FEB 4 1991

Docket No. STN 50-482/90-39
License No. NPF-42
EA 91-003

Wolf Creek Nuclear Operating Corporation
ATTN: Bart D. Withers
President and Chief Executive Officer
P.O. Box 411
Burlington, Kansas 66839

Gentlemen:

This refers to the enforcement conference conducted at Region IV's request in the Region IV office on January 30, 1991. This meeting pertained to the frozen safety injection pump recirculation line that occurred December 23, 1990. The meeting was attended by those on the attached Attendance List.

The subjects discussed at this meeting are described in the enclosed Meeting Summary. At the meeting, you committed to provide to the NRC Staff the written guidance given to the dedicated operator, for the safety injection pumps.

It is our opinion that this meeting was beneficial and has provided the staff with a better understanding of the event and your corrective actions. In accordance with Section 2.790 of the NRC's "Rules of Practice," Part 2, Title 10, Code of Federal Regulations, a copy of this letter will be placed in the NRC's Public Document Room.

Should you have any questions concerning this matter, we will be pleased to discuss them with you.

Sincerely,

ORIGINAL SIGNED BY
SAMUEL J. COLLINS

Samuel J. Collins, Director
Division of Reactor Projects

Enclosure:
Meeting Summary w/attachments

cc w/enclosure:
Wolf Creek Nuclear Operating Corp.
ATTN: Gary Boyer, Plant Manager
P.O. Box 411
Burlington, Kansas 66839

*RIV:DRP/D	*C:DRP/D	D/DRP
LLGundrum;df	ATHowell	SJCollins
1/ /91	1/ /91	2/4/91

*previously concurred

IE45
1/1

Shaw, Pittman, Potts & Trowbridge
ATTN: Jay Silberg, Esq.
1800 M Street, NW
Washington, D.C. 20036

Public Service Commission
ATTN: Chris R. Rogers, P.E.
Manager, Electric Department
P.O. Box 360
Jefferson City, Missouri 65102

U.S. Nuclear Regulatory Commission
ATTN: Regional Administrator, Region III
799 Roosevelt Road
Glen Ellyn, Illinois 60137

Wolf Creek Nuclear Operating Corp.
ATTN: Otto Maynard, Manager
Regulatory Services
P.O. Box 411
Burlington, Kansas 66839

Kansas Corporation Commission
ATTN: Robert Elliot, Chief Engineer
Utilities Division
4th Floor - State Office Building
Topeka, Kansas 66612-1571

Office of the Governor
State of Kansas
Topeka, Kansas 66612

Attorney General
1st Floor - The Statehouse
Topeka, Kansas 66612

Chairman, Coffey County Commission
Coffey County Courthouse
Burlington, Kansas 66839

Kansas Department of Health
and Environment
Bureau of Air Quality & Radiation
Control
ATTN: Gerald Allen, Public
Health Physicist
Division of Environment
Forbes Field Building 321
Topeka, Kansas 66620

bcc to DMB (IE45)

bcc distrib. by RIV:

R. D. Martin	Resident Inspector
Section Chief (DRP/D)	DRP
DRSS-RPEPS	Section Chief (RIII, DRP/3C)
RIV File	SRI, Callaway, RIII
Project Engineer (DRP/D)	Lisa Shea, RM/ALF
DRS	

MEETING SUMMARY

Licensee: Wolf Creek Nuclear Operating Corporation (WCNOC)

Facility: Wolf Creek Generating Station (WCGS)

License No.: NPF-42

Docket No.: STN 50-482

Subject: FROZEN SAFETY INJECTION PUMP RECIRCULATION LINE

On January 30, 1991, representatives of WCNOC presented to Region IV personnel in Arlington, Texas, their description of the freezing of the safety injection pumps' common recirculation line to the refueling water storage tank.

The licensee's presentation addressed the design bases for the safety injection system and freeze protection heat tracing; operations issues, including the applicable Technical Specification, the timeline of events, and immediate actions; long-term actions; safety significance of the event; and the lessons learned.

The attendance list is attached to this summary.

Attachments:
1. Attendance List
2. Licensee Presentation (NRC distribution only)

ATTACHMENT 1

ATTENDANCE LIST

Attendance at the January 30, 1991, meeting between WCNOC and NRC in Arlington, Texas:

WCNOC

B. Withers, President
J. Bailey, Vice President, Operations
G. Boyer, Director, Plant Operations
J. Pippin, Director, Nuclear Plant Engineering
J. Weeks, Manager, Operations
T. Garrett, Manager, Nuclear Safety Assessment
H. Chernoff, Supervisor, Licensing

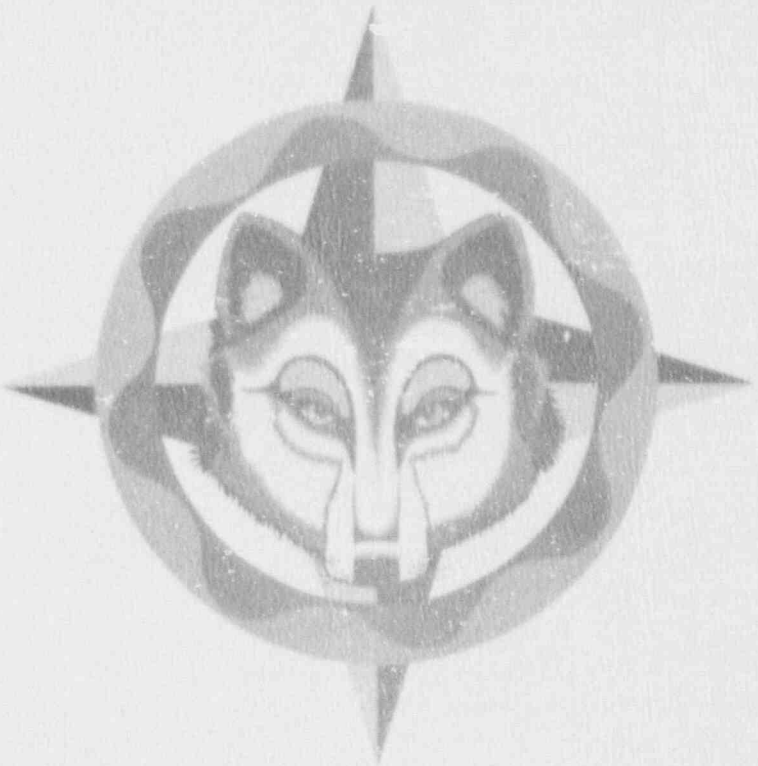
NRC

S. Collins, Director, Division of Reactor Projects
J. Jaudon, Acting Director, Division of Reactor Safety
T. Stetka, Acting Deputy Director, Division of Reactor Safety
A. Howell, Chief, Project Section D, Division of Reactor Projects
G. Sanborn, Enforcement Officer
D. Pickett, Project Manager, Office of Nuclear Reactor Regulation
M. Skow, Senior Resident Inspector, Wolf Creek Generating Station
L. Gundrum, Resident Inspector, Wolf Creek Generating Station

ATTACHMENT 2

WCNOC MANAGEMENT MEETING WITH NRC REGION IV MANAGEMENT

FROZEN SAFETY INJECTION PUMP RECIRCULATION LINE



January 30, 1991

WOLF CREEK
NUCLEAR OPERATING CORPORATION

FROZEN SAFETY INJECTION PUMP RECIRCULATION LINE

INTRODUCTION	-	JOHN BAILEY
DESIGN BASIS DISCUSSION	-	JACK PIPPIN
OPERATIONS ISSUES	-	JIM WEEKS

TECHNICAL SPECIFICATIONS
TIMELINE OF EVENTS
IMMEDIATE ACTIONS

LONG-TERM ACTIONS	-	GARY BOYER
SAFETY SIGNIFICANCE	-	TERRY GARRETT
LESSONS LEARNED	-	GARY BOYER
SUMMARY	-	JOHN BAILEY
CLOSING REMARKS	-	BART WITHERS

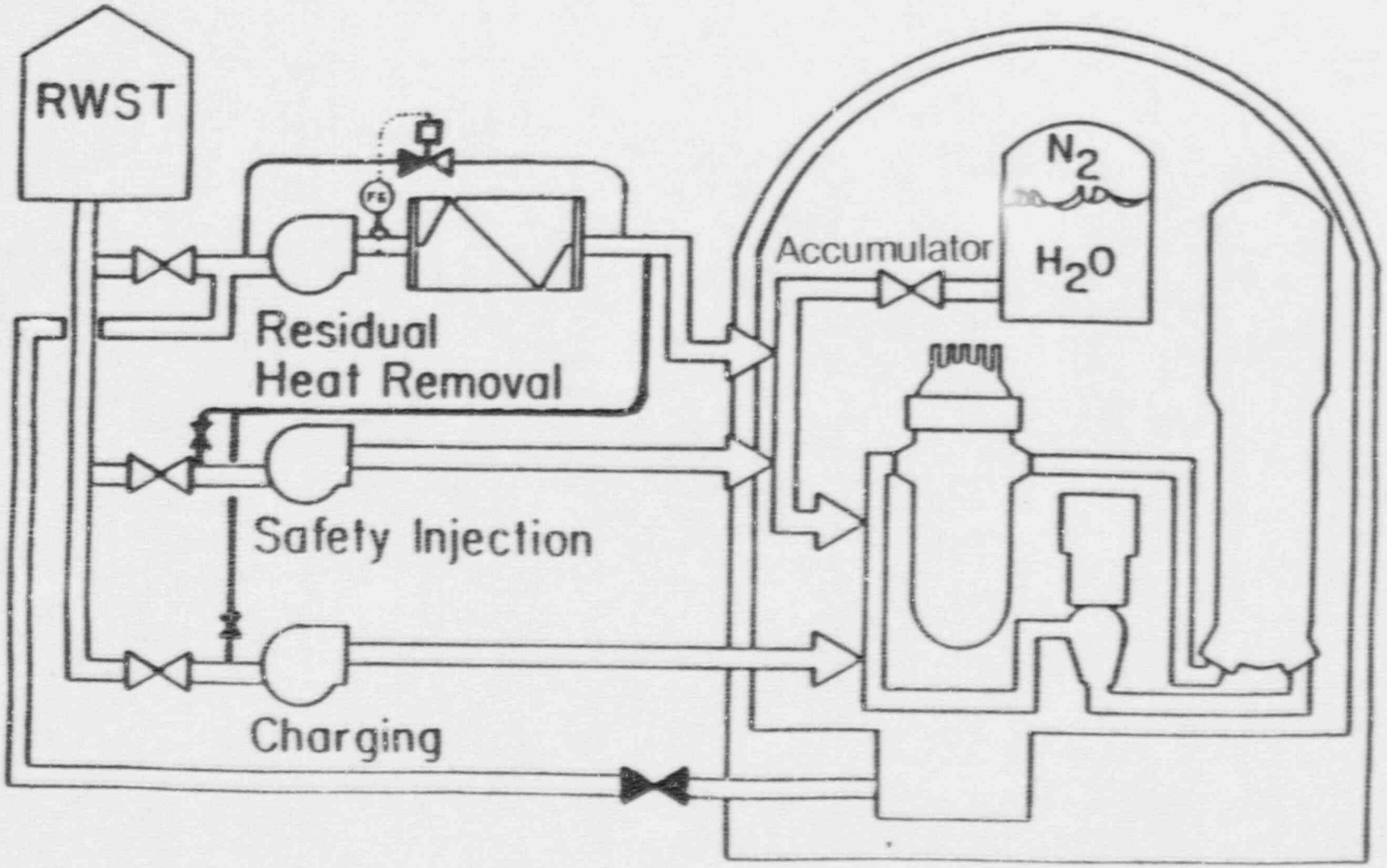
DESIGN BASIS DISCUSSION OF SAFETY INJECTION AND ITS FREEZE PROTECTION

- SI IS ONE OF THE ECCS SYSTEMS

- ECCS PROVIDES TWO SAFETY RELATED FUNCTIONS

- ECCS IS DESIGNED TO COOL THE REACTOR CORE AND PROVIDE SHUTDOWN CAPABILITY

SIMPLIFIED ECCS



SI SYSTEM OVERVIEW

- SI SYSTEM SUPPLEMENTS NORMAL RCS MAKEUP

- SI SYSTEM SPECIFICS

  TWO CENTRIFUGAL HORIZONTAL
  11 STAGE PUMPS

  DESIGN PUMP RATE 450 GPM @ TOTAL
  DEVELOPED HEAD 2780 FT OR 1201 PSI

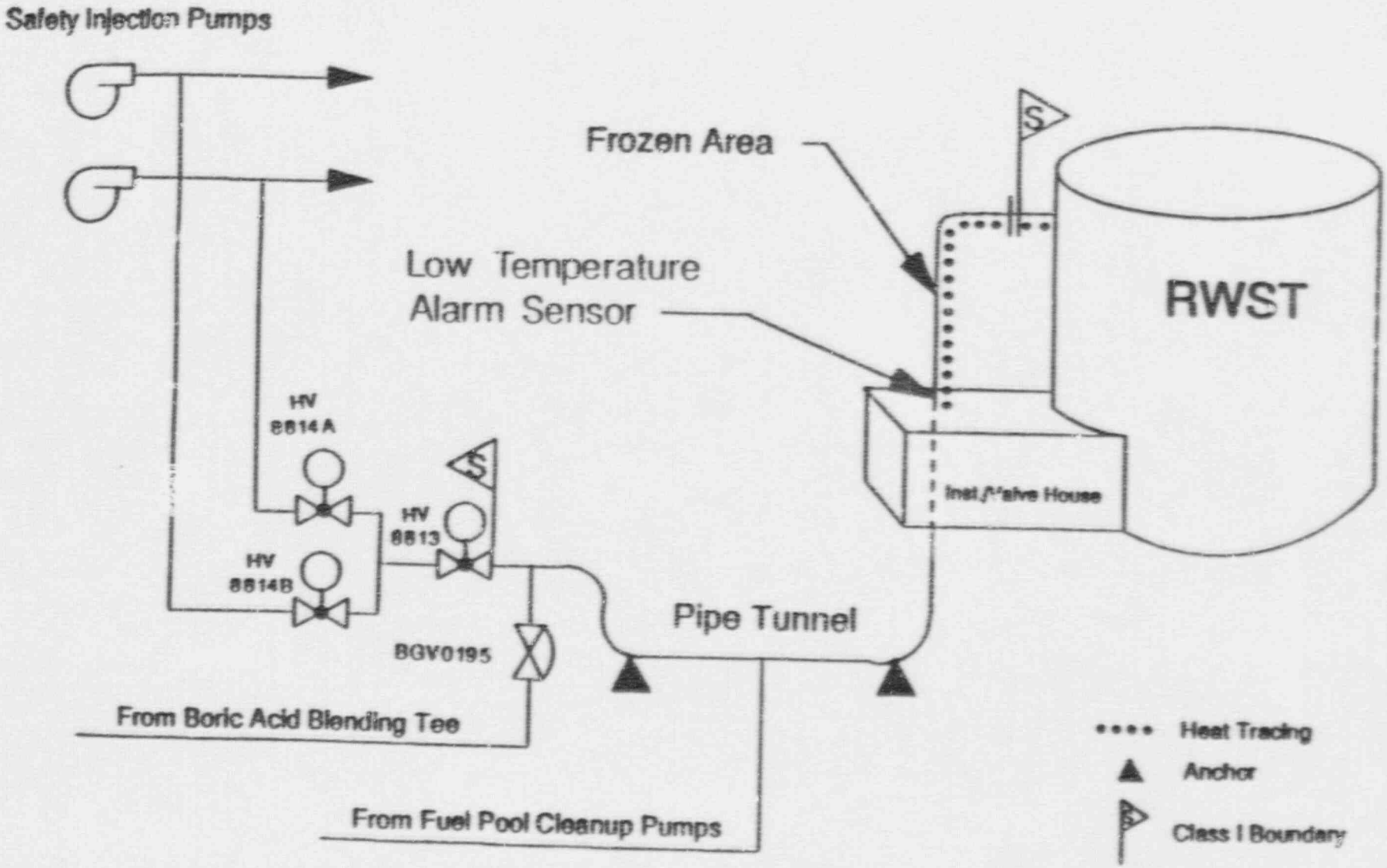
  SHUT-OFF HEAD 1520 PSIG

  MOTOR SIZE NOMINAL
  450 HP/ 4kv/ 3 PHASE/ 60HZ

- MINIMUM RECIRCULATION LINE DESIGN FUNCTION

  PROVIDES PATH TO RWST THAT ALLOWS MINIMUM FLOW TO PROTECT PUMP AT OR NEAR SHUT-OFF CONDITIONS

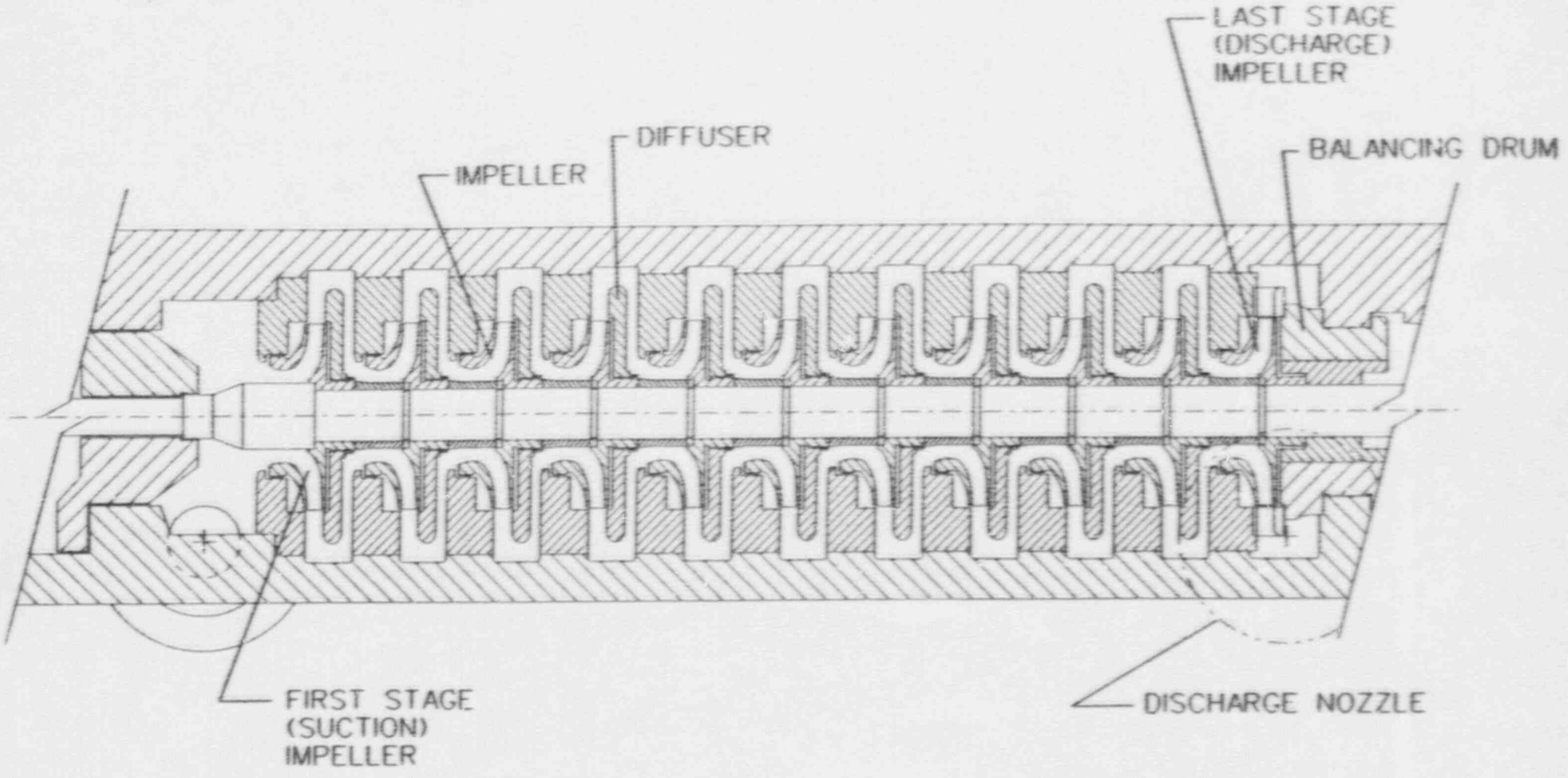
SI Recirculation Line



CREDIBLE PUMP FAILURE MECHANISMS

- PREDICTED FAILURE DUE TO FLASHING WATER (VAPOR LOCK)

SAFETY INJECTION PUMP
(INTERNAL ASSEMBLY SIMPLIFIED)



NOTES: 1.NOT TO SCALE

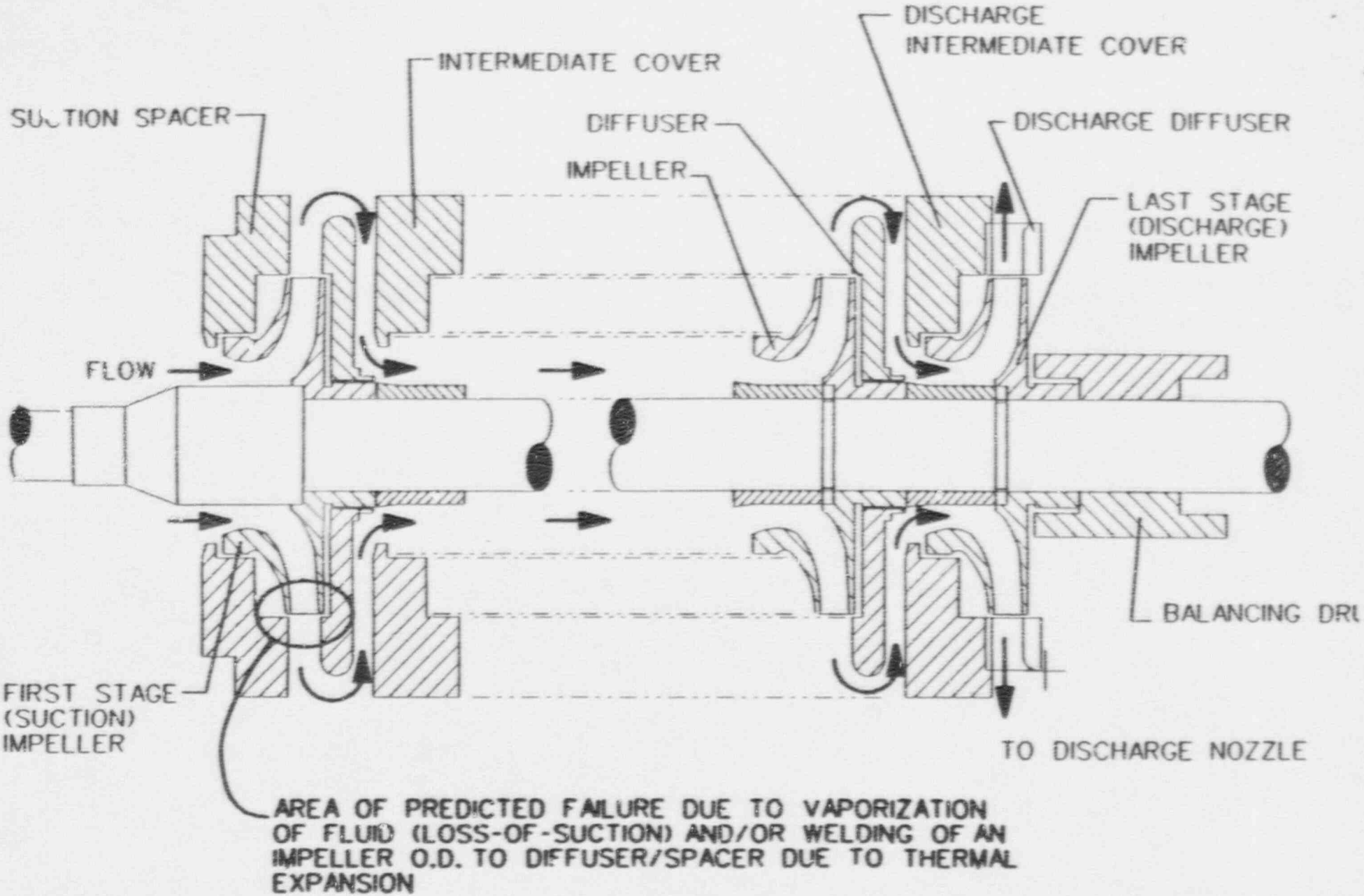
2.PORTIONS SIMPLIFIED FOR DISCUSSION PURPOSES

CREDIBLE PUMP FAILURE MECHANISMS

(CON'T)

- SUBSEQUENT WELDED INTERNALS

- TIME TO FAILURE CONSERVATIVELY CALCULATED AT 2 MIN. 8 SEC. (WESTINGHOUSE AND PACIFIC CONCUR WITH REASONABLENESS OF THE TIME FRAME)


DISCHARGE
INTERMEDIATE COVER
INTERMEDIATE COVER
SUCTION SPACER
DIFFUSER
DISCHARGE DIFFUSER
IMPELLER
LAST STAGE
(DISCHARGE)
IMPELLER
FLOW
BALANCING DRU
FIRST STAGE
(SUCTION)
IMPELLER
TO DISCHARGE NOZZLE
AREA OF PREDICTED FAILURE DUE TO VAPORIZATION
OF FLUID (LOSS-OF-SUCTION) AND/OR WELDING OF AN
IMPELLER O.D. TO DIFFUSER/SPACER DUE TO THERMAL
EXPANSION

FREEZE PROTECTION DESIGN

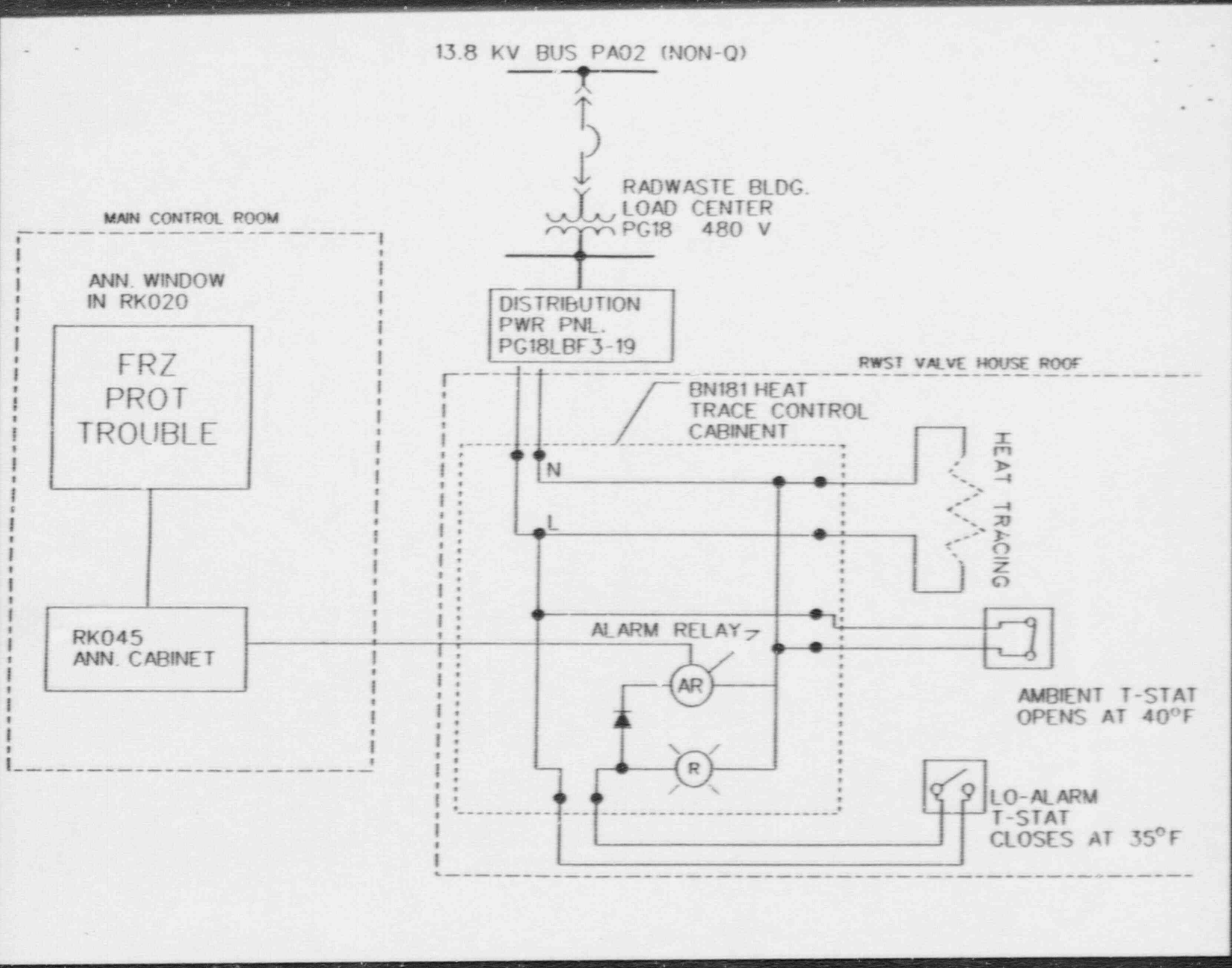
- OUTDOOR FREEZE PROTECTION

  4 SYSTEMS (DEMIN/AN, CONDENSATE/AD, RX MAKEUP/BL, & RWST/BN)

- HEAT TRACE

- INSULATION

- SURVEILLANCES


13.8 KV BUS PA02 (NON-Q)
RADWASTE BLDG.
LOAD CENTER
PG18 480 V
MAIN CONTROL ROOM
ANN. WINDOW
IN RK020
FRZ
PROT
TROUBLE
RK045
ANN. CABINET
DISTRIBUTION
PWR PNL.
PG18LBF3-19
RWST VALVE HOUSE ROOF
BN181 HEAT
TRACE CONTROL
CABINENT
N
L
HEAT TRACING
ALARM RELAY
AR
R
AMBIENT T-STAT
OPENS AT 40°F
LO-ALARM
T-STAT
CLOSES AT 35°F

CREDIBLE FREEZE PROTECTION FAILURE MECHANISMS

(ELECTRICAL & MECHANICAL)

- KEY ELECTRICAL COMPONENTS

- INSULATION SYSTEM INTEGRITY

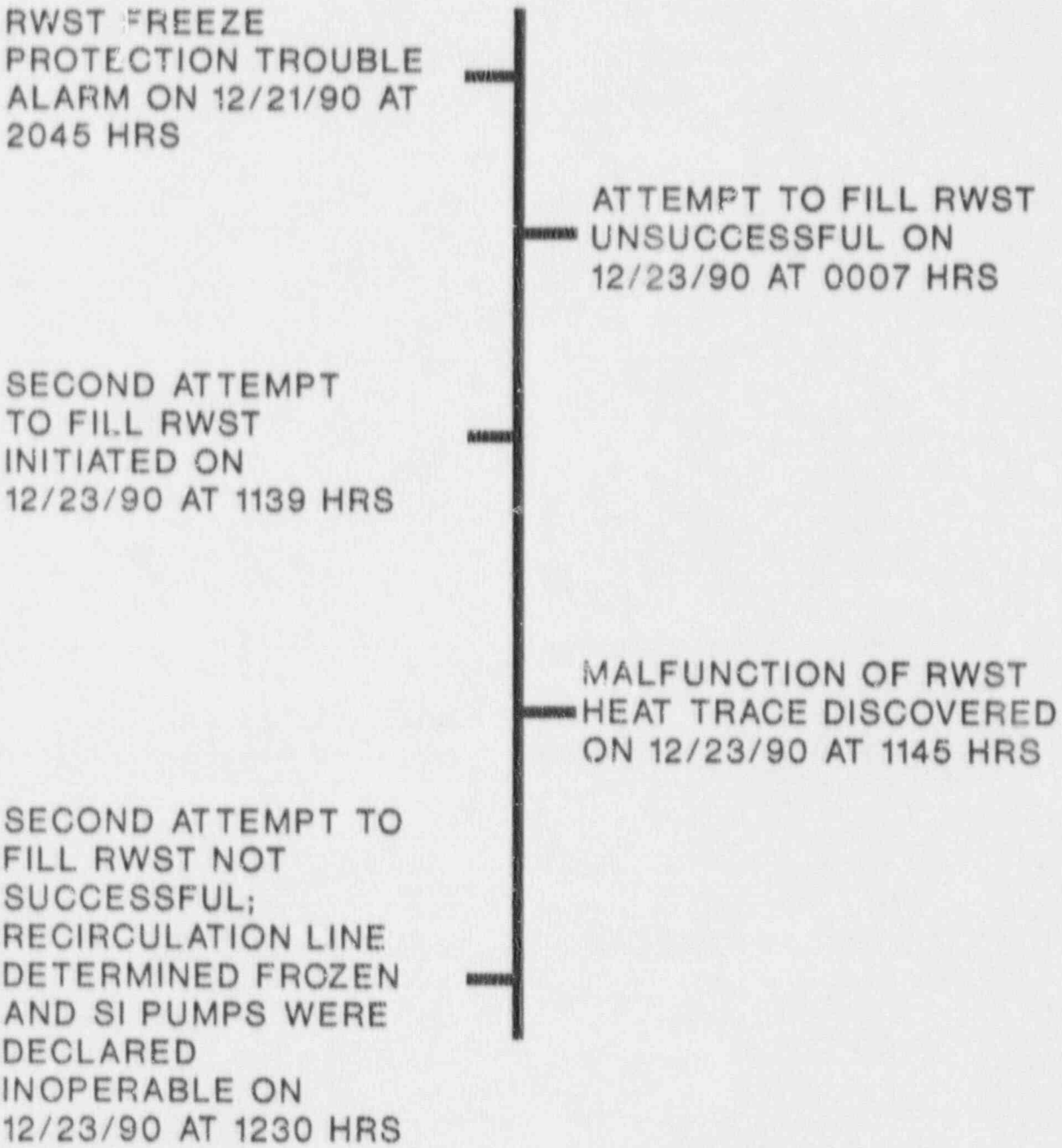
- LACK OF SUFFICIENT ADMINISTRATIVE CONTROLS

TECHNICAL SPECIFICATION 3.5.2

REQUIRES OPERABILITY OF TWO INDEPE[illegible]NT ECCS SUBSYSTEMS. EACH SUBSYSTEM COMPRISED OF:

- ONE CENTRIFUGAL CHARGING PUMP
- ONE SAFETY INJECTION PUMP
- ONE RESIDUAL HEAT REMOVAL PUMP AND HEAT EXCHANGER
- A SUCTION FLOW PATH FROM THE RWST CAPABLE OF TRANSFERRING SUCTION TO THE CONTAINMENT SUMP

SEQUENCE OF EVENTS



SEQUENCE OF EVENTS

- On December 20 and 21, 1990, the Control Room received freeze protection trouble alarms for several outside water storage tanks.
  - On December 20, 1990, at 2203 CST, a Freeze Protection Trouble Alarm was received. Alarm was on the Demineralized Water Storage Tank.
  - On December 21, 1990, at 0357 CST, alarm was received on the Condensate Storage Tank. At 1454 CST, alarm was received on the Reactor Makeup Water Storage Tank.
- The Freeze Protection Panel breakers were verified to be closed by Operations per procedure and the current flow in the heat trace was verified for the affected circuits by Electrical Maintenance at the request of Operations.
- On December 21, 1990, at 2046 CST, the Control Room received a freeze protection trouble alarm for the Refueling Water Storage Tank (RWST).
- The evening shift for Electrical Maintenance on December 21, 1990 was different than the previous two days. It appears that the Control Room personnel did not emphasize the need to check the current on the RWST heat tracing because they knew Electrical Maintenance personnel had been doing it the previous two days and assumed some turnover would have occurred. The major discussion with Electrical Maintenance personnel on that evening was focused on how the alarm circuit worked and whether there was a reflash on that alarm.
- Electrical Maintenance concluded that if an alarm on the heat trace circuit was in and a breaker feeding the heat trace were to trip, a "reflash" would not occur on the locked in alarm.

SEQUENCE OF EVENTS

- Th Control Room then began to check the circuit breakers approximately every four hours to ensure that the breakers were closed.
- On December 22, 1990 at 1206 CST, a RWST low level alarm was received. The Auxiliary Building Watch was dispatched to check for leaks and also to check the heat tracing.
- On December 23, 1990 at 0007 CST, an unsuccessful attempt was made to add water to the RWST following a low level alarm.
- In the process of determining why no flow was indicated, Operations personnel discovered a Work Request Tag on Valve BGV0195 stating that the valve stem was believed to be separated from the valve diaphragm. Based on past experience of having problems with getting flow through BGV0195 when it had similar problems, this was believed to be the reason for no flow at this time.
- Because the RWST level was still substantially above the minimum required level, it was decided to wait until dayshift to have the problem with the valve further evaluated.
- The dayshift crew decided to try to fill the RWST using an alternate flow path and to have Electrical Maintenance verify the operations of the heat trace circuits.
- At 1139 CST, the dayshift crew started the lineup to fill the RWST through an alternate flow path, which did not require flow through Isolation Valve BGV0195.
- At 1145 CST, Electrical Maintenance determined that the heat tracing on the RWST return line had a faulty Ambient Temperature Switch and that no current existed in the heat tracing.

SEQUENCE OF EVENTS

- At 1230 CST, after the attempt to fill the RWST failed, the RWST return line was determined to be frozen and therefore unable to fulfill its function as a recirculation line for both SI pumps. Both SI pumps were declared inoperable and Technical Specification 3.0.3 was entered.

IMMEDIATE ACTIONS

- BOTH SI PUMPS WERE PLACED IN "PULL-TO-LOCK" AT 1250 CST AND AN OPERATOR WAS ASSIGNED TO OPERATE THE SI PUMPS IN THE EVENT THAT FLOW FROM THE SI PUMPS WAS NEEDED

- A JUMPER WAS INSTALLED ACROSS THE INOPERABLE AMBIENT TEMPERATURE SWITCH TO PROVIDE POWER TO THE HEAT TRACE

- A TEMPORARY EXTERNAL HEAT SOURCE WAS USED ON THE FROZEN SECTION OF THE PIPE

- THE FUEL POOL COOLING PUMPS WERE USED TO PROVIDE INTERNAL PRESSURE TO THE BLOCKAGE. FUEL POOL CLEANUP PUMPS CYCLED ON/OFF TO GIVE AN ADDITIONAL PRESSURE SURGE

IMMEDIATE ACTIONS
(CON'T)

- AT 1600 CST, THE PLANT DECLARED A NOTIFICATION OF UNUSUAL EVENT AND BEGAN TO REDUCE POWER

- AT 1702 CST, FLOW WAS ESTABLISHED TO THE RWST FROM THE FUEL POOL COOLING PUMPS AND REACTOR POWER WAS STABILIZED AT 85 PERCENT WHILE VERIFYING SI PUMP RECIRCULATION FLOW

- AT 1705 POWER REDUCTION STOPPED PENDING SI PUMP FLOW VERIFICATION

- RECIRCULATION FLOW FOR SI PUMP PEM01A WAS VERIFIED AT 1735 CST PER SURVEILLANCE PROCEDURE STS EM-100A AND TECHNICAL SPECIFICATION 3.0.3 WAS EXITED

IMMEDIATE ACTIONS
(CON'T)

- TECHNICAL SPECIFICATION 3.5.2 WAS THEN ENTERED FOR HAVING ONE EMERGENCY CORE COOLING SYSTEM SUBSYSTEM INOPERABLE AND THE NOTIFICATION OF UNUSUAL EVENT WAS TERMINATED

- RECIRCULATION FLOW FOR SI PUMP PEM01B WAS VERIFIED AT 1757 CST PER SURVEILLANCE PROCEDURE STS EM-100B AND TECHNICAL SPECIFICATION 3.5.2 WAS THEN EXITED

- AT 2235 CST, REACTOR POWER WAS RESTORED TO 100 PERCENT

SUBSEQUENT ACTIONS

- ELECTRICAL MAINTENANCE WAS INSTRUCTED TO VERIFY THE CURRENT FLOW IN ALL HEAT TRACE CIRCUITS EVERY FOUR HOURS TO CONFIRM PROPER OPERATION WHILE ANY ALARM EXISTED

- A REVIEW WAS CONDUCTED TO DETERMINE IF THERE WERE OTHER SIMILAR PUMP ARRANGEMENTS IN WHICH A HEAT TRACED LINE COULD FREEZE AND PREVENT RECIRCULATION CAPABILITIES OF PUMPS AND NONE WERE FOUND

- A NEW AMBIENT TEMPERATURE SWITCH WAS SUBSEQUENTLY INSTALLED TO REPLACE THE TEMPORARY JUMPER AT 1340 CST ON DECEMBER 24, 1990

SUBSEQUENT ACTIONS
(CON'T)

- THE RWST WAS PLACED IN RECIRCULATION

- ENGINEERING WAS REQUESTED TO EVALUATE THE EFFECTS OF FREEZING ON PIPE STRUCTURE AND TO REVIEW DESIGN ASPECTS OF LINE

ROOT CAUSE AND LONG TERM CORRECTIVE ACTIONS

- AMBIENT TEMPERATURE SWITCH
- ADMINISTRATIVE CONTROLS
- COMMUNICATIONS
- PREVENTATIVE MAINTENANCE
- DESIGN ENHANCEMENTS

EVALUATION APPROACH

- REVIEW FUNCTIONAL REQUIREMENTS OF IHSI PUMPS TO MITIGATE CONSEQUENCES OF DESIGN BASIS ACCIDENTS

- IDENTIFY USAR LICENSING BASIS ANALYSES IMPACTED BY THE RETURN LINE FREEZE CONDITION

- EVALUATE AFFECTED DESIGN BASIS ACCIDENTS TO ASSESS THE CONSEQUENCES

- CONCLUSIONS

FUNCTIONAL REQUIREMENTS

- ECCS PRIMARY FUNCTIONS:

  1. PROVIDE EMERGENCY CORE COOLING FOR A DECREASE IN REACTOR COOLANT RESULTING FROM A LOCA
  2. PROVIDE EMERGENCY BORATION FOR AN EXCESSIVE COOLDOWN EVENT

- ECCS IS DESIGNED TO COOL THE REACTOR CORE AND PROVIDE SHUTDOWN CAPABILITY FOR:

  1. LOCA
  2. ROD EJECTION ACCIDENT
  3. SECONDARY SYSTEM PIPE RUPTURE ACCIDENT
  4. STEAM GENERATOR TUBE RUPTURE ACCIDENT

AFFECTED DESIGN BASIS ACCIDENTS

THE AFFECTED SAFETY ANALYSES ARE THOSE WHICH CREDIT THE ACTUATION OF SAFETY INJECTION FLOW:

- LOCA SPECTRUM
- FEEDWATER LINE BREAK ACCIDENT
- STEAM LINE BREAK ACCIDENT - CORE RESPONSE
- STEAMLINE BREAK ACCIDENT - M & E RELEASE IN CONTAINMENT
- STEAMLINE BREAK ACCIDENT - M & E RELEASE OUTSIDE CONTAINMENT
- STEAM GENERATOR TUBE RUPTURE ACCIDENT
- INADVERTENT OPENING OF STEAM GENERATOR RELIEF OR SAFETY VALVE

CONSEQUENCE EVALUATION

- FEEDWATER LINE BREAK ACCIDENT:

  POTENTIAL IHSI PUMP DAMAGE

  NO IMPACT TO THE CONSEQUENCES SINCE THE IHSI PUMP WAS NOT CREDITED

- STEAMLINE BREAK ACCIDENT - CORE RESPONSE:

  NO IHSI PUMP DAMAGE

  NO IMPACT TO THE CONSEQUENCES SINCE THE IHSI PUMP WAS NOT CREDITED

- STEAMLINE BREAK ACCIDENT - M & E RELEASE IN CONTAINMENT:

  POTENTIAL IHSI PUMP DAMAGE

  NO IMPACT TO THE CONSEQUENCES SINCE THE IHSI PUMP WAS NOT CREDITED

CONSEQUENCE EVALUATION

- STEAMLINE BREAK ACCIDENT - M & E OUTSIDE CONTAINMENT:

  POTENTIAL IHSI PUMP DAMAGE

  NO IMPACT TO THE CONSEQUENCES SINCE THE IHSI PUMP WAS NOT CREDITED

- STEAM GENERATOR TUBE RUPTURE ACCIDENT:

  POTENTIAL IHSI PUMP DAMAGE

  MAXIMIZING SAFETY INJECTION FLOW MAXIMIZES THE CONSEQUENCES

  THUS LOSS OF IHSI PUMP FLOW WOULD RESULT IN LESS SEVERE CONSEQUENCES

- INADVERTENT OPENING OF A STEAM GENERATOR RELIEF OR SAFETY VALVE:

  NO IHSI PUMP DAMAGE

  NO IMPACT TO THE CONSEQUENCES SINCE THE IHSI PUMP WAS NOT CREDITED

CONSEQUENCE EVALUATION

- LARGE BREAK LOCA:

  (BREAK SIZES GREATER THAN 1 FT.^{2})

  THESE EVENTS ARE CHARACTERIZED BY A RAPID DEPRESSURIZATION

  NO IHSI PUMP DAMAGE

  THE IHSI PUMPS PROVIDE AN INSIGNIFICANT PROPORTION OF THE TOTAL SI FLOW

  THEREFORE CONSEQUENCES ARE NOT AFFECTED

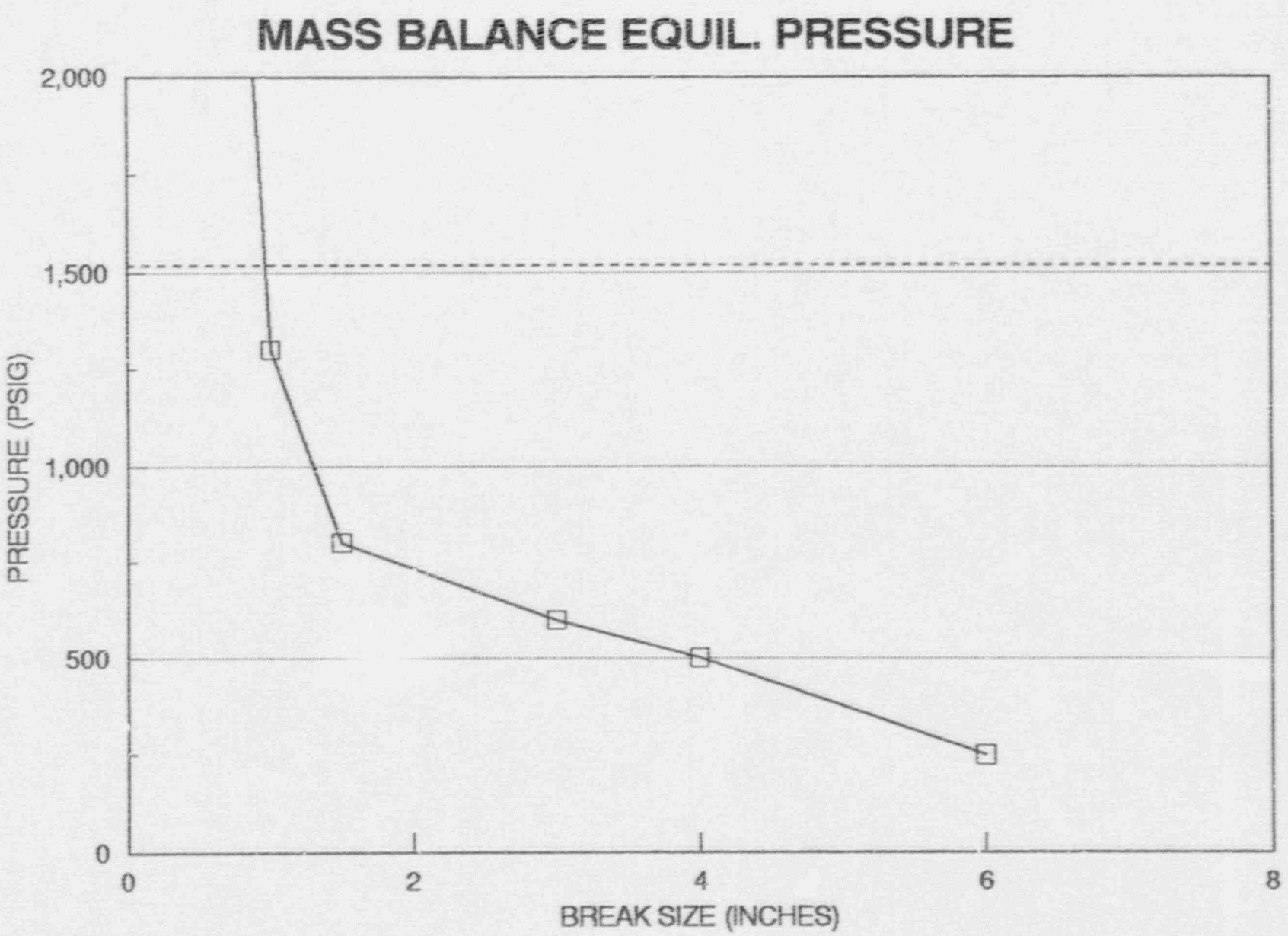
CONSEQUENCE EVALUATION

- SMALL BREAK LOCA - BREAKS LESS THAN 1":

  EQUILIBRIUM PRESSURE GREATER THAN IHSI PUMP CUT-IN PRESSURE

  POTENTIAL IHSI PUMP DAMAGE

  CONSEQUENCES ARE NOT ADVERSELY AFFECTED


MASS BALANCE EQUIL. PRESSURE
2,000
1,500
1,000
500
0
PRESSURE (PSIG)
0
2
4
6
8
BREAK SIZE (INCHES)

CONSEQUENCE EVALUATION

- SMALL BREAK LOCA -
  BREAKS GREATER THAN 1.75":

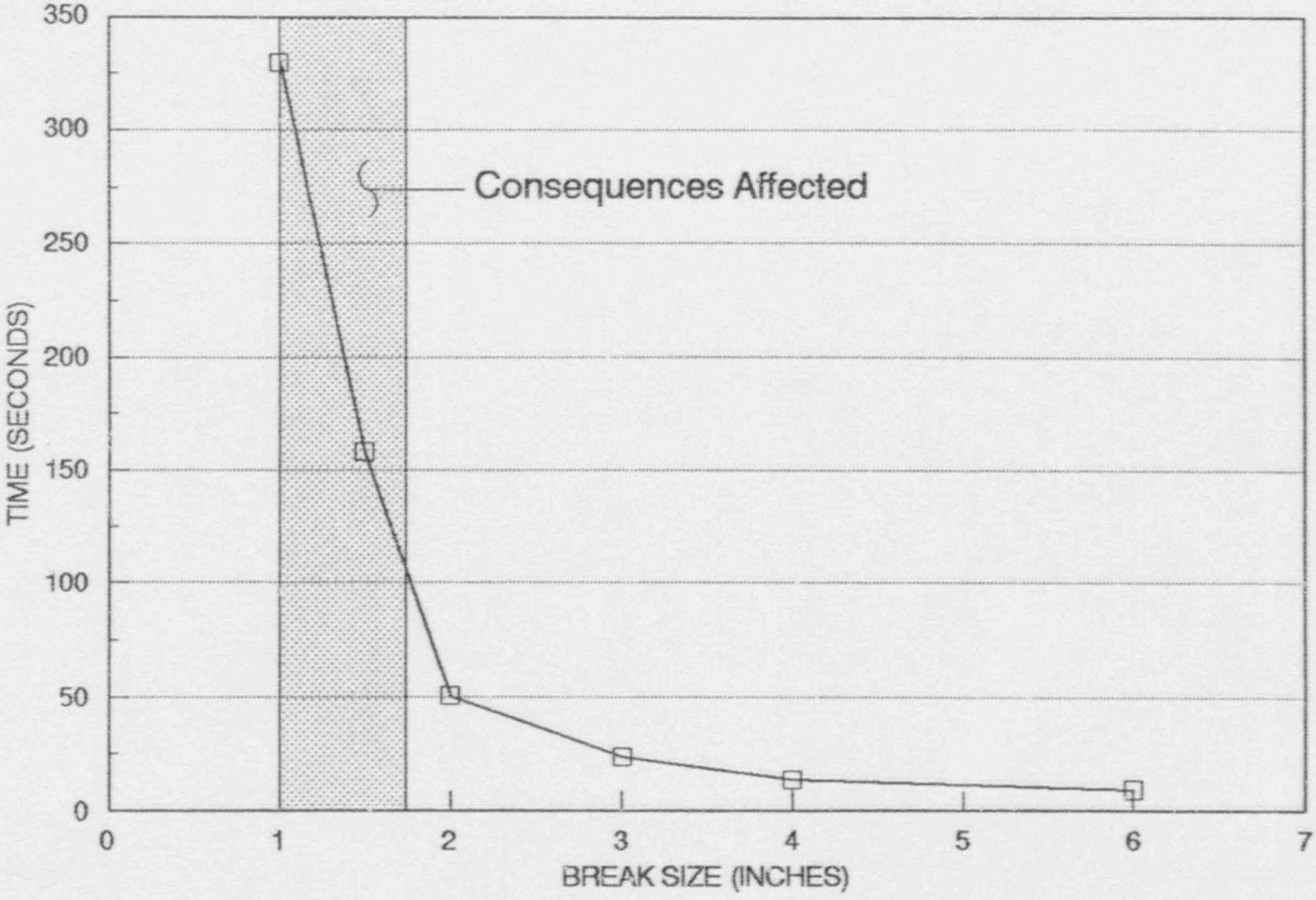
  EQUILIBRIUM PRESSURE BELOW
  IHSI PUMP CUT-IN PRESSURE

  RCS WILL DEPRESSURIZE BELOW
  IHSI PUMP CUT-IN PRESSURE
  WITHIN 2 MINUTES

  NO IHSI PUMP DAMAGE

  THEREFORE CONSEQUENCES ARE
  UNAFFECTED

DELTA TIME TO REACH IHSIP CUT-IN PRESSURE



CONSEQUENCE EVALUATION

- SMALL BREAK LOCA - BREAKS BETWEEN 1" AND 1.75":

  EQUILIBRIUM PRESSURE BELOW IHSI PUMP CUT-IN PRESSURE

  RCS DEPRESSURIZATION TO IHSI PUMP CUT-IN PRESSURE GREATER THAN 2 MINUTES

  POTENTIAL IHSI PUMP DAMAGE

  CONSEQUENCES ADVERSELY AFFECTED

CONSEQUENCE EVALUATION

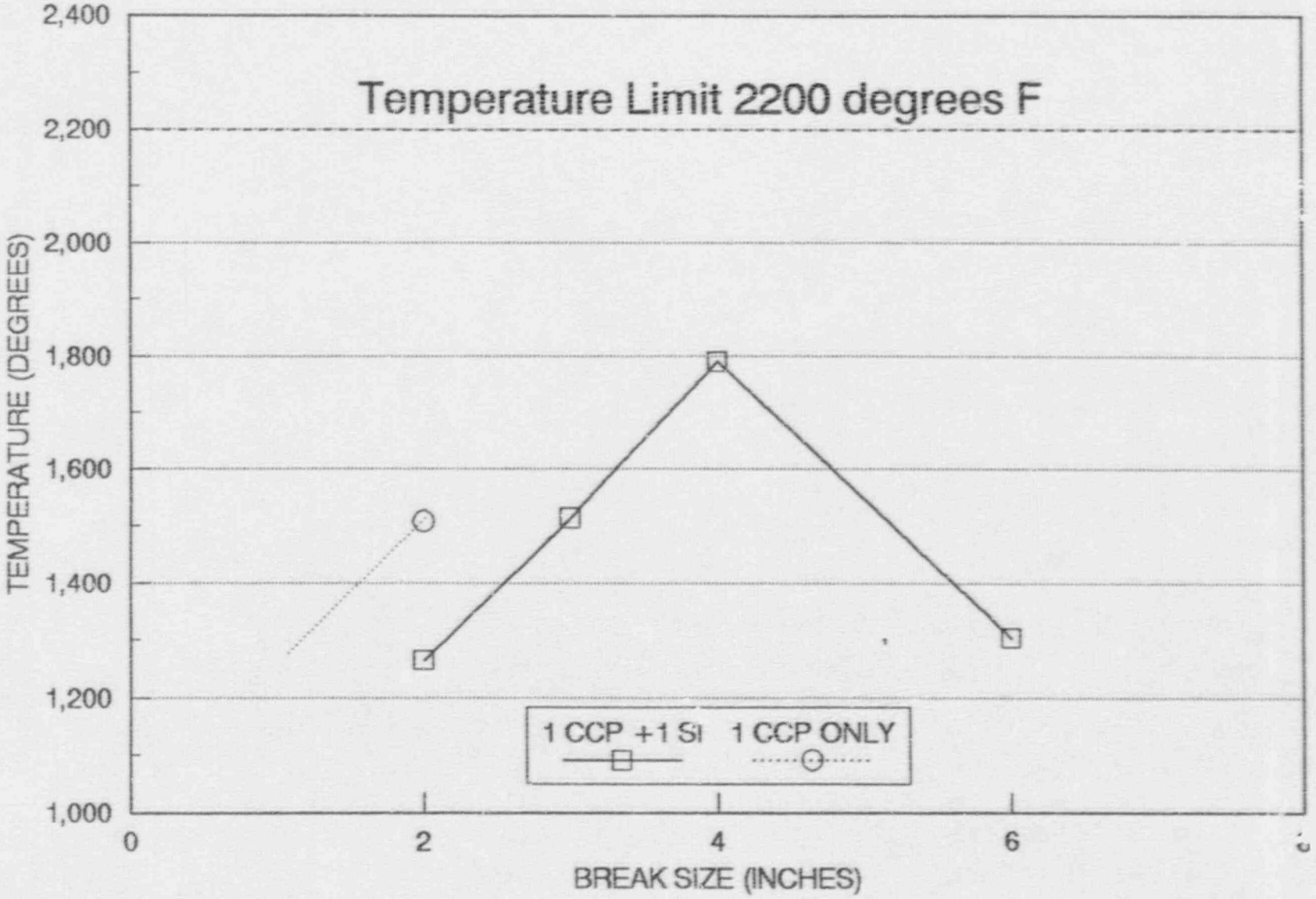
- CONSEQUENCES OF LOCAS BETWEEN 1" AND 1.75":

EVALUATION BASED ON A 2" LOCA AND WILL BOUND ALL BREAK SIZES BETWEEN 1" AND 1.75"

ONLY 1 CCP ASSUMED AVAILABLE

NOTRUMP ANALYSIS OF A 2" LOCA RESULTS IN LESS THAN 2200 DEGREES F PCT

PEAK CLAD TEMPERATURE



CONCLUSIONS

- EVALUATION AND ANALYSIS HAVE DEMONSTRATED THAT FOR ALL AFFECTED ACCIDENTS THE CONCLUSIONS IN THE USAR REMAIN VALID

- ECCS CONTINUES TO COOL THE REACTOR CORE

- ECCS WILL PROVIDE SHUTDOWN CAPABILITY FOR:

  1. LOCA
  2. ROD EJECTION ACCIDENT
  3. SECONDARY SYSTEM PIPE RUPTURE ACCIDENT
  4. STEAM GENERATOR TUBE RUPTURE ACCIDENT