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 TERRY,C.D.    Niagara Mohawk Power Corp.  
 RECIPIENT AFFILIATION  
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SUBJECT: Forwards summary of 880426 meeting & responds to 880504 ltr re torus wall thinning & Rev 1 to TR-6801-2, "Mark I...."

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88 JUN -7 AIO:31

May 27, 1988  
NMP1L 0260

U.S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington, D.C. 20555

Re: Nine Mile Point Unit 1  
Docket No. 50-220  
DPR-63

Gentlemen:

On April 26, 1988, Niagara Mohawk met with members of the Nuclear Regulatory Commission staff to provide information regarding the Nine Mile Point Unit 1 torus wall thinning. Subsequent to that meeting, the Commission, in a May 4, 1988 letter, requested additional information (Attachment A, Item 4). The attachments to this letter provide a summary of the April 26, 1988 meeting and respond to the requests in your May 4, 1988 letter.

Very truly yours,

NIAGARA MOHAWK POWER CORPORATION



C. D. Terry  
Vice President  
Nuclear Engineering and Licensing

NJF/pns  
5021G  
Attachments

xc: Regional Administrator, Region I  
Mr. R. A. Capra, Director  
Mr. R. A. Benedict, Project Manager  
Mr. W. A. Cook, Resident Inspector  
Records Management

*Adol 11* *Revised Dist*



[The text in this section is extremely faint and illegible due to low contrast and noise. It appears to be a list or a series of entries.]

## ATTACHMENT A

### Niagara Mohawk Power Corporation Summary of April 26, 1988 Meeting

A presentation on torus wall thinning was given at an April 26, 1988 meeting with the Nuclear Regulatory Commission. This presentation included a discussion of past reports, investigations, inspection results and programs dating back to 1975. A copy of the visual aids used during the presentation is included as Attachment B.

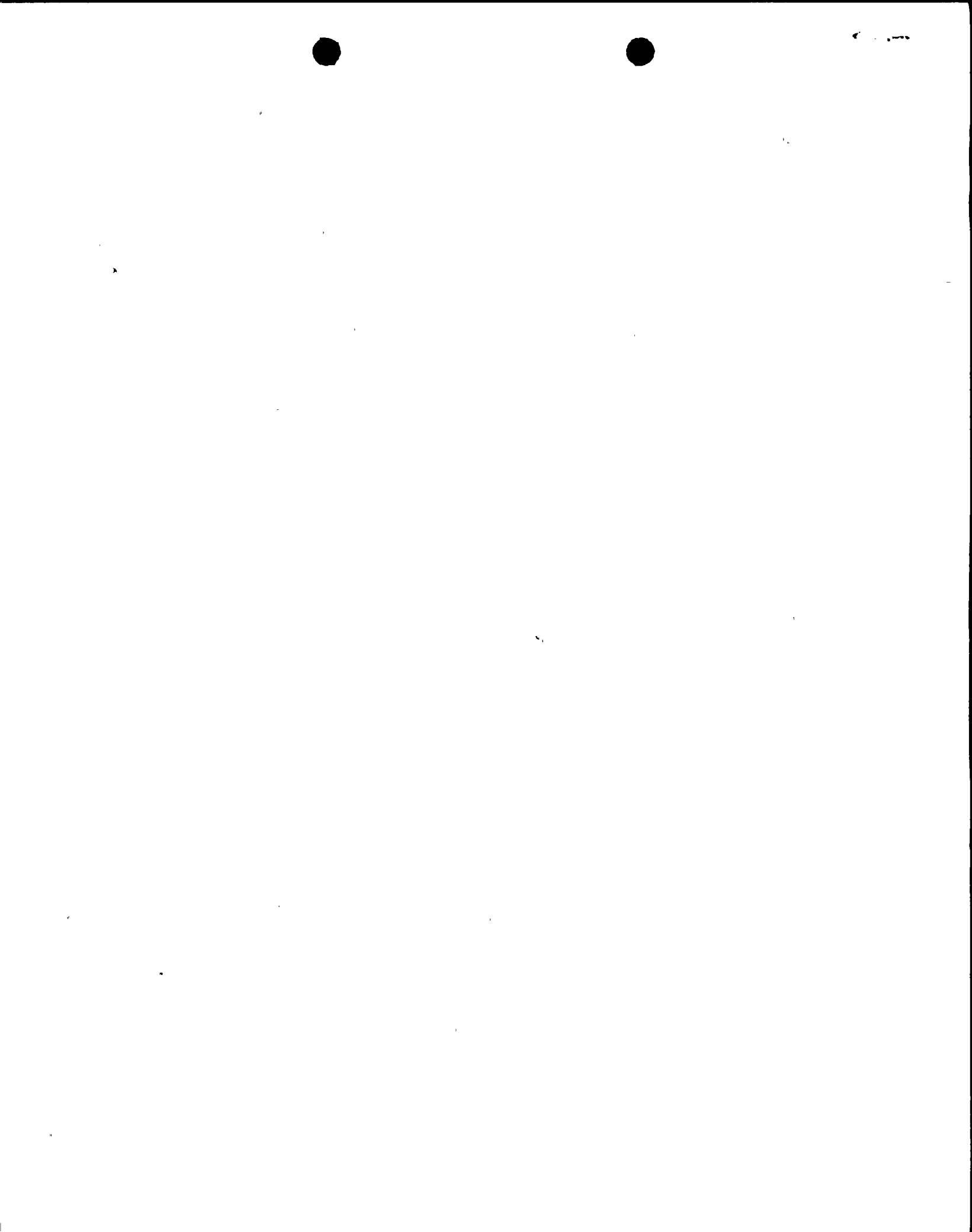
A comparison was made of the past inspection results to the most recent inspection results and the results taken in April 1988 at four additional locations. The graphs depicting statistical analysis (reference Attachment D Niagara Mohawk Calculation S22-4-WW198-STAT01) of past as well as current inspection results show that even for the worst case or limiting torus area (bottom), that the defined minimum general area wall thickness of 0.447 inches is not projected to be reached until 1992 or later. Further, any local areas falling below that minimum wall thickness of 0.447 inches can be analyzed per Teledyne Report TR-6801-2, Rev. 1 (Attachment C). Graphs and several examples of how local areas falling below general area minimum wall can be analyzed were provided. For example, a local area approximately 9 1/2 inches in diameter and approximately 30 mils deep (or 30 mils less than 0.447) is acceptable according to Teledyne Report TR-6801-2, Rev. 1.

The minimum wall thicknesses defined by Teledyne Report TR-6801-2 are based on meeting ASME Code allowables without regard to mill certification properties. When the mill certification properties are accounted for, an additional margin of 27 mils could be justified. Niagara Mohawk has positive mill certification identification of approximately 85-90 percent of the plate material composing the torus.

Operation until 1990 is justified based on the above discussion of existing margins. To date, no credit has been taken for the additional margins relating to mill certification. Our current long-term program includes investigation of possible modifications such as installation of saddles at mid-bay, oxygen control, cathode protection, coatings, and increased surveillance of the torus. The new program will provide for consistency on how measurements will be taken and their location. This program will be in place by the end of July 1988, at which time we will inform you of the actions we plan to take.

The following questions were raised during the meeting:

- 1) What affect does the sludge created by corrosion have on the ability of the Emergency Core Cooling Systems (ECCS) pumps to perform during a Loss of Coolant Accident?



Niagara Mohawk Calculation M79-81-M001 (Attachment E) addresses this concern. This calculation shows that the specific gravity of a worst case slurry of water/sludge is 1.0058 and would not affect the function of the ECCS pumps. An investigation of this matter also reveals no plugging of the core spray strainers or nozzles will result.

- 2) Are there any plans to monitor the torus during mid-cycle?

Niagara Mohawk will take mid-cycle thickness measurements to confirm that the torus shell still meets required minimum wall thickness by June 30, 1989.

ATTACHMENT B

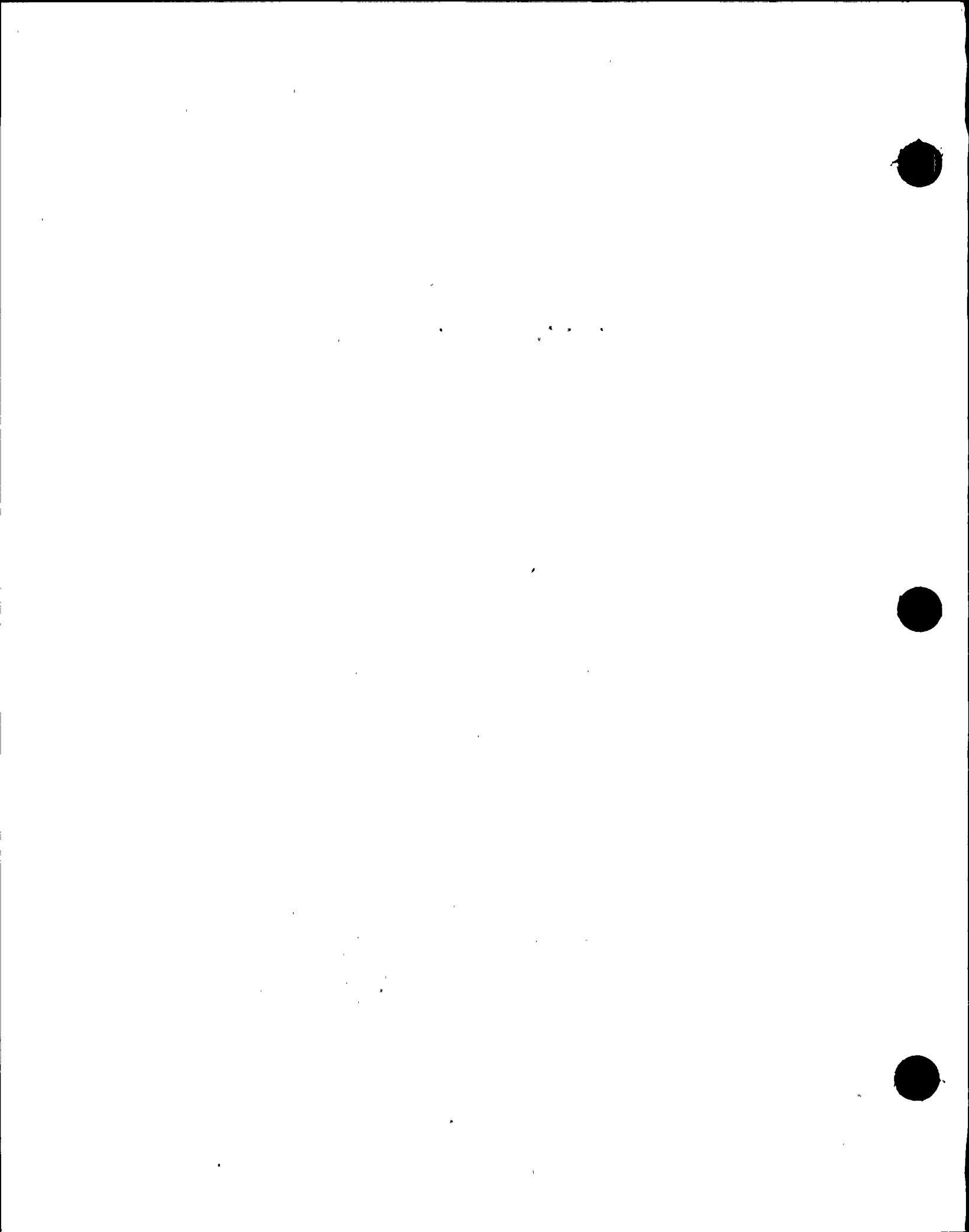
Presentation Outline/Viewgraphs From  
April 26, 1988 Meeting  
In The  
Region I Office  
Regarding  
Torus Wall Thinning

#8896060722  
2/27/88





NIAGARA MOHAWK POWER CORPORATION  
PRESENTATION TO  
NUCLEAR REGULATORY COMMISSION  
CONCERNING  
NINE MILE POINT UNIT 1  
INSERVICE INSPECTION PROGRAM  
AND  
TORUS MONITORING PROGRAM



## AGENDA

INTRODUCTION - G. Gresock

INSERVICE INSPECTION OF WELDS AND SUPPORTS - T. Lee

TORUS MONITORING PROGRAM - R. Oleck

REACTOR VESSEL BELT LINE INSPECTION - R. Pasternak

EROSION/CORROSION PROGRAM - R. Pasternak

CONCLUDING REMARKS - C. Terry



## INTRODUCTION

- ° ROOT CAUSE ISI PROBLEMS
  - INADEQUATE MANAGEMENT ATTENTION
  - ROLES AND RESPONSIBILITIES NOT CLEARLY DEFINED
  - OVER RELIANCE ON CONTRACTOR



## NMPC RESPONSE TO PROBLEM

- ° TRANSITION PLAN
  - DEFINE REQUIRED WORK FLOW
  - CLEARLY DEFINE NMPC GROUPS RESPONSIBLE
  - ASSURE THAT PROCEDURES AND POLICIES MATCH DEFINED RESPONSIBILITIES
- ° COMMITTED TO 100% OF FIRST AND SECOND INTERVAL REQUIREMENTS BEFORE STARTUP
- ° EXPAND STAFF TO ADDRESS ISI ISSUES





## KEY TASKS FOR 1988 OUTAGE COMPLETION

- ° VERIFICATION OF PROGRAM PLAN REQUIREMENTS
- ° RESOLUTION OF NONCONFORMANCES
- ° DETERMINATION OF EXPANDED INSPECTIONS
- ° SCHEDULING/TRACKING/MONITORING INSPECTIONS



VERIFICATION OF 1ST AND 2ND INTERVAL PROGRAM

- ° IDENTIFY COMMITTED INSPECTIONS (PROGRAM PLAN)
- ° DEFINE LICENSING REQUIREMENTS
- ° QUALITY ASSURANCE VERIFICATION OF 1ST INTERVAL INSPECTIONS
- ° COMPARE PROGRAM PLAN AND LICENSING REQUIREMENTS
- ° COMPARE INSPECTIONS PERFORMED VERSUS PROGRAM PLAN



## RESULTS OF 1ST INTERVAL VERIFICATIONS

- ° REVIEW OF PROGRAM PLAN IN PROCESS
  - INCLUDES REVIEW OF COMMITTED INSPECTIONS
  - INCLUDES IDENTIFYING CHANGES MADE
- ° LICENSING REQUIREMENTS ARE IDENTIFIED
- ° 7242 DATA SHEETS EVALUATED BY QUALITY ASSURANCE
  - APPROXIMATELY 700 BEING EVALUATED FURTHER
  - 208 DCA PACKAGES BEING CLOSED OUT/SUMMARIZED
- ° COMPARISON OF PROGRAM PLAN VERSUS LICENSING REQUIREMENTS - COMPLETE MAY 19
- ° QUALITY ASSURANCE COMPARISON OF INSPECTIONS PERFORMED VERSUS PROGRAM PLAN
  - INITIAL VERIFICATION IS COMPLETE
    - ° 700 - 1,200 UNRESOLVED ISSUES
    - ° ADDITIONAL INSPECTIONS MAY BE REQUIRED
  - FINAL VERIFICATION TO OCCUR WHEN PROGRAM PLAN REVIEW COMPLETE



## RESULTS OF 2ND INTERVAL VERIFICATION

- ° ANII INITIALLY VERIFIED THE 1988 OUTAGE PLAN VERSUS THE ASME XI CODE REQUIREMENTS
  - 92 ADDITIONAL INSPECTIONS IDENTIFIED
- ° PLAN TO PERFORM 33% OF PROGRAM PLAN REQUIRED INSPECTIONS
  - RESOLVES ANII CONCERNS
- ° VERIFICATION OF 2ND INTERVAL PROGRAM PLAN IN PROCESS - COMPLETE MAY 19, 1988
  - INCLUDES QUALITY ASSURANCE VERIFICATION OF INSPECTION
  - COMPARISON OF PROGRAM PLAN VERSUS LICENSING REQUIREMENTS
  - COMPARISON OF INSPECTIONS PERFORMED VERSUS PROGRAM PLAN





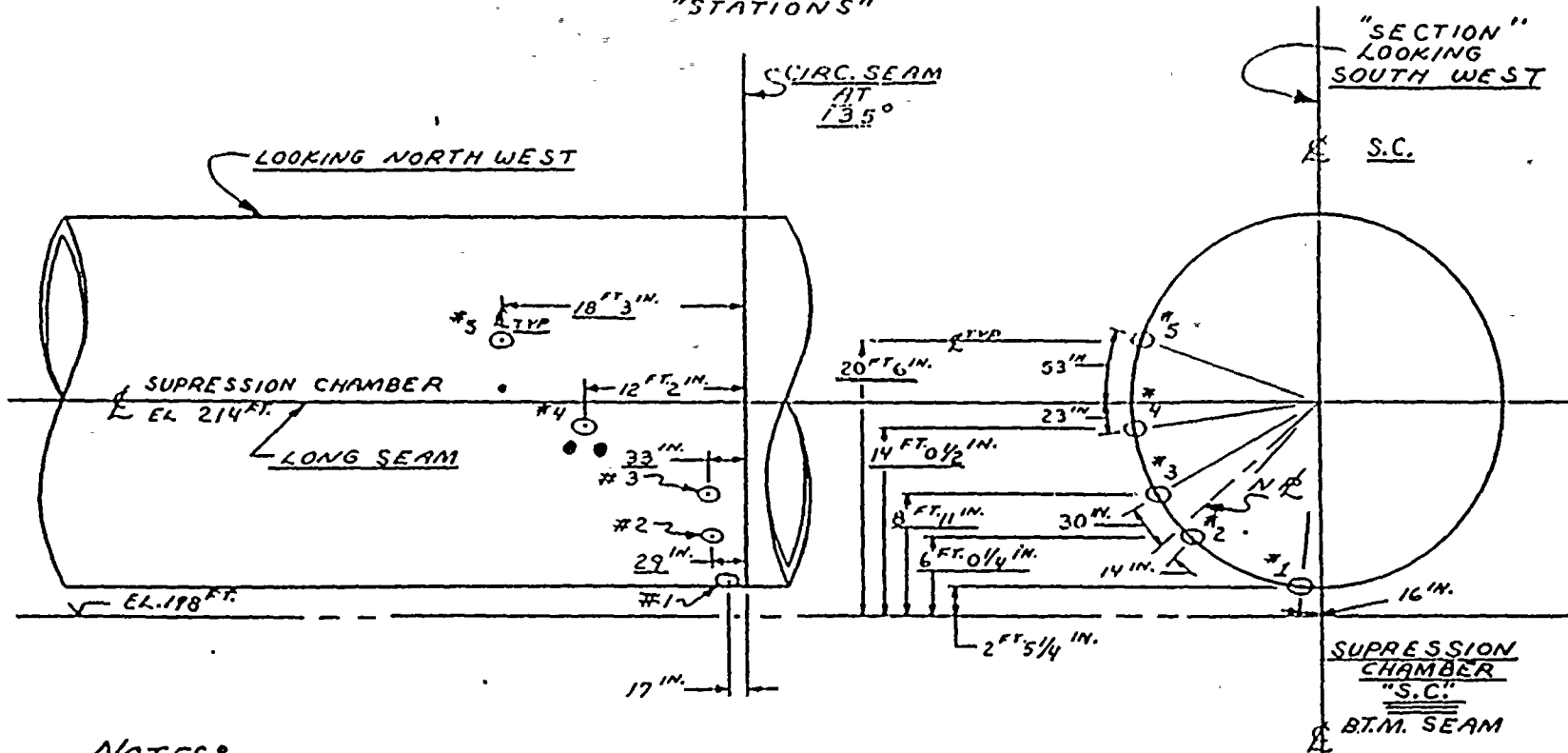
## TORUS WALL THICKNESS PROGRAM

### I HISTORY/BACKGROUND

- ° C.B.I. (1/16" CORROSION)
- ° TORUS: ISI 1975-1988  
6x6 12x12
- ° MARK I PROGRAM 1975-1984
- ° WATER QUALITY (IRON-EATING BACTERIA) 1979/1980  
RCT REPORT
- ° CONTAINMENT COATING STUDY 1984
- ° 1987 - PART 21 - EVALUATION ----> NO CORROSION  
ALLOWANCE ----> NO IMMEDIATE PROBLEM
- ° T.E.S. ----> REPORT 9/87 - 1/88
- ° FURTHER TES EVALUATIONS - WELD REPAIR, PROPOSAL FOR  
LONG TERM 2/5/88
- ° 1988 ISI/NRC READINGS (UT)



LOCATION OF  
NINE MILE PT  
UNIT #1  
SUPPRESSION CHAMBER  
THICKNESS MEASUREMENT  
"STATIONS"



NOTES:

- 1 SCALE 1/8 IN. = 1 FT. 0 IN.
- 2 • = 6 IN. CORE SPRAY BYPASS
- = 12 IN. CORE SPRAY

NIAGARA MOHAWK  
POWER CORP.

4-26-79

SE corner



MARK I TORUS SHELL AND VENT SYSTEM  
THICKNESS REQUIREMENT

TELEDYNE ENGINEERING SERVICES REPORT

TORUS SHELL ANALYSIS

CALCULATION OF MINIMUM TORUS SHELL THICKNESS REQUIREMENTS

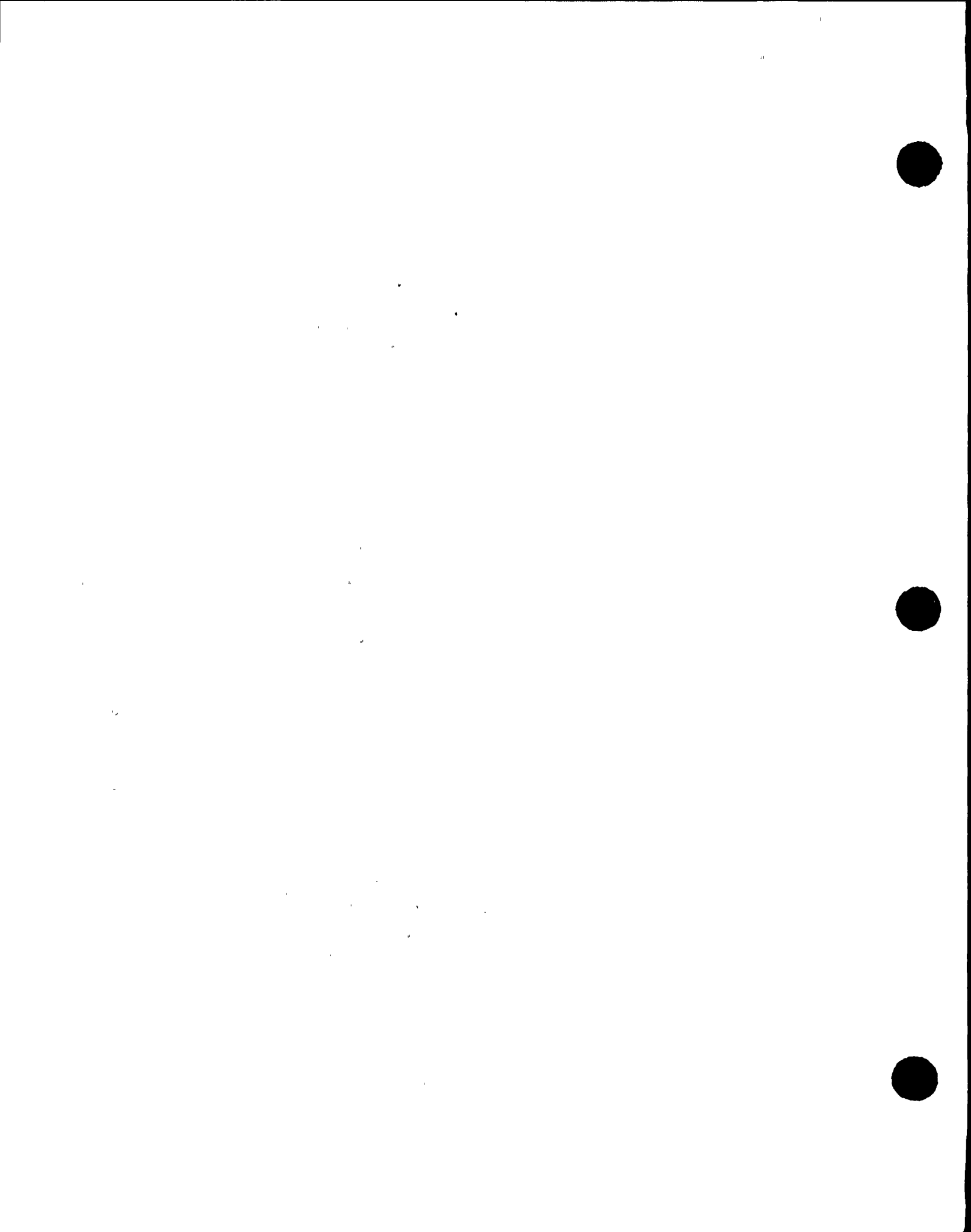
CALCULATION OF PERMISSIBLE LOCAL REDUCTION IN TORUS SHELL  
THICKNESS FOR AN INDICATION

REVIEW OF CERTIFIED MATERIAL TEST REPORTS

VENT SYSTEM ANALYSIS

CALCULATION OF MINIMUM VENT SYSTEM THICKNESS REQUIREMENTS

CALCULATION OF PERMISSIBLE LOCAL REDUCTION IN VENT SYSTEM  
THICKNESS FOR AN INDICATION



## TORUS SHELL ANALYSIS

### MINIMUM TORUS SHELL THICKNESS REQUIREMENTS

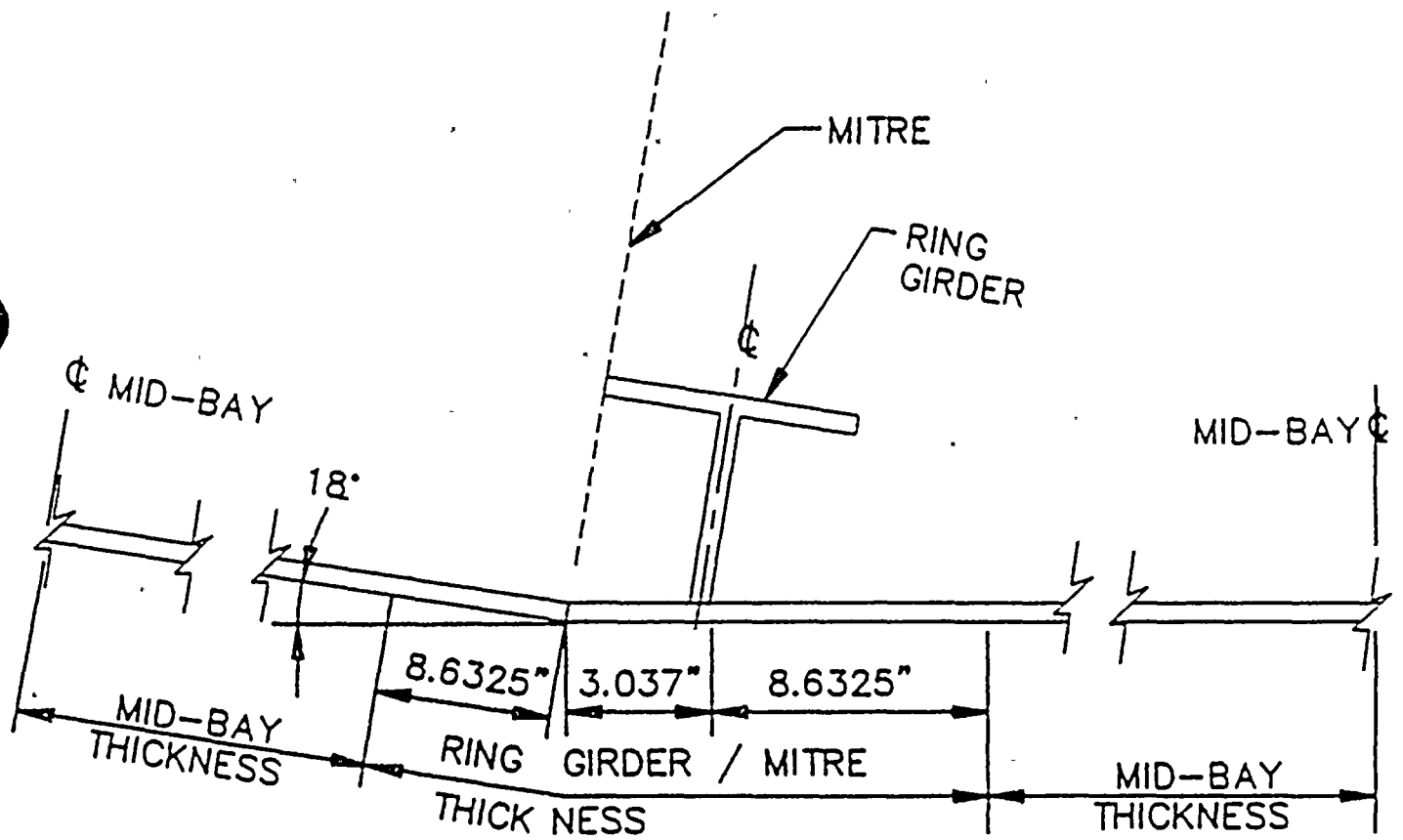
- ° TWO CRITICAL TORUS SHELL AREAS
  - MID-BAY BETWEEN RING GIRDERS
  - TORUS SHELL ADJACENT TO RING GIRDER
- ° CODE COMPLIANCE
  - BASED ON COMPARISON OF ACTUAL MARK I STRESS INTENSITY TO CODE ALLOWABLE STRESS





# TORUS SHELL ANALYSIS

## TORUS SHELL STRESS REGIONS NINE MILE POINT UNIT 1 NUCLEAR STATION





## TORUS SHELL ANALYSIS

### MARK I PROGRAM EVENT COMBINATIONS

- ° 27 MARK I EVENT COMBINATIONS REDUCED TO 4 BOUNDING EVENT COMBINATIONS
- ° BOUNDING EVENT COMBINATIONS

<u>NUMBER</u>	<u>TITLE</u>
14	C.O., Chug, O.B.E., S.B.A, S.R.V.
18	Pool Swell, O.B.E., D.B.A.
20	C.O., Chug, O.B.E., D.B.A.
25	Pool Swell, S.S.E., D.B.A., S.R.V.

C.O. = CONDENSATION OSCILLATION LOADS  
Chug = CHUGGING LOADS  
SBA = SWELL BREAK ACCIDENT (SWELL DIAMETER PIPE BREAK)  
DBA = DESIGN BASIS ACCIDENT  
SRV = SAFETY RELIEF VALVE ACTUATION  
OBE = OPERATING BASIS EARTHQUAKE  
SSE = SAFE SHUTDOWN EARTHQUAKE



## TORUS SHELL ANALYSIS

### MINIMUM SHELL THICKNESS

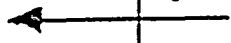
- ° MARK I PROGRAM LOADS
  - PRESSURE LOADINGS
  - HOOP STRESS - PRIMARY STRESS
- ° BACK CALCULATE MINIMUM TORUS SHELL THICKNESS
  - MID-BAY (FREE SHELL)
  - AREA ADJACENT TO RING GIRDER (LOCAL SHELL)



# TORUS SHELL ANALYSIS

TABLE 1		
MINIMUM TORUS SHELL THICKNESS REQUIREMENTS NINE MILE POINT UNIT 1 NUCLEAR STATION		
Element No. (Midbay)	Required Thickness (Inches)	Remaining Thickness (Inches)
11	.304	.156
13	.362	.098
15	.418	.042
17	.446	.014
19	.447	.013
21	.425	.035
23	.382	.078
25	.320	.140
27	.287	.173
(Ring Girder)		
123	.172	.288
129	.191	.269
135	.168	.292
141	.173	.287
147	.125	.335
153	.139	.321
159	.198	.262
NOTE: Only lower shell elements are listed.		

governs

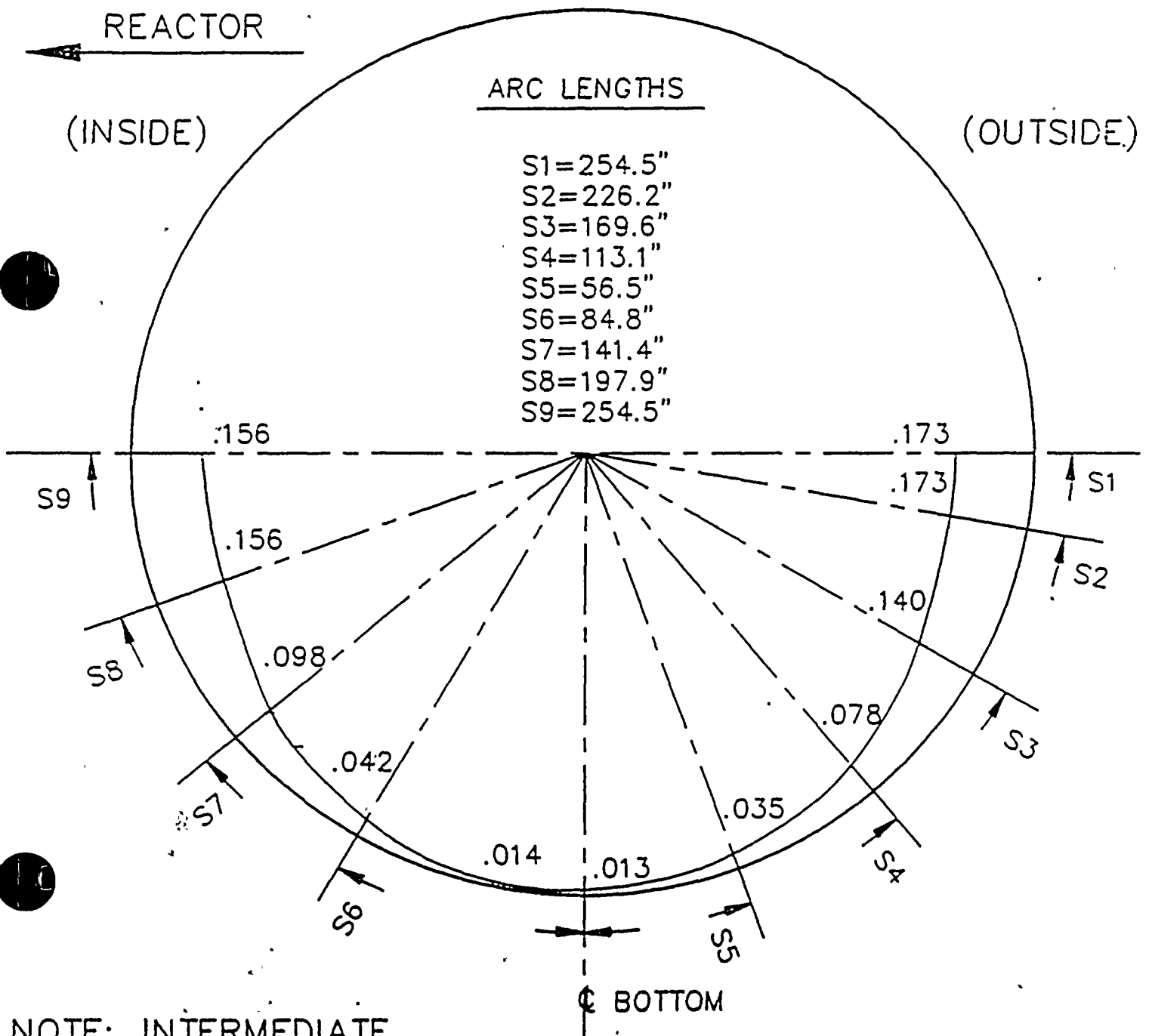






# TORUS SHELL ANALYSIS

PERMISSIBLE CORRODED THICKNESS FOR THE TORUS  
CROSS-SECTION AT MID-BAY  
(FREE SHELL REGION)  
NINE MILE POINT UNIT 1 NUCLEAR STATION



NOTE: INTERMEDIATE  
VALUES MAY BE



## TORUS SHELL ANALYSIS

### PERMISSIBLE LOCAL REDUCTION IN TORUS SHELL THICKNESS FOR AN INDICATION

#### ° ANALYTICAL BASIS

- EVALUATION OF CYLINDRICAL DEPRESSION EFFECTS ON  
LARGE CIRCULAR PLATE  
CONSTANT THICKNESS  
UNIFORM STRESS

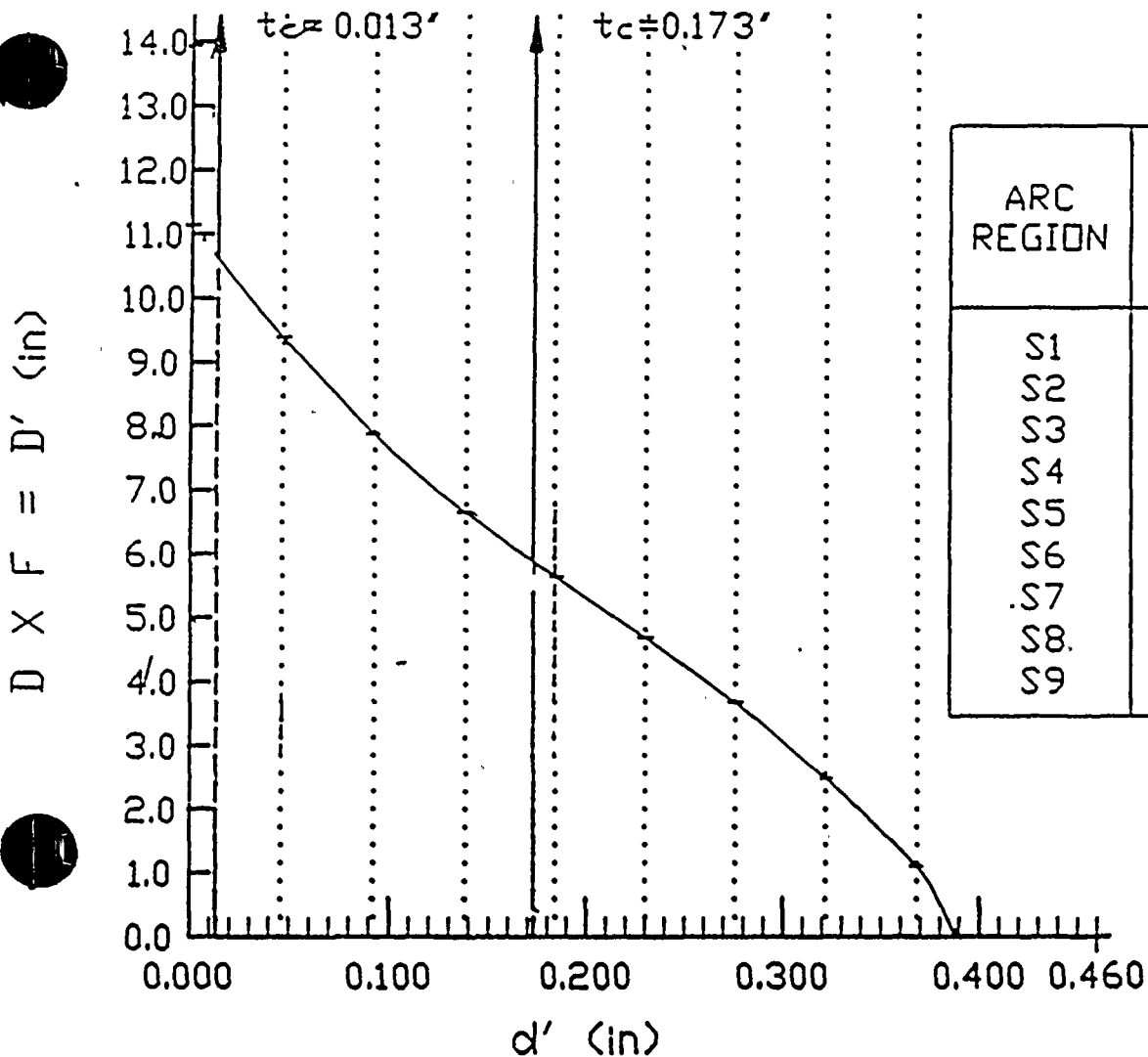
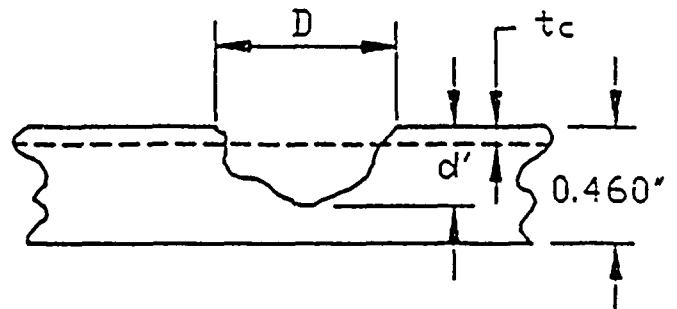
#### ° CALCULATION OF PERMISSIBLE LOCAL REDUCTION

- EQUIVALENT PRESSURE FOR A HOOP MEMBRANE STRESS EQUAL  
TO THE MARK I EVENT COMBINATION PRIMARY MEMBRANE  
(MID-BAY)
- FOR LOCAL MEMBRANE (RING GIRDER REGION) STRESS  
INTENSITY



# TORUS SHELL ANALYSIS

PERMISSIBLE SIZE RANGE FOR INDICATION  
 FREE SHELL REGION OF THE TORUS  
 NINE MILE POINT UNIT 1 NUCLEAR STATION



ARC REGION	FACTOR 'F'	GEN. CORR. $t_c$
S1	0.800	0.173
S2	0.851	0.140
S3	0.930	0.078
S4	0.974	0.035
S5	1.000	0.013
S6	1.000	0.014
S7	0.965	0.042
S8	0.904	0.098
S9	0.824	0.156



TORUS SHELL ANALYSIS  
CERTIFIED MATERIAL TEST REPORT  
REVIEW FOR TORUS SHELL

- ° STATISTICAL ANALYSIS OF TORUS SHELL CERTIFIED MATERIAL TEST REPORTS
  - LARGE SAMPLE
  - 99% CONFIDENCE LEVEL FOR MATERIAL MINIMUM YIELD ULTIMATE STRENGTH
  
- ° CODE ALLOWABLE STRESS INTENSITY 16,500 PSI
  
- ° CALCULATE ALLOWABLE STRESS INTENSITY BASED ON CERTIFIED MATERIAL TEST REPORTS ( $2\sigma$ ) 17,600 PSI
  
- ° RESULT
  - 6% ADDITIONAL MARGIN IN MINIMUM TORUS SHELL THICKNESS REQUIREMENTS





## VENT SYSTEM ANALYSIS

- ° COMPONENT ANALYZED FOR STRESS
  - VENT PIPE
  - VENT SPHERE
  - VENT HEADER
  - DOWNCOMERS
  
- ° CALCULATION OF MINIMUM THICKNESS REQUIREMENTS
  - TORUS SHELL METHODOLOGY
  
- ° PERMISSIBLE LOCAL REDUCTION IN VENT SYSTEM THICKNESS FOR AN INDICATION
  - TORUS SHELL METHODOLOGY



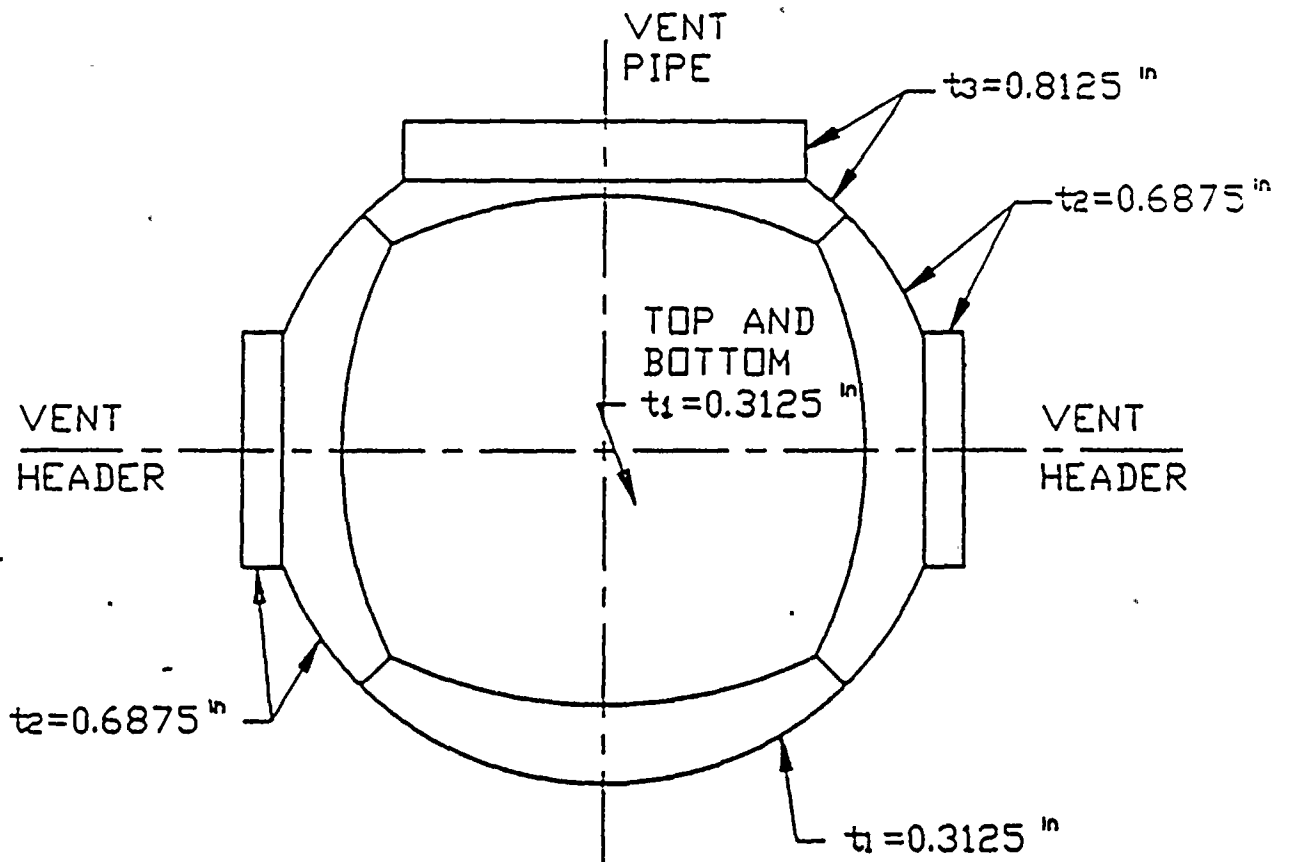
# VENT SYSTEM ANALYSIS

TABLE 2			
MINIMUM VENT SYSTEM THICKNESS REQUIREMENTS NINE MILE POINT UNIT 1 NUCLEAR STATION			
Component Location	Shell Thickness (in)	Required Thickness (in)	Remaining Thickness (in)
Vent Pipe	.3125	.201	.1115
Vent Header	.3125	.159	.1535
Downcomer	.250	.222	.028
Vent Pipe at Drywell	.3125	.134	.1785
Vent Header at Mitre Joint	.3125	.203	.1095
Vent Header at Downcomer	.3125	.248	.0645
Downcomer at Mitre Joint	.250	.148	.102
Vent Sphere at t <sub>1</sub>	.3125	.290	.0225
Vent Sphere at t <sub>2</sub>	.6875	.637	.0505
Vent Sphere at t <sub>3</sub>	.8125	.753	.0595



# VENT SYSTEM ANALYSIS

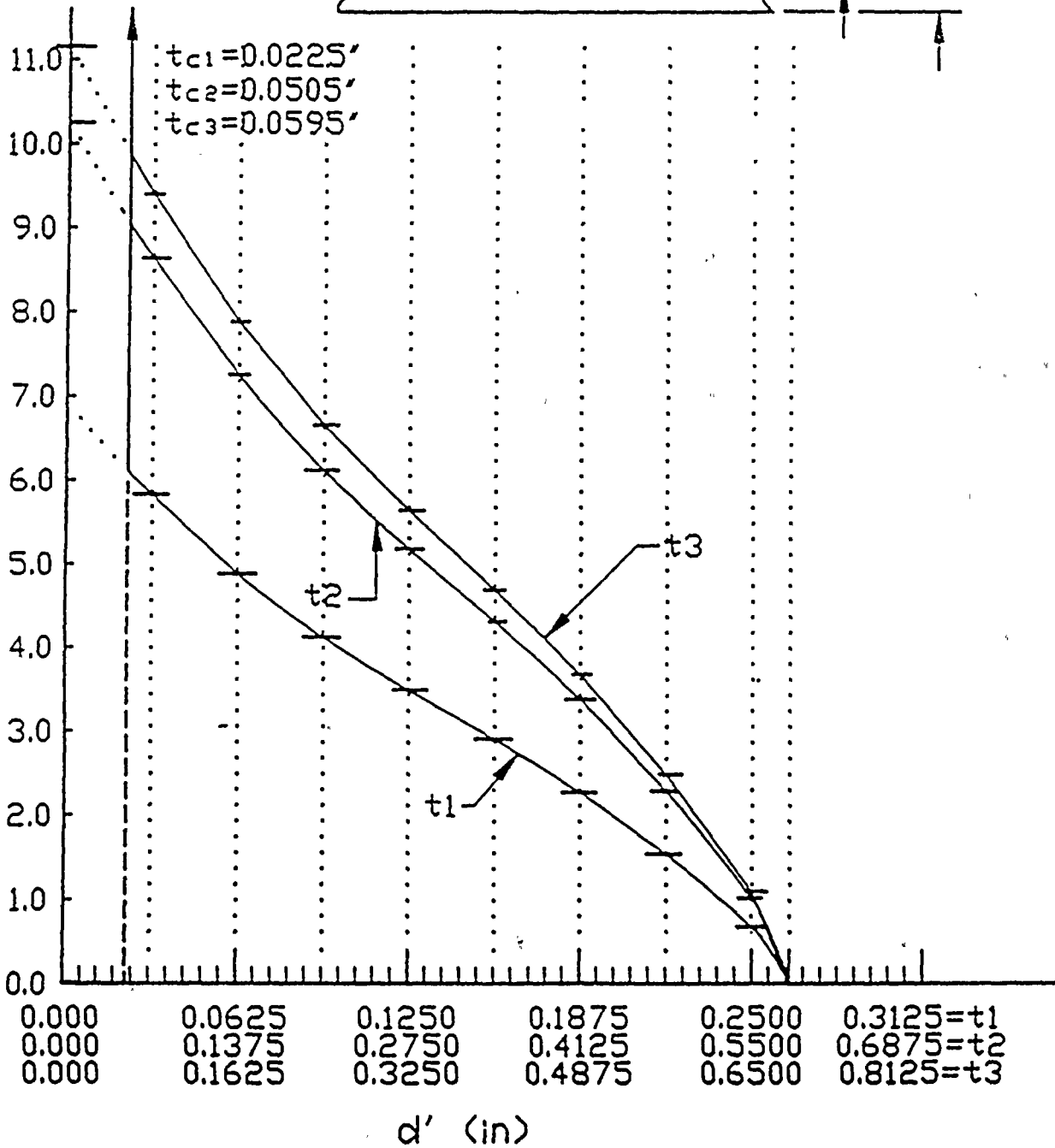
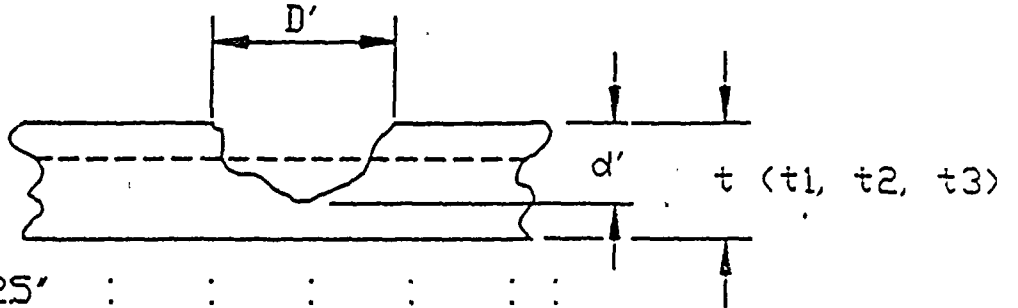
## VENT SPHERE LOCAL THICKNESS REGIONS NINE MILE POINT UNIT 1 STATION





# VENT SYSTEM ANALYSIS

PERMISSIBLE SIZE RANGE FOR INDICATION VENT SPHERE  
NINE MILE POINT UNIT 1 NUCLEAR STATION







## TORUS SHELL ANALYSIS

### ADDITIONAL MARGINS TO BE INVESTIGATED

° GOVERNING LOADS

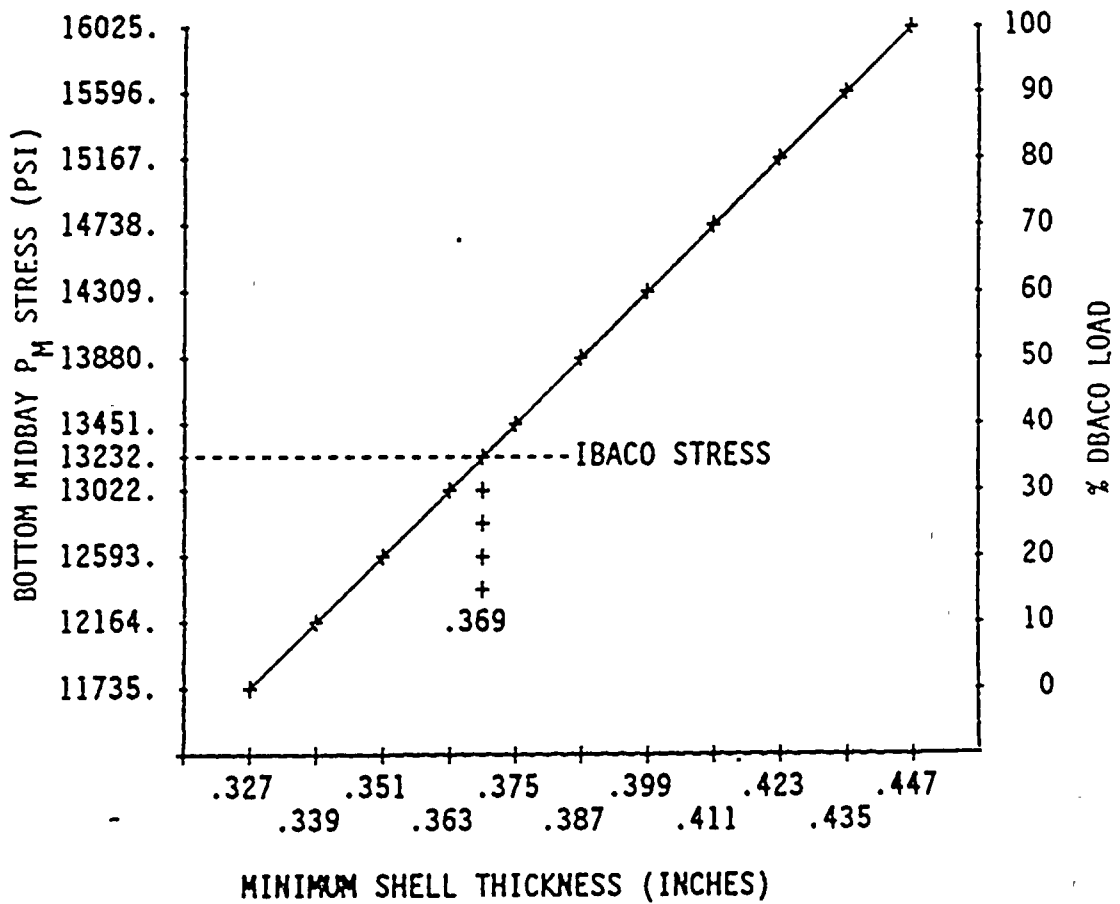
- CONDENSATION OSCILLATIONS
- TORUS PRESSURE

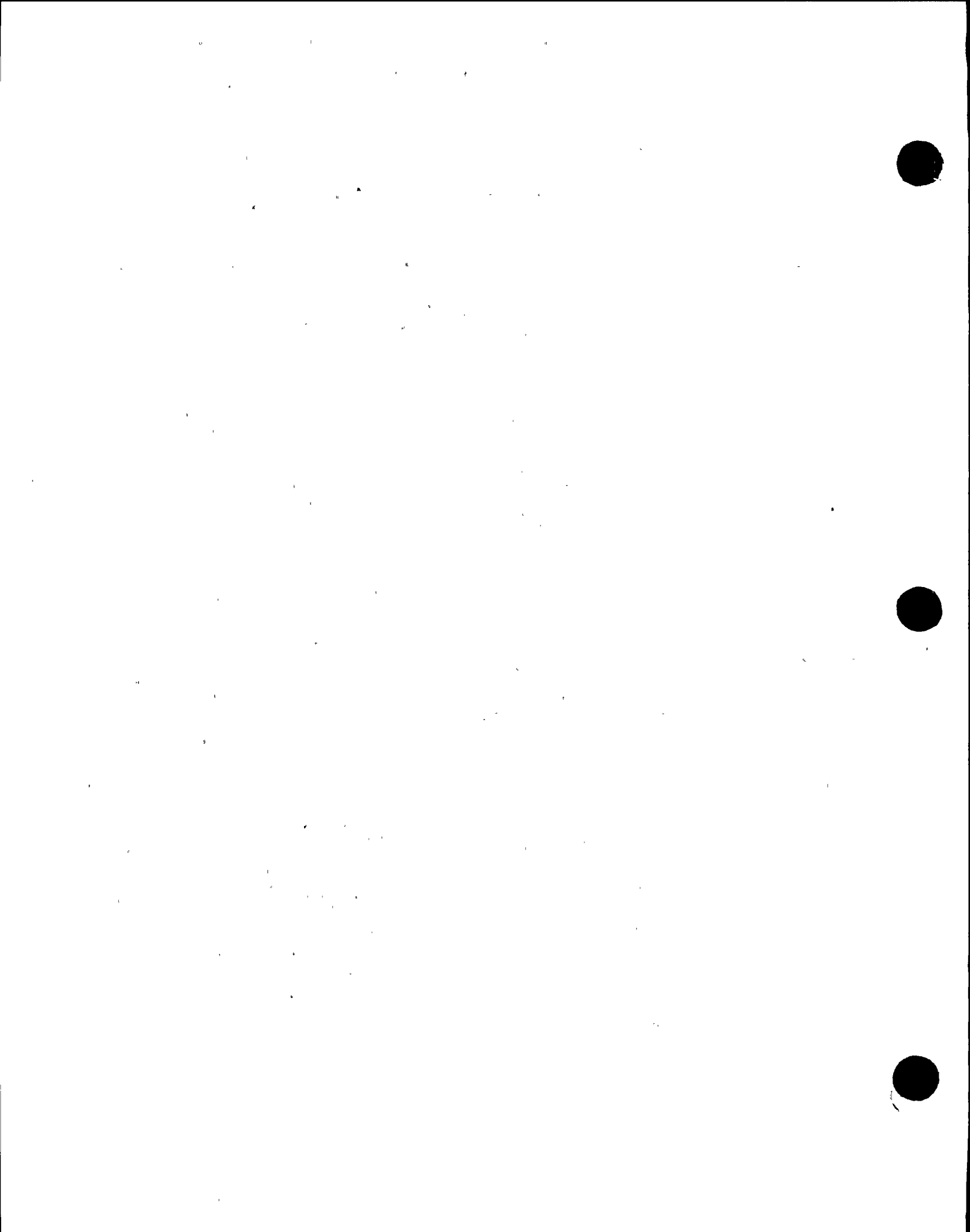
° POTENTIAL REDUCTIONS IN MINIMUM TORUS SHELL THICKNESS

- CONDENSATION OSCILLATIONS  
12 MILLS/10% REDUCTION
- TORUS PRESSURE  
8 MILLS/1 PSI REDUCTION

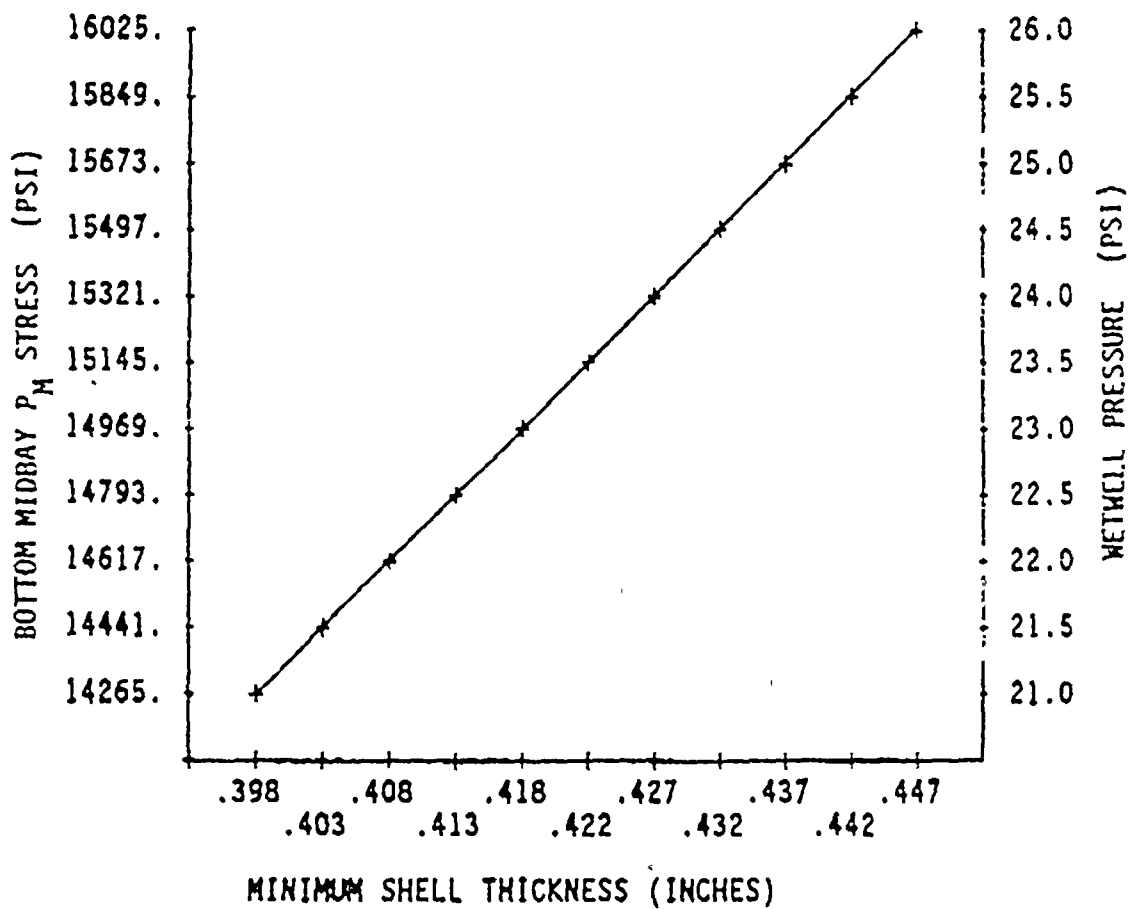


EVENT 20 COMBINATION AT BOTTOM MID-BAY  
 MINIMUM SHELL THICKNESS  
 VERSUS  
 $P_M$  STRESS AND PERCENT DBACO LOAD





EVENT 20 COMBINATION AT BOTTOM MID-BAY  
 MINIMUM SHELL THICKNESS  
 VERSUS  
 $P_M$  STRESS AND WETWELL PRESSURE





## CONSERVATISM IN VENT SPHERE

### MINIMUM THICKNESS

- ° LOADS WERE COMBINED BY ABSOLUTE SUMMATION
- ° RESULTANT STRESSES WERE CALCULATED WITHOUT REGARD TO LOCATION
- ° GENERAL ELECTRIC GENERIC VENT HEADER/VENT PIPE INTERSECTION (TYPE I) STRESS INTENSITY FACTORS WERE USED TO DETERMINE VENT SPHERE MAXIMUM STRESS
- ° CMTRs COULD BE USED TO DETERMINE HIGHER CODE ALLOWABLES





## TORUS WALL THICKNESS PROGRAM

### II DATA COLLECTION METHODS & EVALUATION

- ° UT METHOD/INSTRUMENT
  - 1975-1979 ----> THICKNESS TRANSDUCERS; SINGLE CALIBRATION BLOCK - 6x6 MIN. THICK.
- ° STATISTICAL -----> TIME VARYING  
-----> LOCATION VARYING
- ° VENT HEADER SPHERES ----> NEW AREA, NO PREVIOUS DATA  
----> NO DETAILED STRESS ANALYSIS
  - ANNUAL CORROSION (LINEAR/EXPONENTIAL?)



## TORUS WALL THICKNESS PROGRAM

### III PRESENT PLANS/PROGRAMS (FOR 1990)

- ° INCREASE SAMPLE SIZE/CONFIRM 1988 DATA
  - VISUAL INSPECTION VENT SPHERES
- ° FURTHER ANALYSIS
  - FULL SCALE TEST DATA
- ° O2 CONTROL
- ° COATINGS
- ° MID-BAY SADDLES



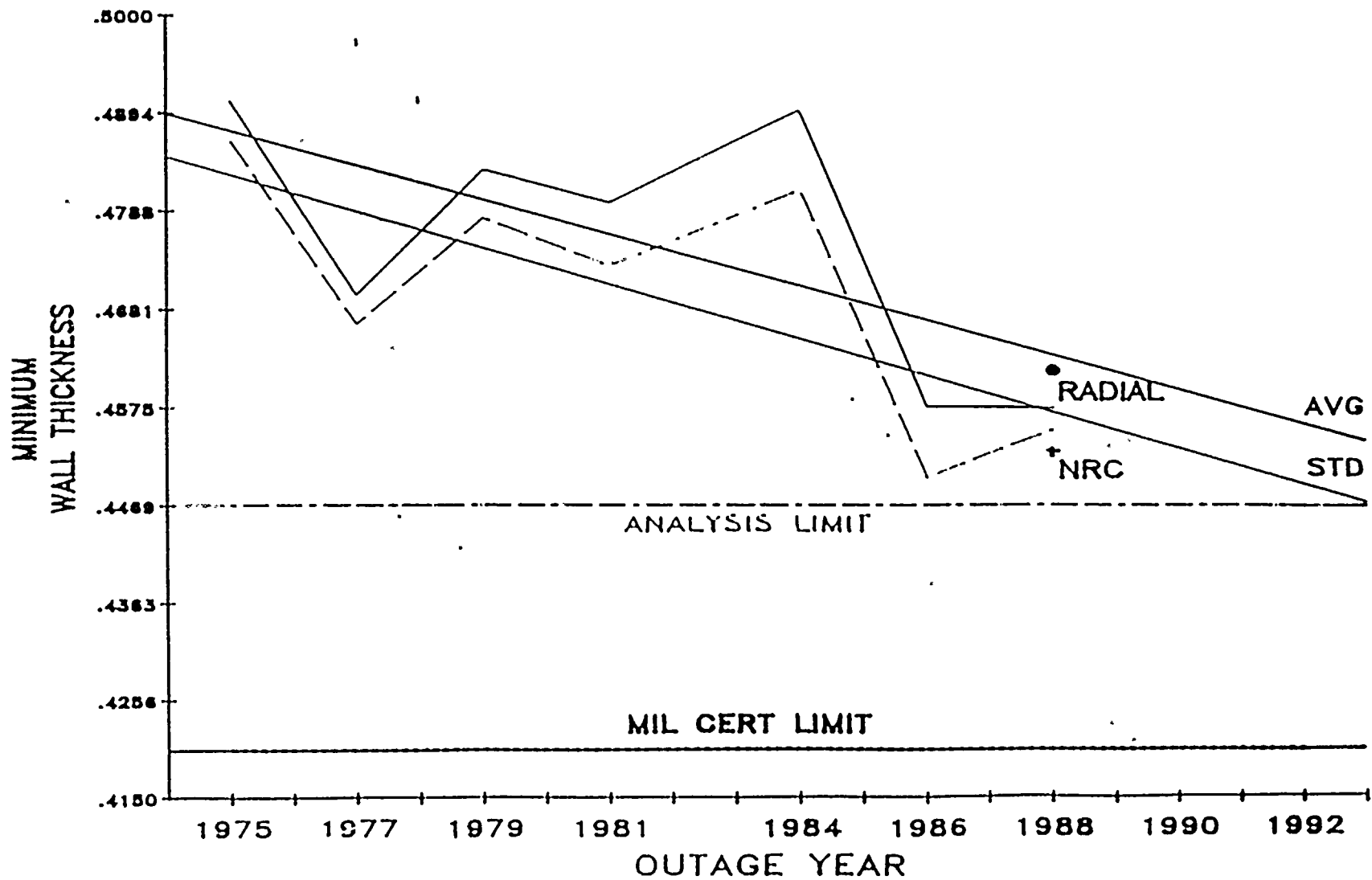
## TORUS WALL THICKNESS PROGRAM

### IV CONCLUSIONS

- ° WHY OK UNTIL 1990?
  - LOCAL THICKNESS VS. OVERALL THICKNESS
  - TORUS THICKNESS AT MID-BAY - ADJACENT
  - CORROSION RATE = .002 in/year
  - VENT SPHERE, THICKNESS - ADEQUATE
  - CMTRs GIVE ADDITIONAL MARGIN
  - FURTHER ANALYSIS TO INCREASE THICKNESS MARGIN



NINE MILE POINT UNIT 1  
MINIMUM TORUS WALL THICKNESS  
AREA NUMBER ONE







## RPV BELT LINE WELD EXAMINATION

- ° 1ST TEN YEAR INTERVAL
  - RELIEF GRANTED DUE TO ACCESS RESTRICTIONS
  
- ° 2ND TEN YEAR INTERVAL
  - RELIEF REQUEST PENDING NRR APPROVAL
  - NIAGARA MOHAWK WILL EXAMINE THE RPV WELDS ABOVE THE THERMAL SHIELD
    - 1988 DETERMINE ACCESSIBILITY AND INSULATION MODIFICATIONS REQUIRED
    - 1990 TENTATIVE SCHEDULE FOR EXAMINATION
  
- ° NRC INSPECTION 87-11
  - NIAGARA MOHAWK COMMITTED TO PERFORM A FEASIBILITY STUDY ON RPV BELT LINE EXAMINATIONS



## NMPC FEASIBILITY STUDY

- ° BWROG PLEX COMMITTEE
- ° PURSUING THIS TOPIC WITH EPRI/BWROG IGSCC
  - DEVELOPING A SUBMERSIBLE UNIT FOR UT EXAMINATION FROM INTERIOR
- ° COMBUSTION ENGINEERING
  - LOW PROFILE MAGNETIC CRAWLER
  - REQUIRES A THIN TRACK FOR ALIGNMENT
  - INSULATION MODIFICATIONS REQUIRED
- ° SOUTHWEST RESEARCH
  - LOW PROFILE DEVICE AVAILABLE
  - USED ON EUROPEAN BWR
  - TRACKLESS SYSTEM



## EROSION/CORROSION MONITORING PROGRAM

- ° INITIAL PROGRAM DEVELOPMENT IN 1981 FOR TWO PHASE FLOW
- ° MONITORED TWO PHASE FLOW LOCATIONS DURING 1984 AND 1986 OUTAGES
- ° PROGRAM EXPANDED IN 1987 TO INCLUDE SINGLE PHASE FLOW
- ° NUMARC/EPRI GUIDELINES FOR HIGH-ENERGY SINGLE-PHASE FLOW EROSION/CORROSION REVIEW ARE INCLUDED IN PROGRAM
- ° NRC BULLETIN NO. 87-01 GUIDELINES AND RECOMMENDATIONS ARE INCLUDED IN PROGRAM



EROSION/CORROSION MONITORING PROGRAM (Continued)

° PROGRAM TASKS

- DESIGN REVIEW

PIPING CONFIGURATION

BULK FLUID VELOCITIES

WATER CHEMISTRY

MATERIALS

PERCENT MOISTURE IN STEAM FOR TWO PHASE

- OPERATING DATA REVIEW

TRANSIENT HISTORY

WATER CHEMISTRY

- SAMPLE LOCATION





## 1988 REFUELING OUTAGE

- ° NMPC PROGRAM PLAN
- ° NMPC OUTAGE PLAN
- ° CBI SURFACE PREPARATION
- ° NES ULTRASONIC MEASUREMENT
- ° NMPC ENGINEERING REVIEW
  - ACTUAL DATA VERSUS MINIMUM WALL THICKNESS REQUIREMENTS
  - ACTUAL DATA INPUTTED TO "CHEC" COMPUTER PROGRAM
    - ° DEVELOPED BY EPRI
    - MONITORS EROSION/CORROSION RATE



NINE MILE POINT UNIT 1  
EROSION/CORROSION REVIEW STATUS

° PROGRAM LOCATIONS

- SINGLE PHASE	34
- TWO PHASE	37

° DATA

- NES COMPLETED	44
- NES TO BE COMPLETED	27
- NES TURNOVER TO ENGINEERING	37
- NMPC ENGINEERING DATA REVIEW COMPLETED	0



ATTACHMENT C

Teledyne Engineering Services

Technical Report TR-6801-2 Revision 1

January 29, 1988

Mark I Torus Shell and Vent System Thickness Requirements

Nine Mile Point Unit 1 Nuclear Station

