March 6, 1997

LICENSEE: Commonwealth Edison Company (ComEd)

FACILITY: Dresden, Units 2 and 3

SUBJECT: SUMMARY OF MEETING CONCERNING AN UP-COMING TECHNICAL SPECIFICATION CHANGE TO USE CONTAINMENT OVERPRESSURE TO COMPENSATE FOR A DEFICIENCY IN NET POSITIVE SUCTION HEAD FOR THE EMERGENCY CORE COOLING PUMPS

On January 30, 1997, the staff met with ComEd to discuss the licensee's proposed Technical Specification (TS) change concerning the use of containment overpressure to compensate for a deficiency in net positive suction head (NPSH) for the Emergency Core Cooling Pumps. A list of attendees is provided as Enclosure 1.

The objectives of the meeting were to discuss the schedule when the proposed amendment would be submitted and a detailed discussion of all analysis to be used in the amendment. During the meeting, the licensee discussed the containment codes which would be used to justify the amount of overpressure which would be present in the containment following a design basis accident. The staff indicated that adequate bench marking would have to be provided to justify the use of any code not previously reviewed and approved by the staff. The licensee also provided the details of the NPSH calculations performed to justify operability of the Emergency Core Cooling pumps.

In addition to the presentation on the proposed license amendment, the licensee also provided a short discussion on Dresden's compliance with NRC Bulletin 96-03, "Potential Plugging of Emergency Core Cooling Suction Strainers by Debris in Boiling Water Reactors."

A copy of the licensee's presentation is included as Enclosure 2.

ORIGINAL SIGNED BY:

John F. Stang, Senior Project Manager
Project Directorate III-2
Division of Reactor Projects - III/IV
Office of Nuclear Reactor Regulation

Docket Nos. 50-237, 50-249

Enclosures:
1. List of Attendees
2. Licensee's Presentation

cc w/encls: see next page

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

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John F. Stang, Senior Project Manager
Project Directorate III-2
Division of Reactor Projects - III/IV
Office of Nuclear Reactor Regulation

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2. Licensee's Presentation

cc w/encls: see next page

cc:

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LIST OF MEETING ATTENDEES
JANUARY 30, 1997

Nuclear Regulatory Commission

Robert Capra, NRR

Jim Lyons, NRR

Carl Berlinger, NRR

Dick Wessman, NRR

Rich Lobel, NRR

Dave Lynch, NRR

Bob Pulsifer, NRR

Jack Dawson, NRR

Jack Kudrick, NRR

Kerri Kavanagh, NRR

John Stang, NRR

Commonwealth Edison Company

Bob Rybak

Russ Freeman

Linda Weir

Frank Spangenburg

Kevin Ramsden

Duke Power

Greg Ashley

Enclosure 1

COMED MEETING WITH NRC

DRESDEN UNITS 2 & 3

LICENSE AMENDMENT REQUEST - CONTAINMENT HEAT REMOVAL SYSTEM REQUIREMENTS

JANUARY 30, 1997

Enclosure 2

PURPOSE OF MEETING

- DISCUSSION OF LICENSE AMENDMENT TO BE SUBMITTED IN FEBRUARY 1997
- DISCUSSION OF NEW ECCS SUCTION STRAINER INSTALLATION

ISSUES REQUIRING LICENSE AMENDMENT

- CONTAINMENT MODEL
- CREDIT FOR CONTAINMENT OVER PRESSURE
- CCSW FLOW REDUCTION
- LPCI HEAT EXCHANGER PERFORMANCE
- UHS AND TORUS TEMPERATURE LIMITS

HISTORY

- DRESDEN DESIGNED FOR OVERPRESSURE
- LICENSING BASIS ON USE OF OVERPRESSURE WAS NOT RESOLVED
- RECENT LICENSE AMENDMENT FOR 2 PSIG OVERPRESSURE REQUIRES SEVERE LIMITATIONS ON TORUS AND ULTIMATE HEAT SINK TEMPERATURES

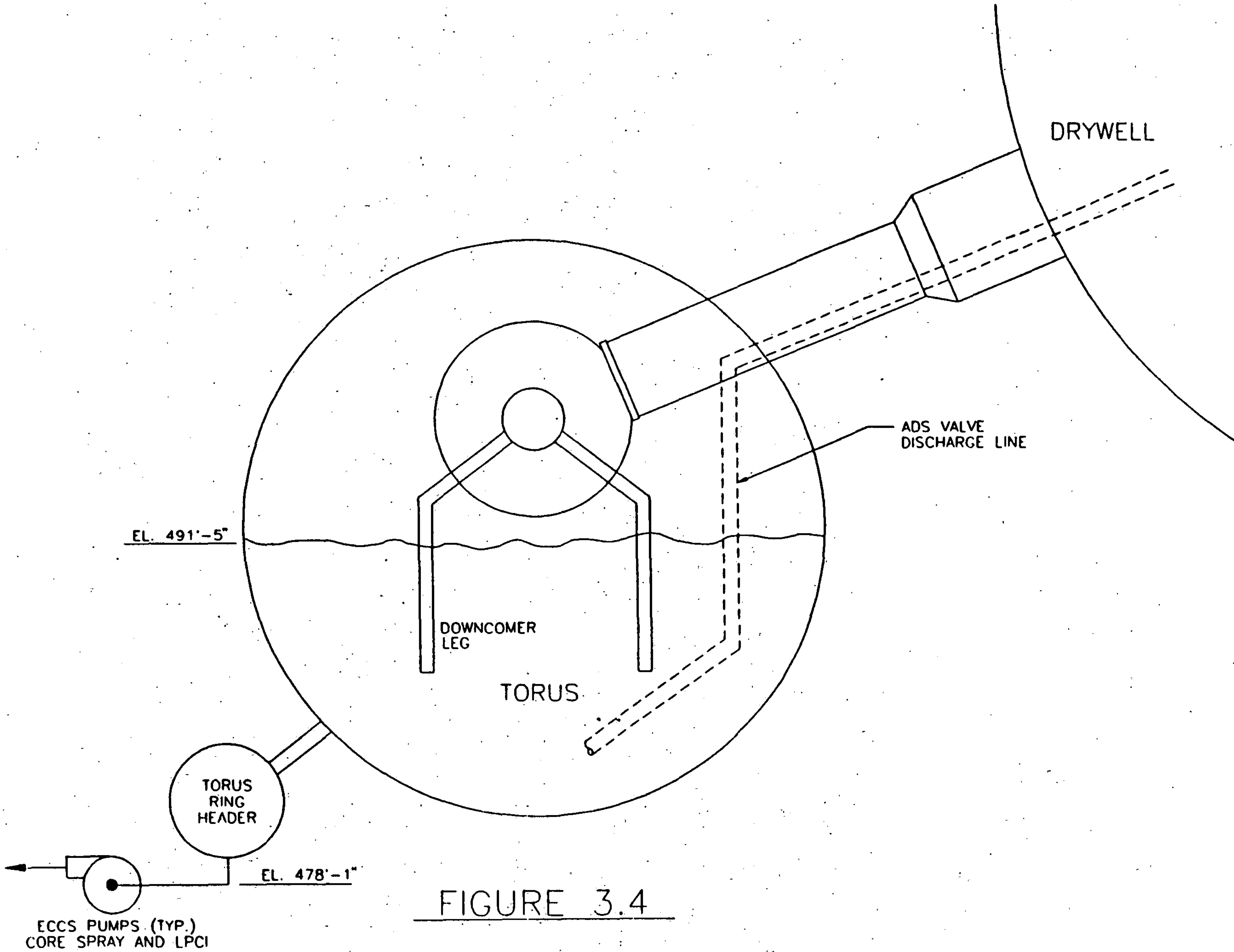
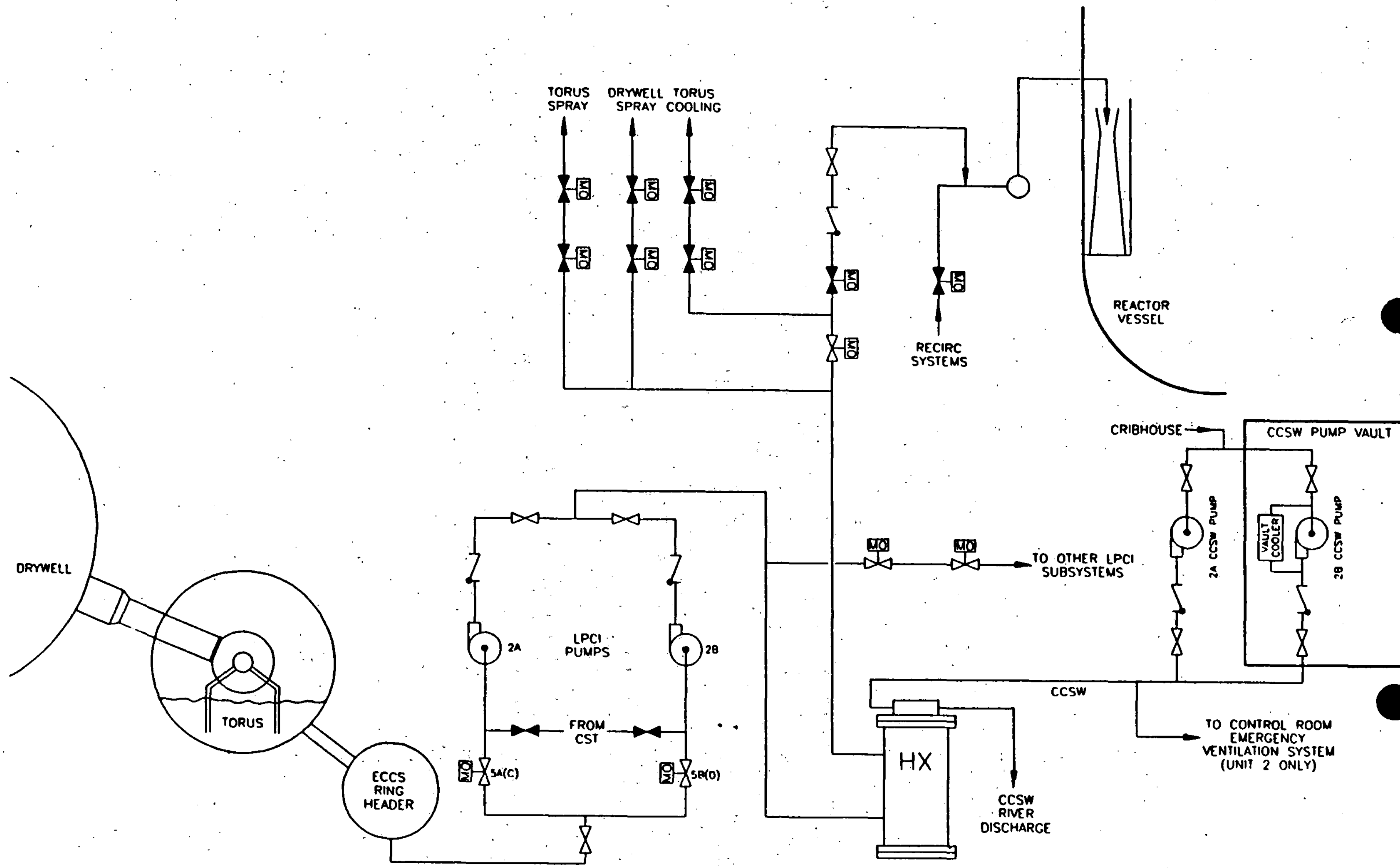

DRYWELL
ADS VALVE
DISCHARGE LINE
EL. 491'-5"
DOWNCOMER
LEG
TORUS
TORUS
RING
HEADER
EL. 478'-1"
ECCS PUMPS (TYP.)
CORE SPRAY AND LPCI

FIGURE 3.4



TORUS SPRAY
DRYWELL SPRAY
TORUS COOLING
MO
REACTOR VESSEL
RECIRC SYSTEMS
CRIBHOUSE
CCSW PUMP VAULT
2A CCSW PUMP
2B CCSW PUMP
VAULT COOLER
DRYWELL
TO OTHER LPCI SUBSYSTEMS
2A
LPCI PUMPS
2B
TORUS
CCSW
FROM CST
TO CONTROL ROOM EMERGENCY VENTILATION SYSTEM (UNIT 2 ONLY)
ECCS RING HEADER
5A(C)
5B(D)
HX
CCSW RIVER DISCHARGE

FIGURE 3.0

CCSW FLOW

- CCSW DESIGN REQUIREMENTS
  - CONTROL TORUS WATER TEMPERATURES
  - PREVENT RELEASE OF POTENTIALLY CONTAMINATED WATER BY MAINTAINING CCSW AT A HIGHER PRESSURE THAN LPCI WHILE PROVIDING SUFFICIENT FLOW TO MAINTAIN TORUS TEMPERATURES
- AMENDMENT CLARIFIES DESIGN REQUIREMENTS ASSOCIATED WITH THE ABOVE FUNCTIONS
- MINIMUM CCSW FLOW REQUIRED TO MEET DESIGN OBJECTIVES IS 5000 GPM
- PEAK POST-ACCIDENT TORUS TEMPERATURE WILL INCREASE FROM 170 F TO ABOUT 176 F

LPCI HEAT EXCHANGER PERFORMANCE

- LOWER HEAT EXCHANGER DUTY FROM 105 MBTU/HR TO 98.5 MBU/HR
- CHANGE DISCOVERED DURING RECONSTITUTION OF HEAT EXCHANGER DUTY CALCULATIONS, IT IS NOT DUE TO HEAT EXCHANGER DEGRADATION

ULTIMATE HEAT SINK AND TORUS TEMPERATURES

- ORIGINAL DESIGN BASIS
  - 95 F PEAK TORUS TEMPERATURE DURING NORMAL OPERATIONS
  - 95 F MAXIMUM ULTIMATE HEAT SINK TEMPERATURE
- RECENT LICENSE AMENDMENT LIMITED TORUS AND UHS TEMPERATURES TO 75 F DUE TO ECCS PUMP NPSH REQUIREMENTS

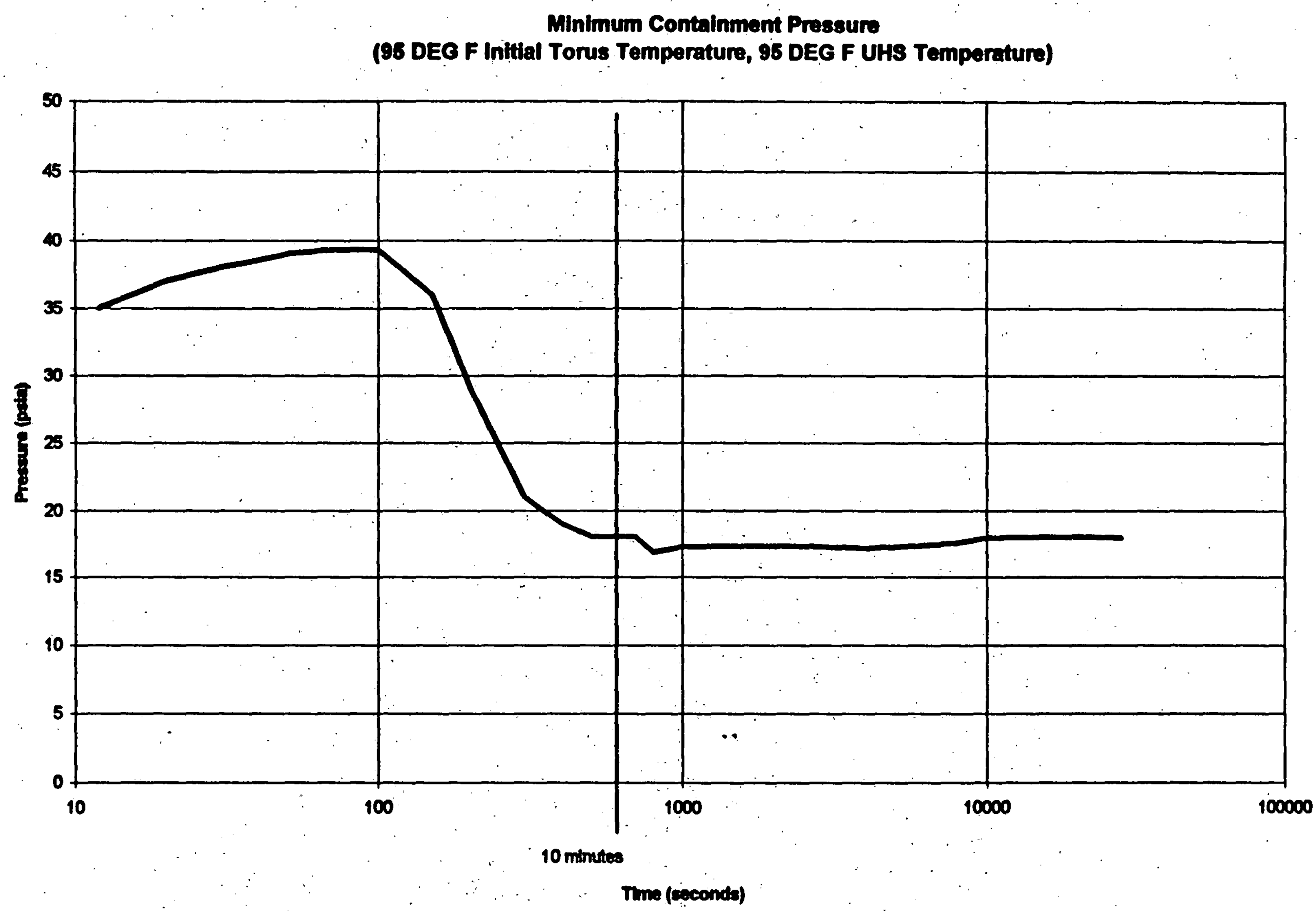
CONTAINMENT MODEL

- BASIS AND RESULTS OF ORIGINAL CONTAINMENT MODEL
- NEW MODEL USES GE SHEX-04 TO GENERATE CONTAINMENT RESPONSE
- ANS 5.1-1979 USED FOR DECAY HEAT
- SENSITIVITY ANALYSES PERFORMED TO IDENTIFY LIMITING CASES
  - PUMP COMBINATIONS
  - FLOWS
  - MIXING VALUES
  - INITIAL CONDITIONS

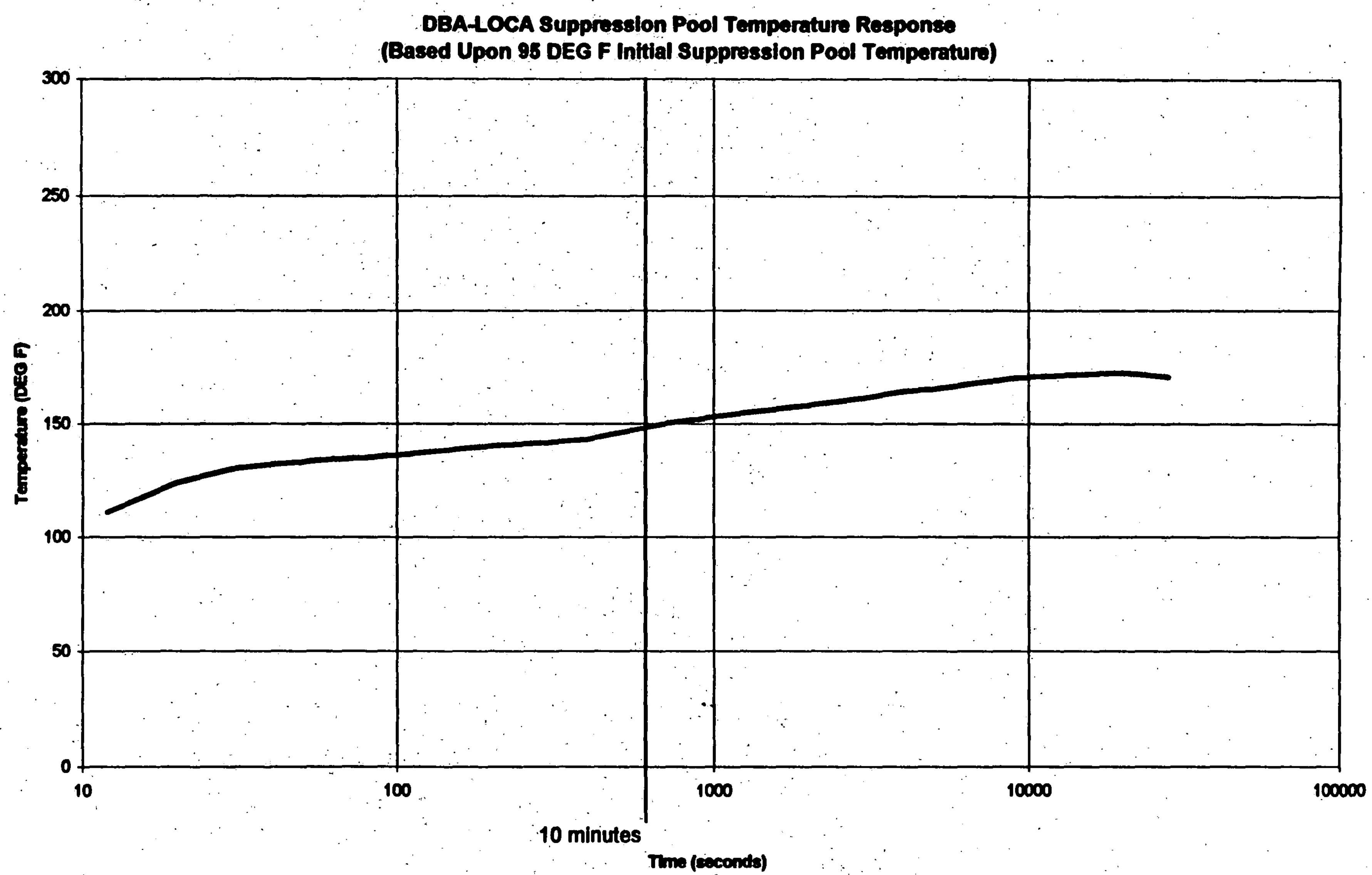
CONTAINMENT MODEL (CONTINUED)

- BENCHMARKING OF MODEL
  - SHEX BENCHMARKED IN 1993 FOR DRESDEN AND QUAD 1/1 COMPARISONS

- CONSERVATISMS
  - INITIAL CONDITIONS MINIMIZE NON-CONDENSIBLES
  - INITIATION OF CONTAINMENT SPRAYS AT 10 MINUTES
  - CONTAINMENT OVERPRESSURE CALCULATED PER METHODOLOGY IN I.N. 96-55 TO MINIMIZE CALCULATED OVERPRESSURE AVAILABLE



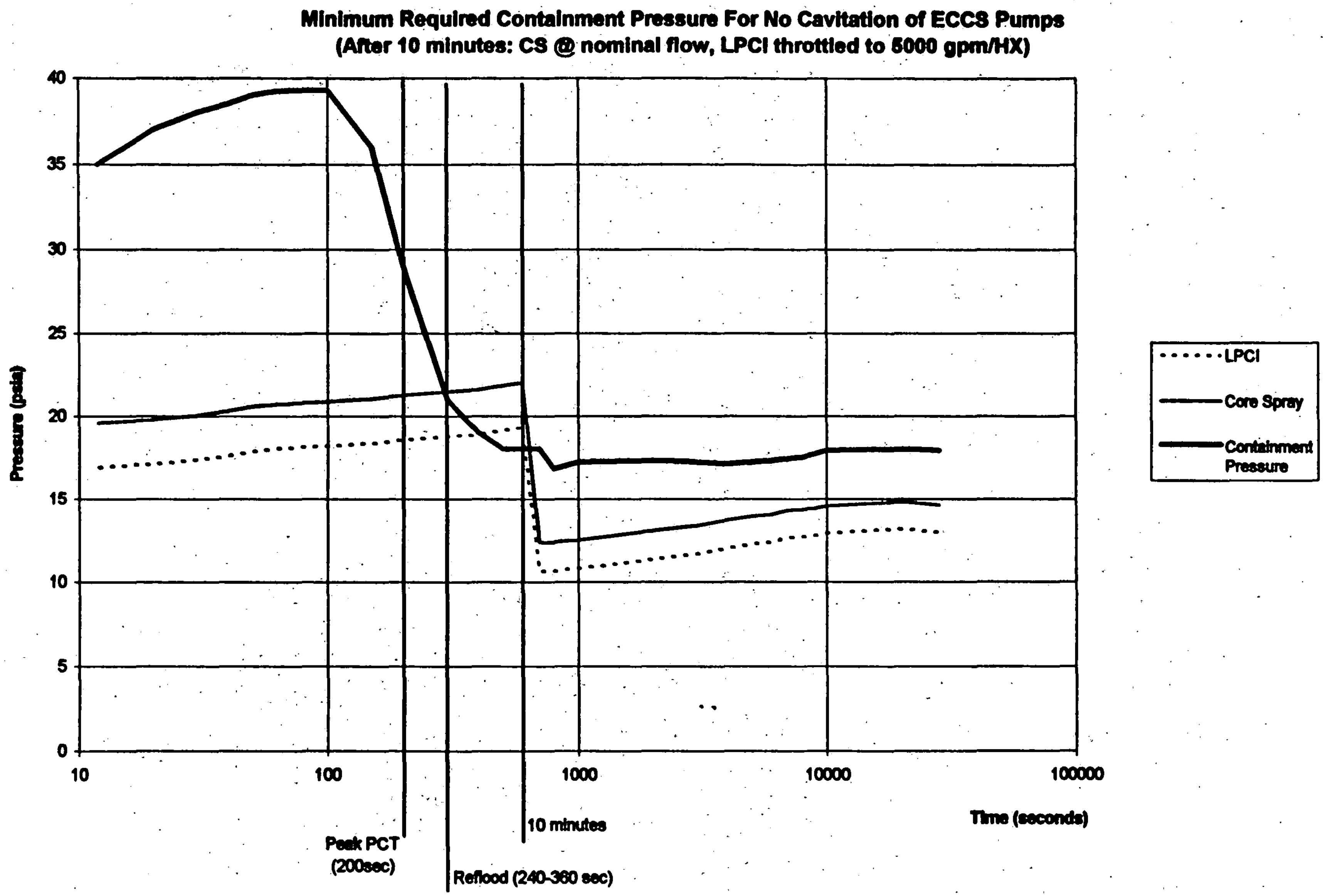
Minimum Containment Pressure
(95 DEG F Initial Torus Temperature, 95 DEG F UHS Temperature)
Pressure (psia)
50
45
40
35
30
25
20
15
10
5
0
10
100
1000
10000
100000
10 minutes
Time (seconds)



DBA-LOCA Suppression Pool Temperature Response
(Based Upon 95 DEG F Initial Suppression Pool Temperature)
300
250
200
150
100
50
0
Temperature (DEG F)
10
100
1000
10000
100000
10 minutes
Time (seconds)

ECCS PUMP NPSH

- NPSH CALCULATED USING MINIMUM AVAILABLE OVERPRESSURE
- RUNOUT FLOWS ON CS AND LPCI PUMPS FOR FIRST 10 MINUTES
- NO CS CAVITATION AT TIME OF PCT
- CS FLOW AT PCT OF 5800 GPM (5276 GPM REQUIRED)
- CAVITATION OF CORE SPRAY PUMPS AT APPROXIMATELY 5 MINUTES
- DEGRADED FLOW DURING CAVITATION CALCULATED USING SAME METHODOLOGY AS IN RECENT LICENSE AMENDMENT
- CS FLOW (AT 10 MINUTES) OF 5300 GPM (4500 GPM REQUIRED)
- PCT $\leq$ 2030 F


Minimum Required Containment Pressure For No Cavitation of ECCS Pumps
(After 10 minutes: CS @ nominal flow, LPCI throttled to 5000 gpm/HX)
Pressure (psia)
40
35
30
25
20
15
10
5
0
10
100
1000
10000
100000
Time (seconds)
Peak PCT
(200sec)
Reflood (240-360 sec)
10 minutes
LPCI
Core Spray
Containment Pressure

ECCS PUMP NPSH - IMPACT OF NEW STRAINER INSTALLATION

- NEW STRAINERS TO BE INSTALLED IN UNIT 3 DURING THE REFUELING OUTAGE SCHEDULED TO START IN MARCH 97
- ANALYSES PERFORMED FOR THIS AMENDMENT BOUNDS INSTALLATION OF NEW STRAINERS
- STRAINERS TO BE INSTALLED VIA 50.59 USING CURRENT DESIGN BASIS ASSUMPTIONS ON STRAINER PLUGGING (1 STRAINER COMPLETED PLUGGED, 3 UNPLUGGED)
- COMPARISON OF EXISTING VERSUS NEW STRAINERS

TECHNICAL COMPARISON OF DRESDEN ECCS SUCTION STRAINERS

	EXISTING TRUNCATED CORE	NEW STACKED DISK
CIRCUMSCRIBED AREA (SQ FT)	4.5	57
TOTAL SURFACE AREA (SQ FT)	4.5	134
APPROACH VELOCITY (FT/SEC @ 10,000 GPM)	4.94	0.39
CLEAN HEAD LOSS (FT OF WATER @ 10,000 GPM)	5.8	4.2

ECCS SUCTION STRAINER - HISTORY

COMED :

- HAS BEEN INVOLVED SINCE 1993 WITH THE BWROG
- IS AN ACTIVE MEMBER OF ALL THE COMMITTEES
- BELIEVES THE URG APPROACH IS THE BEST RESOLUTION PATH

DRESDEN REPLACEMENT STRAINER

- INSTALL LARGER STRAINERS NOW
  - LIMITED BY STRUCTURAL DESIGN
  - NEED FOR CONTAINMENT OVERPRESSURE IS NOT DRIVEN BY NEW STRAINER INSTALLATION
- PROVIDE 60 DAY RESPONSE AFTER URG RESOLUTION
- BASIS FOR APPROACH
  - INTERIM COMPENSATORY ACTION
  - BASIS FOR COMPLIANCE WITH IEB 96-03 NOT YET ESTABLISHED BY URG AND NRC

Containment Analyses

NRC/ComEd Meeting

1/30/97

K. Ramsden

Analysis Basis

Existing Analytical Basis

- Maximum Pressure Analysis
- Long Term NPSH Analysis
- Mk I Dynamic Loads Analysis
- Mk I Condensation Stability Analysis

Proposed Amendment

New Analysis

- Long Term NPSH
- Detailed SIL 151 Case

Modification

Remove Condensation Stability Requirements

Long Term NPSH Analysis

Key Features

- Based on SHEX-04 computer code
- Model Benchmarks performed for D/QC
- Based on limiting LPCI/CCSW configuration
- ANS 5.1-1979 Decay Heat Model
- Reconstituted HX performance model
- Incorporates CCSW flow reductions necessary to assure adequate CCSW/LPCI DP
- Conservative treatment of D/W mixing
- Conservative treatment of non-condensible loading

Key Features, continued

- All Heat Sources included (FW M/E, Pump Ht, etc.)
- Effects of Heat Transfer to D/W liner
- Extensive Sensitivity Calculations performed

Results of Calculations

- Short term results show significant pressures exist through reflood period, even with highly conservative inputs
- Primary effect of heat sink models is on short term behavior
- Long term results indicate that overpressures of approximately 3 psi will exist at the time of peak pool temperature

1/2 pump combinations provide highest temperatures and lowest pressures

The "new" temperatures predicted are of comparable magnitude to "original"

The use of less restrictive decay heat models is balanced by more conservative reconstructed LPCI HX model and inclusion of FW and pump heat.

Validation Efforts

ComEd has performed the following:

- Independent evaluation of Heat Exchanger Performance
- Independent evaluation of limiting cases based on ideal gas formulation
- In-house QA audit of GE containment analysis in late 1994
- Check of long term P/T behavior

Conclusions

ComEd seeks the following review and acceptance of the following:

- Use of the coupled analysis (pressure/temperature) to support ECCS NPSH evaluations
- Application of time dependent pressure/temperature response
- Acceptability of overall methodology

ECCS Suction Strainer - History

- *ComEd has been involved since 1993 with the BWROG*
- *ComEd believes the URG approach the best resolution path*

Dresden Strainer Mods

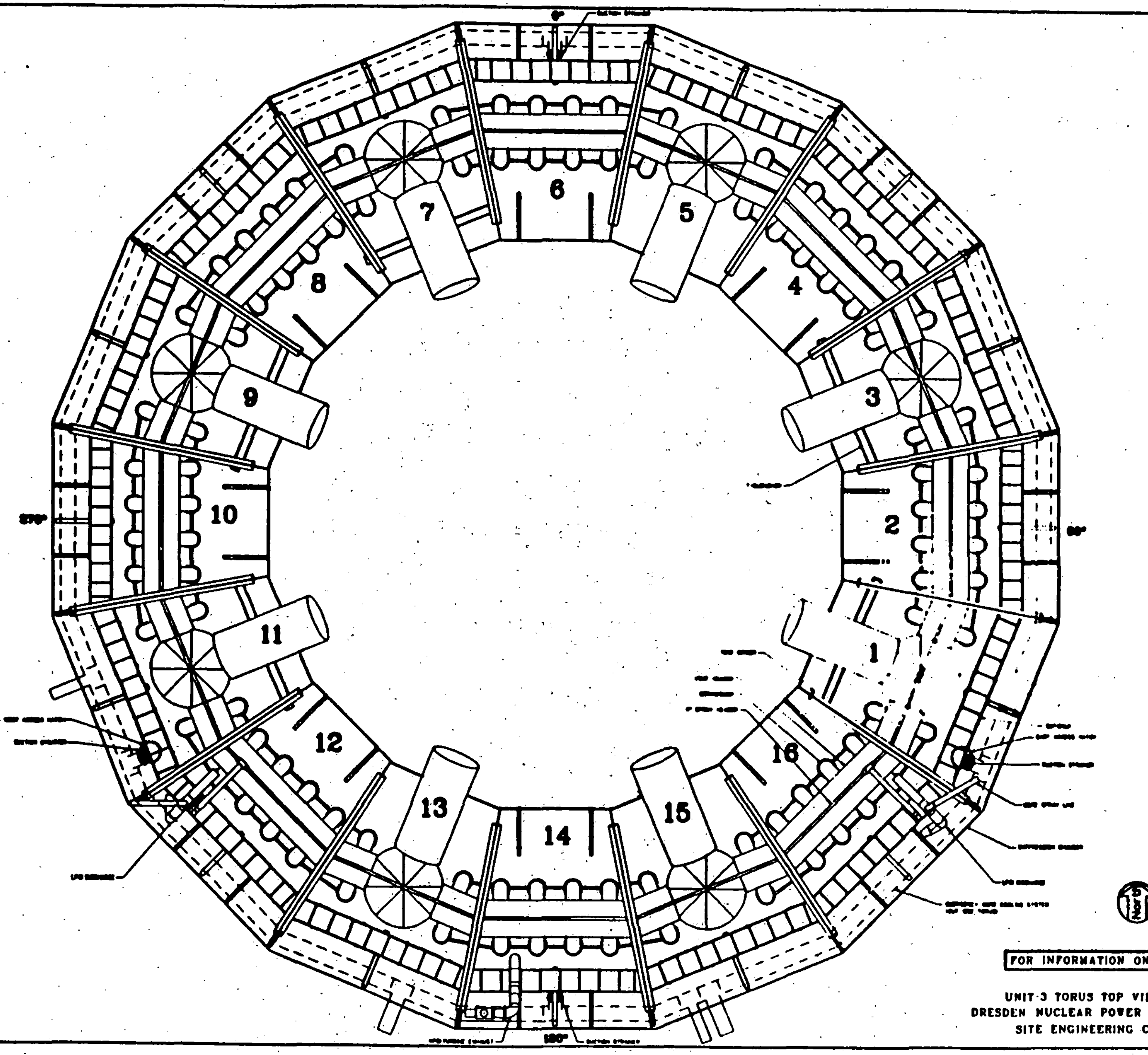
- *Install larger strainers now*
  - *Limited by structural design*
  - *Need containment overpressure credit anyway*
- *Provide 60 day response <u>after</u> URG resolution*
- *Basis for Approach*
  - *Interim Compensatory Action*
  - *Can not show compliance with IEB 96-03*

Replacement Strainer Design Objectives

- Respond to NRC Bulletin 96-03
- Maintain adequate NPSH margin
- Assure that design is structurally robust
- Avoid new license amendment (USQs)
- Assure that design can be Installed in Spring 1997

Background Leading to Design Options

- *Drywell Insulation is nearly all RMI*
- *Fiber Insulation is used at a limited number of locations*
- *ECCS flow is filtered by four strainers (see Figure)*
- *ECCS systems take flow from a common ring header*



UNIT 3 TORUS TOP VIEW
DRESDEN NUCLEAR POWER STATION
SITE ENGINEERING CAD

Background Leading to Design Options (cont'd)

- *Access to the suppression pool is through torus hatches with nominal 34 inch diameter*
- *Current plant design provides small NPSH margin*
- *Structural design margins are small*

Selected Design Option

- *Several designs were evaluated*
- *Dresden will install four replacement Radial Stacked Disk Strainers*
- *Alternate design could not be installed to replace all four existing strainers*

Selected Design Option (cont'd)

- *Alternate strainers design would be adversely affected by SRV Discharge and T-Quenchers at two of four locations*
  - *Without change to licensed load generation methodology, this alternate design can only be installed at two locations*
  - *Increased surface area (compared to radial design) requires use of pipe fittings resulting in higher clean strainer losses*
  - *Although alternate design offered greater surface area, there was no significant NPSH advantage*

New Strainer Performance

- *New strainers were evaluated conservatively for a variety of temperature and flow conditions.*
- *Conservatively predicted losses across postulated debris beds were added to clean strainer losses and compared to NPSH margin evaluated in the time domain.*

New Strainer Performance (cont'd)

- *For example, predicted head loss across postulated debris bed for 8000 gpm at 140°F is approximately 2 feet (<1 psi).*
- *Predicted head loss assuming 100 percent fiber in the torus at 8000 gpm at 140°F is approximately 15 feet.*
- *Head loss prediction assumes that debris is transported instantaneously to the strainers. Detailed evaluation of the time dependency of this phenomena demonstrates some of the conservatisms and, hence, additional margin in this design (blockage plot).*

New Strainer Performance (cont'd)

- *For example, predicted head loss across postulated debris bed for 8000 gpm at 140°F is approximately 2 feet (<1 psi).*
- *Predicted head loss assuming 100 percent fiber in the torus at 8000 gpm at 140°F is approximately 15 feet.*
- *Head loss prediction assumes that debris is transported instantaneously to the strainers. Detailed evaluation of the time dependency of this phenomena demonstrates some of the conservatisms and, hence, additional margin in this design.*

Technical Comparison of Dresden Strainers

	Existing Truncated Core	*New Stacked Disk*
Circumscribed Area (ft^2)	4.5	57
Total Surface Area (ft^2)	4.5	134
Approach Velocity (ft/sec @ 10,000 gpm)	4.94	.39
Clean head loss (ft of water @ 10,000 gpm)	5.8	4.2
Size (∅ (in) x L (in))	*18.3 (base)/14.5 (top) x 10.625*	32.5 x 54

Strainer Design Options

	Design Option	
Design Parameter	*Radial*	*Alternate Design*
Surface Area per Strainer		√
Hydrodynamic Load Effects	√	
Installation	√	
Replace All Four Strainers	√	
Clean Strainer Losses	√	
Total Cost	√	

√ *This design option was evaluated superior when considering this design parameter.*