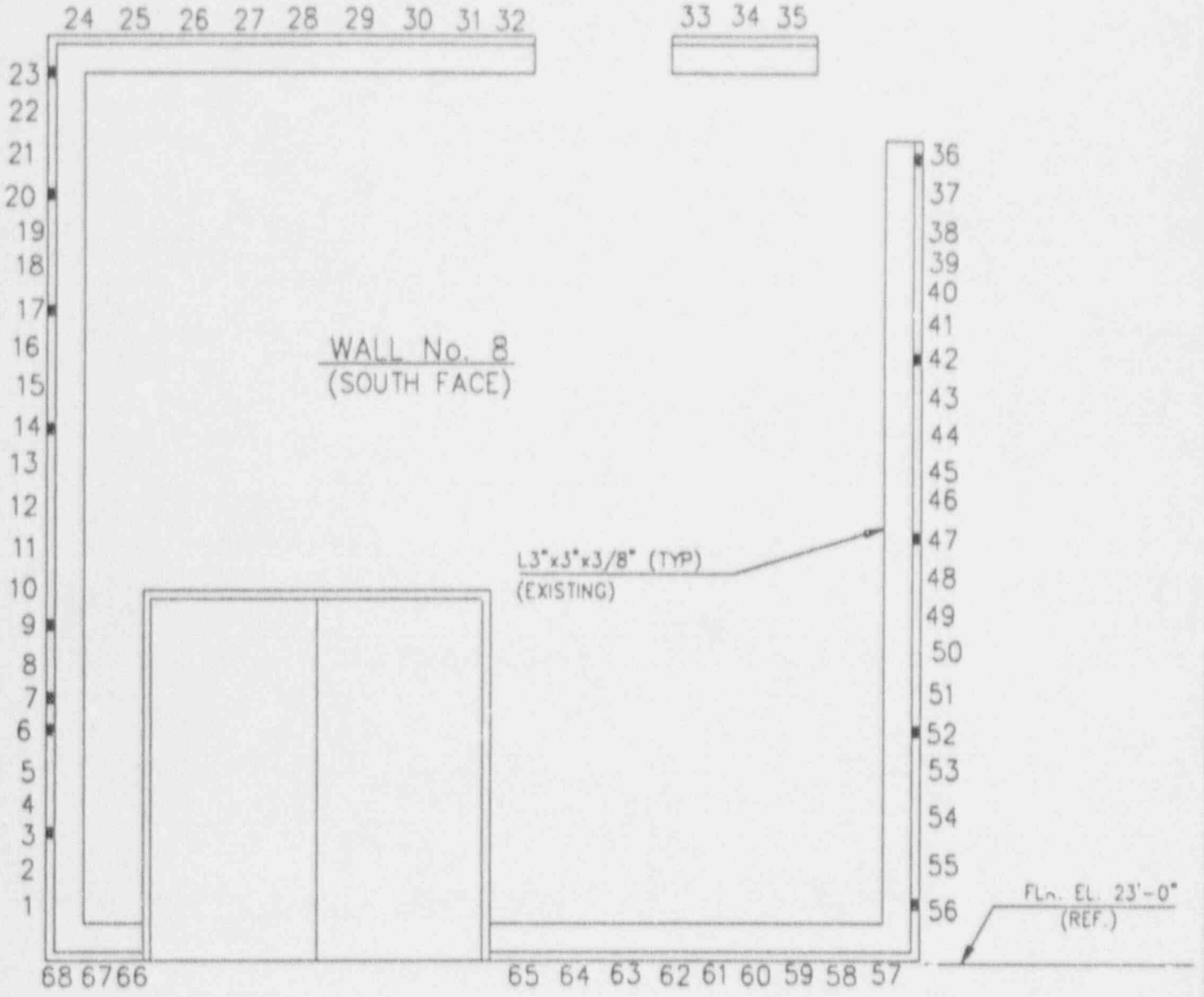
SHORT-TERM WALL EVALUATIONS
APRIL 1992

- CONSERVATIVE OPERABILITY DETERMINATIONS MADE
- PLATED SHIELD WALLS
  - BOLTS CONSIDERED IN ANALYSIS REMOVED AND REINSTALLED
  - NO. 8 DECLARED INOPERABLE (CRITICAL BOLT LOCATION)
  - REMAINING QUALIFIED BY 4, 9, 10 (WORST CASE) (43 BOLTS "WORST CASE")
- REINFORCED BLOCK - DGB
  - IN SITU TESTING TO CREDIT NEAR EDGE ANCHORS
- REINFORCED CONCRETE PANELS
  - 4 BOLTS WORST CASE
    - -- 5 WALLS DECLARED INOPERABLE
- BLOCK WALLS - CONTROL ROOM
  - 3 WALLS DECLARED INOPERABLE



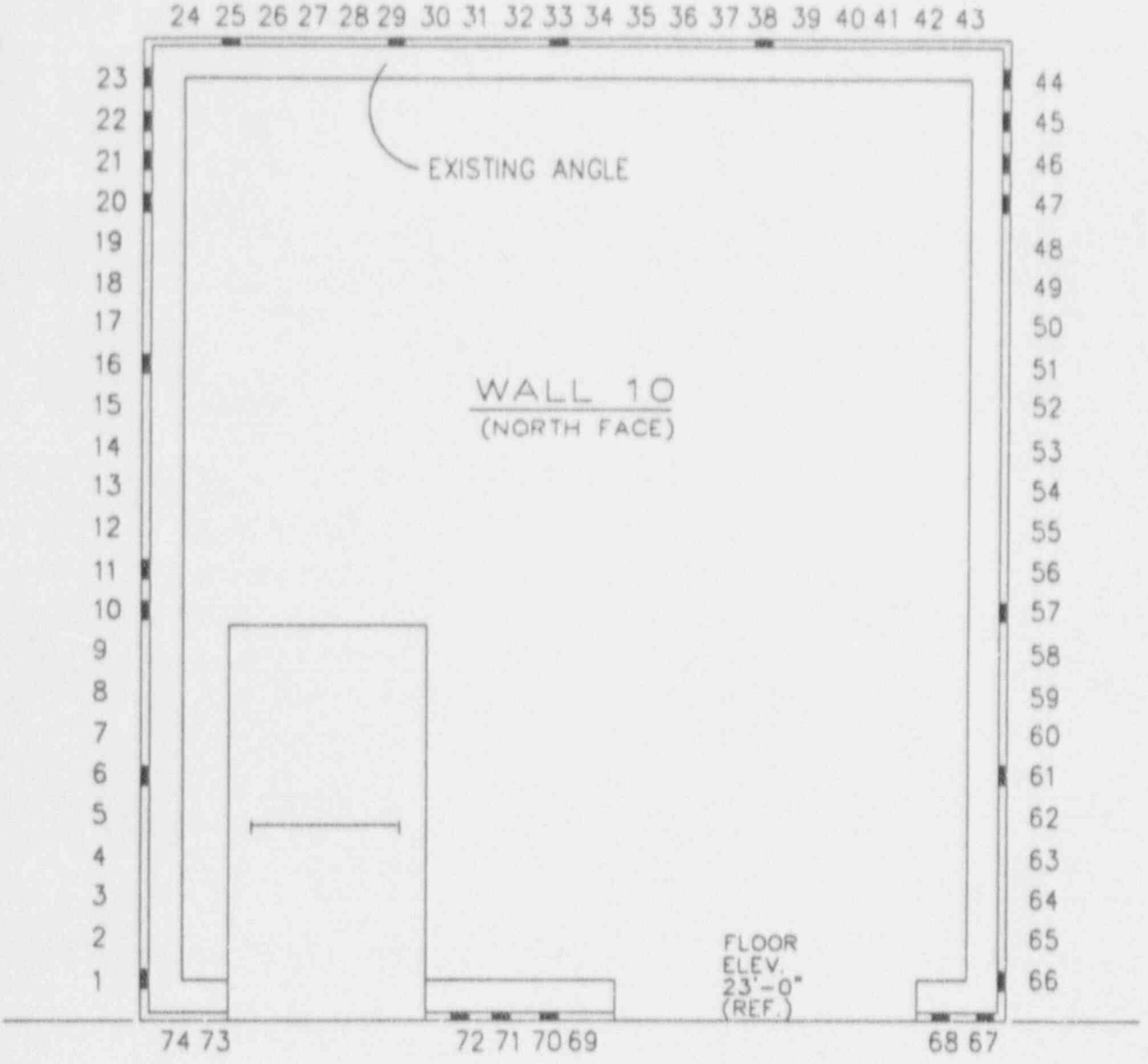
SECTION "S-S"

(LOOKING SOUTH)



SECTION "W-W"

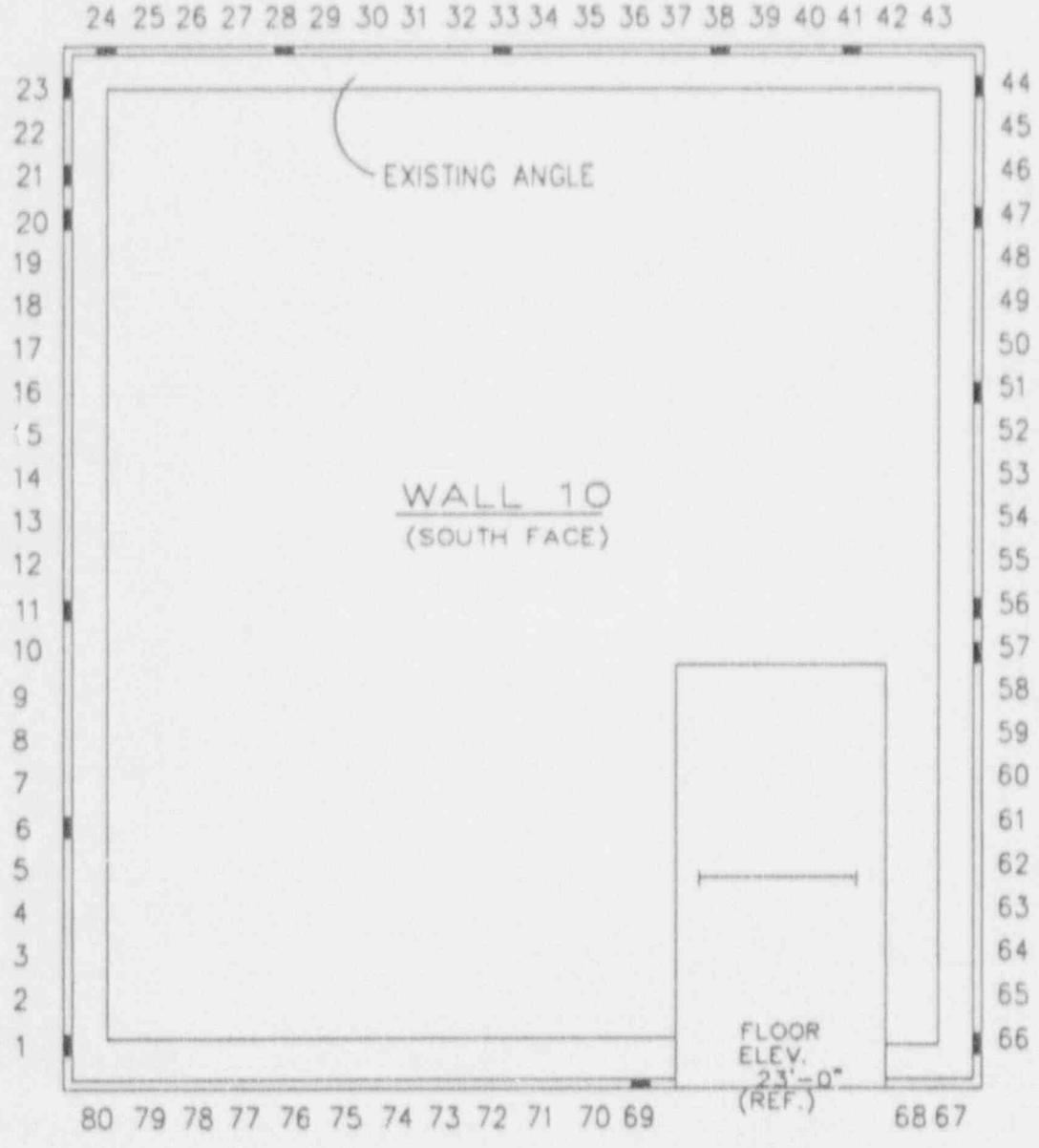
(LOOKING NORTH)



■ - DENOTES EXCEPTABLE ANCHOR BOLTS PER INITIAL INSPECTION

SECTION P–P

(LOOKING SOUTH)



■ -DENOTES ACCEPTABLE ANCHOR BOLT PER INITIAL INSPECTION

SECTION T-T

(LOOKING NORTH)

SHORT-TERM EVALUATIONS
BASIS FOR ALLOWABLES

- ANCHORS

  3/4"ø RED HEAD SELF-DRILLING

	VENDOR ALLOWABLE (FS-3)	GIP ALLOWABLES (FS-3)	SHORT-TERM EVALUATION ALLOWABLES (FS-3)
T	4.65^{K}	3.5^{K}	1.8^{K}
V	4.11^{K}	4.4^{K}	3.0^{K}*

  * SITE TESTING FOR SHEAR TESTS (11,000# ULTIMATE)
  * BOLT MATERIAL TESTED AS A307 (AVERAGE 65 KSI ULTIMATE)

- <u>BLOCK/MORTAR COMBINATION</u> - F'M = 1820 PSI, TYPE M

  - BASED ON SITE TESTING DATA (COVERING SITE BLOCK WORK) DURING CONSTRUCTION (CALC NO. 9527-1-GP-MW-01-F)

- REBAR

  - ASTM 615-68 GRADE 60 (#6 TO #11 BARS)
  - PRESENCE VERIFIED BY REBAR FINDER, BOROSCOPE VISUAL

T = TENSION
V = SHEAR

SHORT-TERM EVALUATIONS
BLOCK SHIELD WALL

SEISMIC DEMAND VS. RESTRAINT CAPACITY

WALL NUMBER	NUMBER OF BOLTS	OVERALL DEMAND (SHEAR, #)	TOTAL RESISTANCE (F.O.S-5) (SHEAR, #)
4	44	23,030	88,000
9	47	25,482	94,000
10	43	26,978	80,000

OTHER CONSERVATISMS:

- WALL WEIGHT
  - ASSUMED 87 #/S.F.
  - ACTUAL
    62 #/S.F. (WALL) + 8 #/S.F. (ATTACH.) = 70 #/S.F.

STRUCTURAL ISSUES

SUMMARY

- ALL PHYSICAL EVIDENCE LIMITS ISSUE SCOPE TO ORIGINAL ANCHORAGE WORK ON WALLS ON ONE ELEVATION IN DGB

- CONSERVATIVE OPERABILITY DECISIONS MADE,

  (ONCE PROPER FIELD DATA OBTAINED)

- REVIEW OF IEB 80-11 SCOPE

  - PHYSICAL REVIEW OF NONSEISMIC WALLS

  - DESIGN REVIEW FOR WALL FUNCTIONALITY REQUIREMENTS

- ACCELERATE DESIGN BASIS DOCUMENT AND VALIDATION EFFORT FOR STRUCTURES DBD. COMPLETE MARCH 1993.

- ALL WALL DESIGN MARGIN RESTORED TO LONG-TERM OPERABILITY PRIOR TO START-UP

III. SERVICE WATER PUMPS

SERVICE WATER (SW) PUMPS

PURPOSE: REVIEW CHRONOLOGY OF EVENTS. CLARIFY COMPLETION OF SEISMIC UPGRADES IN 1985.

ADDRESS TIMELINESS OF ACTIONS.

REVIEW SCHEDULE FOR PUMP UPGRADE.

REVIEW EXISTING PUMP ACCEPTABILITY.

SERVICE WATER PUMPS CHRONOLOGY

1972 CALCULATIONAL ERROR MADE BY SERVICE WATER PUMP SUPPLIER IN DETERMINING PUMPS' NATURAL FREQUENCY. ERROR NOT DETECTED

1981 DURING ENGINEERING REVIEW FOR PUMP UPGRADE, FOUND ERROR IN NATURAL FREQUENCY CALCULATIONS FOR ORIGINAL PUMPS

- UPGRADE INITIATED TO ADDRESS PUMP RELIABILITY ISSUES
- ORIGINAL PUMPS "SHORT-TERM" QUALIFIED

1982 ISSUED PMs TO ADDRESS LONG-TERM SEISMIC QUALIFICATION

1985 PUMP REPLACEMENT COMPLETED

- CONSIDERED "LONG-TERM" QUALIFIED WHEN REPLACED

11/88 ISSUED PMs TO ACCOMPLISH PRODUCT LUBRICATION UPGRADE FOR EXISTING PUMPS

2/89 CP&L IDENTIFIED A DISCREPANCY BETWEEN RESPONSE SPECTRA IN THE FSAR AND EQUIPMENT SPECIFICATION FOR BUTTERFLY DAMPERS. INITIATED NCR 89-8 TO ADDRESS THE ISSUE

6/89 CP&L INITIATES ENGINEERING REVIEW OF SEISMIC REQUIREMENTS IN PUMP SPECIFICATION AND IDENTIFIES WRONG RESPONSE SPECTRA IN EXISTING PUMPS

PM = PLANT MODIFICATION
NCR = NONCONFORMANCE REPORT

SERVICE WATER PUMPS CHRONOLOGY (CONT'D)

8/89 JOHNSTON PUMP COMPANY IDENTIFIES EXISTING PUMPS WILL NOT MEET LONG-TERM REQUIREMENTS

9/89 ANALYSIS APPROVED QUALIFYING PUMPS FOR SHORT-TERM

11/89 JOHNSTON PUMP SUBMITS DESIGN FOR UPGRADE TO MEET SEISMIC REQUIREMENTS

4/90 PMs RE-RELEASED TO ACCOMMODATE SEISMIC CHANGES RESULTING FROM RESPONSE SPECTRA CHANGE

5/90 NEW PUMP SPECIFICATION 238-044 RELEASED

6/90 ENGINEERING EVALUATION OF SERVICE WATER PUMP MINIMUM FLOW PROBLEM DETERMINES SERVICE WATER MOTOR UPGRADE IS BEST ALTERNATIVE

7/90 PMs PULLED BACK TO ADDRESS MOTOR UPGRADE

8/90 NCR 89-8 ADDRESSING INCORRECT RESPONSE SPECTRA COMPLETED:

- REVIEWED 832 SPECIFICATIONS
- EQUIPMENT WITH NONCONSERVATIVE CRITERIA EVALUATED TO ENSURE QUALIFICATION MET LONG-TERM REQUIREMENTS
- SPECIFICATIONS REVISED

SERVICE WATER PUMPS CHRONOLOGY (CONT'D)

10/90	RECEIVED PUMP BID FROM JOHNSTON PUMP
3/91	PUMP SPECIFICATION REVISED TO UPGRADE PUMP MATERIALS TO HIGHER-STRENGTH AND MORE CORROSIVE-RESISTANT ALLOY
5/91	UNIT 2 PM TO INCLUDE MOTOR UPGRADE RELEASED FOR APPROVAL
6/91	RECEIVED JOHNSTON PUMP QUOTE FOR REVISED SPECIFICATION
	UNIT 1 PM TO INCLUDE MOTOR UPGRADE RELEASED FOR APPROVAL
9/91	PURCHASE ORDER AWARDED TO JOHNSTON PUMP
11/91	RECEIVED PRELIMINARY DESIGN AND SEISMIC ANALYSIS FROM JOHNSTON PUMP
4/92	APPROVED DESIGN AND RELEASED PUMP FOR MANUFACTURE
1993-94	WILL REPLACE PUMPS

SERVICE WATER PUMPS

CONCLUSIONS

- MODIFICATIONS COMPLETED IN 1985 QUALIFIED PUMPS TO LONG-TERM REQUIREMENTS BASED ON KNOWN DESIGN INFORMATION

- MODIFICATION OF PUMPS TO ADDRESS ISSUE OF INCORRECT RESPONSE SPECTRA (1989) WAS INTEGRATED WITH EMERGING SERVICE WATER SYSTEM DESIGN ISSUES

  - DESIGN ISSUES EMERGED AS A RESULT OF COMPREHENSIVE SYSTEM HYDRAULIC AND SINGLE-FAILURE REVIEW

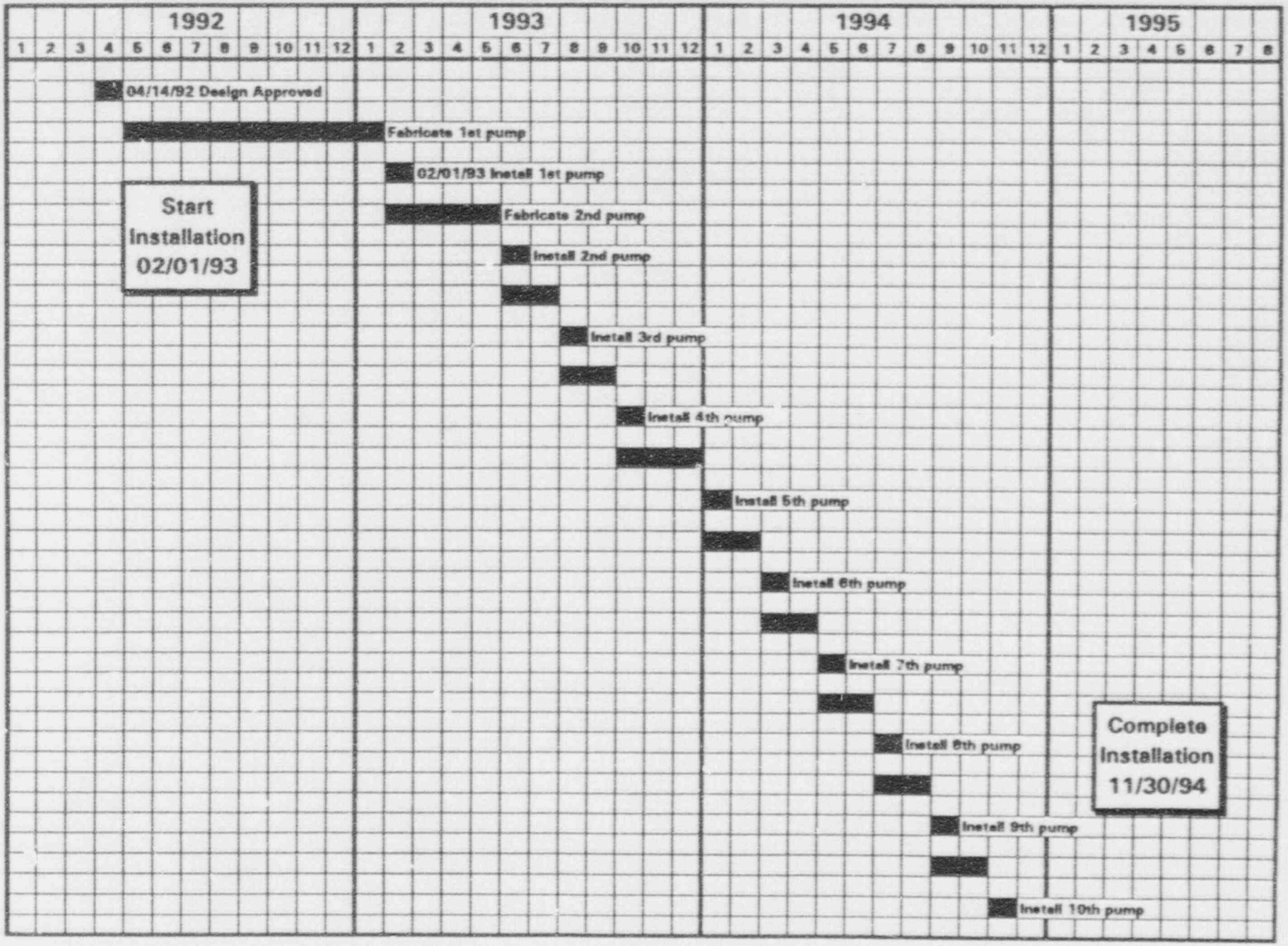
  - CURRENT DESIGN:
    - -- ADDRESSES SEISMIC UPGRADE
    - -- ELIMINATES LUBE WATER SYSTEM
    - -- ADDRESSES MINIMUM FLOW REQUIREMENTS OF SYSTEM
    - -- MINIMIZES MAINTENANCE

- DURING THE SAME TIME PERIOD, NUMEROUS OTHER SERVICE WATER SYSTEM UPGRADES WERE IN PROGRESS TO ADDRESS SYSTEM CORROSION, ENHANCE SINGLE-FAILURE CAPABILITY, AND IMPROVE HYDRAULIC MARGIN

- CP&L PURSUED ROOT CAUSE OF RESPONSE SPECTRA ISSUE. COMPREHENSIVE REVIEW OF EQUIPMENT QUALIFICATION WAS COMPLETED

- CONCLUDE THAT ACTIONS WERE APPROPRIATE BASED ON KNOWN INFORMATION AND RELATIVE SAFETY SIGNIFICANCE

Service Water Pump Upgrade Schedule



SERVICE WATER PUMPS
SEISMIC ANALYSIS SUMMARY

- PUMPS ARE CAPABLE OF WITHSTANDING A DESIGN BASIS EARTHQUAKE (DBE)

- PUMPS MEET SHORT-TERM EVALUATION CRITERIA

- RESULTS FOR DBE
  - ALL COMPONENTS <90 PERCENT OF MINIMUM YIELD
  - COMPONENTS WITH <10 PERCENT MARGIN ARE STAINLESS STEEL
  - CARBON STEEL COMPONENTS HAVE AT LEAST A 20 PERCENT MARGIN
  - PUMP DEFLECTIONS ARE WITHIN MANUFACTURER'S RECOMMENDED VALUES

DBE = DESIGN BASIS EARTHQUAKE

IV. SHORT-TERM STRUCTURAL CRITERIA

SHORT-TERM STRUCTURAL CRITERIA

OVERVIEW

- GENERAL DEFINITIONS
- TECHNICAL QUESTIONS
- CHARACTERIZE THE STSI CURRENT LIST
- SUPPLEMENTAL INSPECTION PROGRAMS

STSI = SHORT-TERM STRUCTURAL INTEGRITY

SHORT-TERM STRUCTURAL CRITERIA

CIVIL/STRUCTURAL

- DESIGN GUIDE II.20 OVERVIEW GUIDANCE

  - PLANT-SPECIFIC GUIDANCE USED TO SUPPLEMENT

- BRUNSWICK PIPING AND PIPE SUPPORTS CP&L STUDY REPORT

  -- M-20 (PIPING)
  -- M-21 (SUPPORTS)

  - SPECIFIC EQUATIONS, GUIDANCE

- STSI "DEFINITION"

  - CP&L DOCKETED LETTER TO NRC (MAY 1979) -

    "DETERMINATION IS MADE IF THE SUPPORT (STRUCTURE ELEMENT) WILL MAINTAIN STRUCTURAL INTEGRITY EVEN IF ALLOWABLE IS EXCEEDED."

- CRITERIA IN M-20 AND M-21 REVIEWED DURING IEB 79-14 INSPECTIONS

STSI = SHORT-TERM STRUCTURAL INTEGRITY

SHORT-TERM STRUCTURAL CRITERIA

- LOADING COMBINATIONS FOR NORMAL AND FAULTED CONDITIONS FOR PIPING AND SUPPORT

  - STUDY REPORT CP&L M-20 APPENDIX A, PROVIDES LOAD COMBINATIONS FOR PIPING

  - STUDY REPORT CP&L M-21 PROVIDES LOADING COMBINATIONS FOR SUPPORTS

  - OTHER INFORMATION PER UFSAR

- OCCASIONAL LOADS

  - M-20, M-21 REQUIRE APPLICABLE SYSTEM TRANSIENT BE CONSIDERED FOR OPERABILITY

  - SECONDARY LOADS (I.E., SELF-LIMITING) NOT DIRECTLY INCLUDED IN PIPING EQUATIONS. INCLUDED IN SUPPORT EVALUATION

- COMPLY WITH GENERIC LETTER 91-18 SECTION 6.13 CRITERIA IS ENVELOPED BY APPENDIX F OF ASME III

- <u>CRITERIA EXAMPLE: PIPING SHORT-TERM STRESS</u>

  SA 106 GRADE B
  BNP ALLOWABLE 2.4 S_H = 36 KSI

  ASME APPENDIX F 2.0 S_Y = 50 KSI
  (ALLOWED PER GENERIC LETTER 91-18)

SHORT-TERM STRUCTURAL CRITERIA

- DAMPING
  - CODE CASE N-411 DAMPING APPROVED FOR BNP PER AUGUST 28, 1985 NRC LETTER TO CP&L
  - HIGHER DAMPING ONLY CONSIDERED ON SPECIFIC CASE BY CASE BASIS AS A "QUICK LOOK," SUPPLEMENTED BY MORE RIGOROUS ANALYSIS INCLUDING TIME HISTORY, GAP EVALUATION
- STRUCTURAL REVIEW PANEL
- USE OF STRUCTURAL REVIEW PANEL CONCEPT BASED ON:
  - USE OF EXPERIENCED ENGINEERS TO MAKE FIELD ASSESSMENTS OF NONCONFORMING CONDITIONS
  - BASED ON PREVIOUS SIMILAR STRUCTURAL EVALUATIONS
  - ENCOURAGE ENGINEERS "HANDS ON" REVIEW IN LIEU OF DRAWING ONLY
  - BACK-UP CALCULATIONS TO "SPOT CHECK" CRITICAL ELEMENTS
  - FOCUS RESOURCES ON FIXES
  - NOT USED TO APPROVE CONDITIONS AS "LONG-TERM"

SHORT-TERM STRUCTURAL CRITERIA

(NED STRUCTURAL)

- CONSOLIDATION OF CRITERIA FROM VARIOUS SOURCES

- TIME LIMIT NOTED ON APPROVALS

  - CONFORMANCE WITH G.L. 91-18

- FIELD VERIFICATION OF CRITICAL ASSUMPTIONS

BACKLOG - STSIs

- PIPE SUPPORTS (95%)
  - INITIAL IEB 79-14 WORK 1980-86
  - 1987 CP&L SELF-IDENTIFIED AN AS-BUILT ISSUE
  - DESIGN RECONSTITUTION EFFORT REINSPECTED 3,493 SUPPORTS
- OVER 2,400 SUPPORT UPGRADES SINCE 1980
  - CURRENTLY
    - -- 100 UPGRADES ISSUED FOR INSTALLATION
    - -- 100 IN DESIGN FOR UPGRADES (SCREENED FOR SHORT-TERM ACCEPTABILITY)
    - -- OTHER UPGRADES EXPECTED (INCLUDING SMALL BORE)
- COMPLETE UPGRADES BY UNIT 2 REFUELING (1993)
  - TWO EXCEPTIONS INVOLVED IN EXISTING MODIFICATIONS
  - SERVICE WATER/LUBE WATER (1994)
  - SERVICE WATER DG SUPPLY AND RETURN (1994)

STSI = SHORT-TERM STRUCTURAL INTEGRITY

MAJOR REMAINING STSI ITEMS

- SERVICE WATER PUMPS
  - ADDRESSED SEPARATELY
- DIESEL BUILDING BLOCK WALL
  - ADDRESSED SEPARATELY
- DIESEL FUEL OIL PIPING (SMALL BORE)
  - IDENTIFIED 1990
  - DESIGN FOR UPGRADES (REROUTE) IN PROGRESS
  - COMPLETE 1993
  - PIPING IS OPERABLE UNDER DBE
- MAIN STEAM LINE RAD MONITOR SUPPORT
  - IDENTIFIED 1992
  - UPGRADES COMPLETE BY NEXT REFUELING OUTAGE
- MISCELLANEOUS ITEMS ON STSI LIST
  - NEXT REFUELING OUTAGE

DBE = DESIGN BASIS EARTHQUAKE

STSI ITEM REVIEW

- WALKDOWN OF:
  - ALL NON-PIPE SUPPORT STSI ITEMS
  - PIPE SUPPORTS IN HIGH-CORROSION AREAS
  - PRIOR TO START-UP
- THIRD-PARTY REVIEW OF STSI:
  - CRITERIA
  - VALIDATION OF ASSUMPTIONS
  - FIELD CONFIRMS CONDITIONS
  - ENSURE CAPTURE OF ITEMS
- INDEPENDENT A/E WITH BROAD SEISMIC EXPERIENCE
- POST START-UP (COMPLETE BY END OF JULY 1992)

EQUIPMENT DRILLED ANCHOR BOLT INSPECTION PROGRAM

PURPOSE

- TO ASSESS IF DEFICIENCIES FOUND IN WALL ANCHORS EXTEND TO OTHER EQUIPMENT

SCOPE

- SEISMIC STRUCTURES
  - HVAC SUPPORTS
  - EQUIPMENT FOUNDATIONS
  - RACEWAY SUPPORTS
  - BUILDING STRUCTURES

- SAMPLE
  ONE EACH IN:
  - CONTROL BUILDING
  - REACTOR BUILDING

  TWO EACH IN:
  - DIESEL BUILDING

- EXPANSION OF SAMPLE IF NECESSARY

SCHEDULE FOR COMPLETION

- 7/31/92

V. SAFETY SIGNIFICANCE

SAFETY SIGNIFICANCE

OBJECTIVE: EVALUATE OVERALL EFFECTS OF CONDITIONS FOR

- WALLS
- SERVICE WATER PUMPS
- REMAINING STSI ITEMS (MAINLY PIPE SUPPORTS)

- DETERMINISTIC EVALUATION

  ALL WALLS WILL MEET DESIGN REQUIREMENTS PRIOR TO START-UP

  BASED ON STANDARD ANALYSIS METHODOLOGY, ALL REMAINING STSI ITEMS AND ALL SERVICE WATER PUMPS WILL REMAIN FUNCTIONAL IF SUBJECTED TO THE DESIGN BASIS EARTHQUAKE (DBE)

- ENGINEERING PRACTICES EVALUATION

  FOR THE SERVICE WATER PUMPS AND THE REMAINING STSI ITEMS, THE FACTORS OF SAFETY ARE ACCEPTABLE UNTIL LONG-TERM CORRECTIVE ACTION CAN BE TAKEN

- PROBABILISTIC EVALUATION

  THESE THREE CLASSES OF ITEMS WERE EVALUATED USING SEISMIC PROBABILISTIC RISK ASSESSMENT (PRA) METHODOLOGY

  RESULTS INDICATE A SMALL INCREASE IN CORE DAMAGE FREQUENCY (CDF) FROM SEISMIC EVENTS FOR THE START-UP CONFIGURATION

CONCLUSION

- OPERATION IN START-UP CONFIGURATION IS SAFE.

- BASES

  - ALL WALLS, SERVICE WATER PUMPS, AND REMAINING STSI ITEMS CAN WITHSTAND THE DBE.

  - FACTORS OF SAFETY FOR ALL ITEMS ARE ACCEPTABLE FROM STRUCTURAL ENGINEERING PRACTICES VIEWPOINT.

  - INCREASE IN ESTIMATED CDF FOR START-UP CONFIGURATION IS SMALL.

CDF = CORE DAMAGE FREQUENCY

LIMITED SCOPE SEISMIC PRA

- SPECIFICALLY INVESTIGATED SEISMIC INTERACTIONS ASSOCIATED WITH WALLS, SERVICE WATER PUMPS, AND REMAINING STSI ITEMS

- DEVELOPED SEISMIC EVENT TREE USING EXISTING BRUNSWICK INTERNAL EVENTS MODEL

- REVIEWED STSI LIST TO SCREEN OUT INTERACTIONS NOT IMPORTANT TO THE SEISMIC PRA

- PLANT WALKDOWN PERFORMED TO VERIFY ASSUMPTIONS AND IDENTIFY OTHER POTENTIAL INTERACTIONS

PRA = PROBABILISTIC RISK ASSESSMENT

LIMITED SCOPE SEISMIC PRA (CONT'D)

- DEVELOPED SEISMIC FRAGILITIES FOR INTERACTIONS IDENTIFIED AS IMPORTANT IN THE PRA

    - SEISMIC FRAGILITY, IN GENERAL TERMS, IS THE CONDITIONAL PROBABILITY OF A COMPONENT FAILURE, GIVEN A SEISMIC EVENT

- FROM THE SEISMIC PRA MODEL, RESULTS WERE OBTAINED FOR THE START-UP CONFIGURATION AND THE DESIGN CASES

- SENSITIVITY STUDIES WERE PERFORMED TO BOUND THE ASSESSMENT AND DETERMINE SPECIFIC COMPONENT SENSITIVITIES

LIMITED SCOPE SEISMIC PRA (CONT'D)

	START-UP CONFIGURATION	DESIGN
ESTIMATED TOTAL SEISMIC CDF	1.9×10^{-5}/YR.	1.2×10^{-5}/YR.
CHANGE IN ESTIMATED SEISMIC CDF FROM:		
WALLS		$< 10^{-7}$/YR.
SERVICE WATER PUMPS		0.7×10^{-5}/YR.
REMAINING STSI ITEMS		$< 10^{-6}$/YR.
TOTAL		0.7×10^{-5}/YR.

LIMITED SCOPE SEISMIC PRA (CONT'D)

CONCLUSIONS

- THE ESTIMATED DESIGN CDF CAUSED BY SEISMIC EVENTS AT BRUNSWICK IS LOW.
  - ON THE ORDER OF 1.2×10^{-5} PER YR.
  - COMPARABLE WITH RESULTS OF OTHER SEISMIC PRAs
- THE INCREASE IN CDF FOR THE START-UP CONFIGURATION IS ABOUT 0.7×10^{-5}/YR.

VI. SUMMARY OF CORRECTIVE ACTIONS

SUMMARY OF CORRECTIVE ACTIONS PRIOR TO START-UP

- RESOLVE THE FOLLOWING CONDITIONS PRIOR TO START-UP OF EITHER UNIT:

  - COMPLETE SAFETY AND NON-SAFETY MASONRY WALL WALKDOWNS AND DESIGN REVIEWS TO ASSURE ALL SAFETY RELATED WALLS ARE FULLY QUALIFIED

  - REVIEW BULLETIN 79-02 (PIPE SUPPORT ANCHOR) PROGRAM TO ENSURE COMPLIANCE AND TO ENSURE METHODS OF INSPECTION WOULD DETECT DEFICIENT BOLT INSTALLATION

  - PERFORM A WALKDOWN FOR NON-PIPE SUPPORT STSI ITEMS AND PIPE SUPPORTS IN AREAS WITH HIGH CORROSION POTENTIAL--TO VALIDATE ASSUMPTIONS

SUMMARY OF CORRECTIVE ACTIONS PRIOR TO START-UP (CONT'D)

- RESOLVE THE FOLLOWING CONDITIONS PRIOR TO START-UP OF EITHER UNIT (CONT'D):
  - DIESEL BUILDING AND CONTROL BUILDING WALLS RESTORED TO SEISMIC DESIGN REQUIREMENTS
  - SERVICE WATER PUMP OPERABILITY AND SHORT-TERM QUALIFICATION CONFIRMED
  - ALL CURRENT TRANSFORMERS IN EMERGENCY BUSSES REPLACED
  - HOT SIDE WALKDOWNS OF BOTH UNITS COMPLETED AND IDENTIFIED CONCERNS AFFECTING EITHER SAFETY OR RELIABILITY RESOLVED
  - TEMPORARY CONDITIONS REDUCED
  - CONDITIONS REQUIRING OPERATOR WORK-AROUNDS REDUCED

SUMMARY OF CORRECTIVE ACTIONS PRIOR TO START-UP (CONT'D)

- RESOLVE THE FOLLOWING ADDITIONAL CONDITIONS PRIOR TO START-UP OF UNIT 1:
  - PRIMARY INVERTER REPAIRED
  - LEAKS IN DRYWELL REPAIRED
  - SELECTED NUCLEAR INSTRUMENTATION REPAIRED
  - DIESEL GENERATOR LOAD TESTS COMPLETED
  - BATTERY DISCHARGE TESTS COMPLETED
  - SECONDARY CONTAINMENT ISOLATION TEST COMPLETED

SUMMARY OF CORRECTIVE ACTIONS PRIOR TO START-UP (CONT'D)

- RESOLVE THE FOLLOWING ADDITIONAL CONDITIONS PRIOR TO START-UP OF UNIT 2:
  - TURBINE EXCITER COUPLING CHANGEOUT AND ALIGNMENT
  - TURBINE PARTIAL ARC MODIFICATION
  - REFURBISHING CONTROL VALVE POWER PACKS, CHANGING OUT TURBINE ELECTRO-HYDRAULIC CONTROL SYSTEM ACCUMULATOR
  - INSPECTION OF DIESEL ENGINE NO. 3
  - 2B REACTOR FEED PUMP WEAR RING REPLACEMENT
  - CONTROL ROD DRIVE PUMP REPAIRS

CLOSING REMARKS

- WALLS LONG-TERM QUALIFIED BEFORE RESTART
- SW PUMPS OPERABILITY CONFIRMED
- TIMELY SCHEDULES FOR
  - SERVICE WATER PUMP REPLACEMENT
  - STSI ITEMS

CURRENT PLAN

- UNIT 1 READY FOR START-UP
  - LATE MAY
- UNIT 2 READY FOR START-UP
  - JUNE

STSI - SHORT-TERM STRUCTURAL INTEGRITY