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

July 28, 1988

Docket Nos. 50-312, 346, 269, 270, 287, 313, 289 and 302

FACILITIES: RANCHO SECO
OCONEE
ARKANSAS NUCLEAR ONE, UNIT 1
THREE MILE ISLAND, UNIT 1
CRYSTAL RIVER 3
DAVIS-BESSE

LICENSEES: SACRAMENTO MUNICIPAL UTILITY DISTRICT
DUKE POWER
ARKANSAS POWER & LIGHT
GPU NUCLEAR
FLORIDA POWER CORPORATION
TOLEDO EDISON

SUBJECT: SUMMARY OF MEETING HELD WITH B&W OWNERS GROUP ON JULY 14, 1988 RE: GL 87-12, "LOSS OF RHR WHILE THE REACTOR COOLANT SYSTEM IS PARTIALLY FILLED"

On July 14, 1988, the NRC staff met with representatives of the B&W Owners Group to discuss industry and NRC actions to resolve the issues raised in Generic Letter 87-12. Persons attending the meeting are identified in Enclosure 1. Viewgraphs presented at the meeting by the NRC staff are contained in Enclosure 2.

The purpose of the meeting was to emphasize the importance of the issues raised in GL 87-12 and to discuss both short-term and longer-term actions that the NRC staff is considering. The meeting provided an opportunity for the B&W Owners Group to comment on the various actions that are being considered. The NRC staff believes that inadequate attention has been given by licensees to this mode of operation, that responses to GL 87-12 were generally inadequate, and prompt action is needed to reduce the probability of losses of decay heat removal in this mode of operation.

The short-term actions being considered are containment closure prior to the time core damage could occur, providing RCS temperature instrumentation, improved level instrumentation, holding off on any maintenance that could potentially perturb RCS water inventory, assuring that backup cooling equipment is available, controlling hot leg and cold leg closure such that rapid RCS level changes cannot occur (steam pressurization), and crew briefings with operating staffs of the Diablo Canyon event of April 10, 1987 (NUREG-1269) and other events.

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Programmed enhancements for the longer term include permanent improved instrumentation, analyses, and technical specification changes where impacts are identified with respect to the recommended enhancements.

B&W plants are less vulnerable to core uncovery while drained down because the core flood check valves prevent differential pressure from developing across the internals and therefore prevent early core uncovery due to steam pressurization. Also, B&W plants do not drain down to the mid-loop level often. Other differences are shown on Enclosure 3.

The B&W Owners Group felt that, because of these differences and the fact that only momentary losses of DHR flow have occurred at B&W plants, B&W plants should either be excluded from the letter NRC is considering or the more forgiving design appropriately noted.

The Group also recommended that the usual Technical Specification definition of containment closure (for fuel movement) should be adequate for a definition of containment closure in the event of a total loss of decay heat removal ability.

Charles M. Trammell

Charles M. Trammell, Senior Project Manager
Project Directorate V
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Enclosure:
1. Attendees
2. Staff Viewgraphs
3. B&W Design Differences

cc: w/enclosures
See next page

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Enclosure 1

ECCS CC
Meeting
7-1-14

Name	Affiliation
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ASHOK THADANI	NRR/DEST
Tim Martin	NRC/NRR/ADT
Robert Wright	NRR/DRSP
CRAIG HARBUCK	NRR/DRSP
Wayne Hodges	NRR/DEST/SRXB
Robert Jones	NRR/DEST/SRXB
Alfred Spano	RES/DRPS/RPSIB
Jerry Mazetis	RES/DRPS/RPSIB
Mike Waterman	INEL/EG&G Idaho CNRA
Wayne Morgan	Duke Power/OPS Eng/Oconee
S.A. Holland	Duke Power Co. - Nuclear operation
Dan Williams	Arkansas Power & Light Co.
RICHARD B. THORNTON	ARKANSAS POWER & LIGHT
Larry Reed	DUKE POWER CO - ONS
J.H. TAYLOR	B&W
Roger Huston	NUMARC
Robert L. Black	B&W
Paul Guill	Duke Power
LOUIS SIMON	TOLEDO EDISON

OPERATION UNDER SHUTDOWN COOLING CONDITIONS

JULY 14, 1988

STAFF PRESENTATION TO

BABCOCK AND WILCOX

OWNERS REPRESENTATIVES

WAYNE HODGES

CHIEF, REACTOR SYSTEMS BRANCH

ISSUE

WE ARE SERIOUSLY CONCERNED THAT PWR OPERATION DURING DECAY HEAT REMOVAL SYSTEM COOLING IS A SIGNIFICANT CONTRIBUTOR TO THE LIKELIHOOD OF A RELEASE DUE TO A CORE DAMAGE ACCIDENT

OVERVIEW

I. BACKGROUND

II. CORRECTIVE ACTIONS

III. FUTURE STAFF ACTION

I. BACKGROUND

A. EXPERIENCE
B. PHENOMENA
C. PROBABILISTIC RISK ANALYSIS (PRA)
D. GENERIC LETTER (GL) 87-12
E. SERIOUS DEFICIENCIES
F. REDUCED RCS INVENTORY OPERATION

A. EXPERIENCE

ACCIDENTS CONTINUE TO INITIATE AT AN UNACCEPTABLY HIGH RATE. TWO REPORTED IN MAY. NUMEROUS PUBLICATIONS AND MEETINGS HAVE NOT LED TO SOLUTION.

B. PHENOMENA

PHENOMENA IDENTIFIED WHICH POTENTIALLY LEAD TO SEVERE CORE DAMAGE IN SHORTER TIME THAN PREVIOUSLY BELIEVED. OTHER "NEW" PHENOMENA AFFECT THE REACTOR COOLANT SYSTEM (RCS), DECAY HEAT REMOVAL (DHR) SYSTEM, INSTRUMENTATION AND OTHER EQUIPMENT.

C. PRA

LIKELIHOOD OF RELEASE DUE TO CORE DAMAGE ACCIDENT DURING DECAY HEAT REMOVAL OPERATION IS OF CONCERN.

D. GL 87-12

a. NO RESPONSES FULLY SATISFACTORY. SOME LICENSEES UNSATISFACTORY IN EVERY ONE OF 12 CATEGORIES EVALUATED. SERIOUS LACK OF UNDERSTANDING AND INADEQUATE PREPARATION FOR OPERATION IDENTIFIED. SOME LICENSEES NOT TAKING CORRECTIVE ACTION OF ANY KIND.

D. GL 87-12 - cont

b. INDIVIDUAL LICENSEES HAVE SHOWN EXCELLENT INSIGHT INTO SELECTED AREAS SUCH AS RCS DRAINING, CONTAINMENT CLOSURE, INSTRUMENTATION, DHR SYSTEM OPERATION, OTHERS. INFORMATION IS NOT EFFECTIVELY SHARED.

D. GL 87-12 - cont

FOR EXAMPLE, DIABLO CANYON HAS RESPONDED TO CONCERNS AND ADDRESSED SUCH ITEMS AS:

1. CONTAINMENT CLOSURE
2. LEVEL INDICATION IN CONTROL ROOM
3. RCS TEMPERATURE INDICATION
4. PREVENTION OF RCS PERTURBATIONS
5. RHR PROCEDURES
6. BACKUP EQUIPMENT
7. ANALYSES
8. QUALITY CONTROL AND FOLLOWUP
9. PROCEDURES
10. OTHERS

E. SERIOUS DEFICIENCIES

1. EVENTS CONTINUE TO INITIATE WHICH HAVE POTENTIAL TO BECOME SERIOUS

2. MITIGATION PLANNING TO PREVENT CORE DAMAGE IS OFTEN POOR

3. PLANNING TO PREVENT A RELEASE SHOULD CORE DAMAGE OCCUR IS OFTEN NONEXISTENT

4. ANALYSES OFTEN NONEXISTENT. PLANTS OPERATED IN UNANALYZED AREAS WHERE IMPLICATIONS NOT UNDERSTOOD.

5. MANY MORE ....

F. REDUCED RCS INVENTORY OPERATION

1. LOSS OF DHR A FREQUENT OCCURRENCE

2. ONE THIRD (40) HAVE OCCURRED DURING REDUCED INVENTORY OPERATION

5. REDUCED RCS INVENTORY OPERATION-CONT

3. THIS IS OF SERIOUS CONCERN BECAUSE:

A. TWO FISSION PRODUCT BARRIERS TYPICALLY ALREADY BREACHED (RCS PRESSURE BOUNDARY AND CONTAINMENT)

B. LOSS OF DHR CHALLENGES THE THIRD BARRIER

F. REDUCED RCS INVENTORY OPERATION-cont

3. CONCERN - con't

C. POOR QUALITY TEMPORARY INSTRUMENTATION USED

D. MUCH INSTRUMENTAITON AND EQUIPMENT UNAVAILABLE

E. PROCEDURES POOR, SOMETIME NONEXISTENT

F. RCS CONDITIONS HAVE NOT BEEN ANALYZED AND NOT UNDERSTOOD

F. REDUCED RCS INVENTORY OPERATION-CONT

4. EVENTS ORIGINATING DURING LOWERED INVENTORY OPERATION CONTRIBUTE SIGNIFICANTLY TO THE LIKELIHOOD OF A SEVERE CORE DAMAGE ACCIDENT AND ARE OF SERIOUS CONCERN ALTHOUGH OTHER REGIONS MUST ALSO BE ADDRESSED.

II. CORRECTIVE ACTIONS

A. APPROACH

B. EXPEDITIOUS ACTIONS

C. PROGRAMMED ENHANCEMENTS

A. APPROACH

1. SOME REDUCTION IN CORE DAMAGE LIKELIHOOD – "EXPEDITIOUS ACTIONS" ACCOMPLISH IMMEDIATE, EFFECTIVE REDUCTION IN LIKELIHOOD OF RELEASE IF CORE DAMAGE ACCIDENT OCCURS

2. SIMULTANEOUSLY INITIATE ACTIONS WHICH TAKE A LONGER TIME TO DEVELOP – "PROGRAMMED ENHANCEMENTS"

3. MODIFY EXPEDITIOUS ACTIONS AS APPROPRIATE AS PROGRAMMED ENHANCEMENTS BECOME AVAILABLE

II. CORRECTIVE ACTIONS

A. APPROACH

B. EXPEDITIOUS ACTIONS

1. ASSURE CONTAINMENT CLOSURE
2. PROVIDE RCS TEMPERATURE
3. PROVIDE LEVEL INFORMATION
4. DO NOT PERTURB RCS
5. ASSURE BACKUP COOLING EQUIPMENT
6. CONTROL HOT AND COLD LEG CLOSURE
7. DISCUSS DIABLO CANYON IMPLICATIONS WITH OPERATION STAFF

C. PROGRAMMED ENHANCEMENTS

1. ASSURE CONTAINMENT CLOSURE

a. DEVELOP PROCEDURES TO REASONABLY ASSURE CONTAINMENT CLOSURE PRIOR TO THE TIME A CORE DAMAGE ACCIDENT CAN OCCUR FOLLOWING LOSS OF DECAY HEAT REMOVAL.

b. IMPLEMENT PROCEDURES WHEN DRAINING RCS WHILE LEVEL IS BELOW TOP OF REACTOR VESSEL OR WHILE OPERATING IN A REDUCED INVENTORY CONDITION.

c. IF CONTAINMENT CANNOT BE CLOSED PRIOR TO REACHING CORE DAMAGE, THEN PENETRATIONS CAUSING CLOSURE FAILURE SHOULD NOT BE OPENED.

2. PROVIDE RCS TEMPERATURE

A. PROVIDE TWO TEMPERATURES REPRESENTATIVE OF CORE EXIT WHENEVER RCS WATER LEVEL AT OR BELOW LEVEL OF TOP OF HOT LEGS AT THE REACTOR VESSEL

B. EITHER BE ABLE TO MONITOR IN CONTROL ROOM OR FROM LOCATION OUTSIDE OF CONTAINMENT BUILDING WITH CONTINUOUS COMMUNICATION CAPABILITY TO OPERATOR

3. PROVIDE LEVEL INFORMATION

APPLICABLE TO PLANTS THAT DO NOT HAVE LEVEL INDICATION IN THE CONTROL ROOM

PROVIDE ESSENTIALLY CONTINUOUS COMMUNICATION OF WATER LEVEL INFORMATION TO THE OPERATORS WHENEVER EITHER:

1. BOTH CONTAINMENT CONDITIONS PERMIT LOCAL OBSERVATION AND RCS LEVEL IS AT OR BELOW THE LEVEL OF THE TOP OF THE HOT LEGS AT THE REACTOR VESSEL

2. IF DRAINING RCS, THEN RCS LEVEL BELOW TOP OF REACTOR VESSEL.

4. DO NOT PERTURB RCS

DO NOT ALLOW PERTURBATION OF THE RCS AND/OR SYSTEMS USED TO MAINTAIN THE RCS IN A STABLE AND CONTROLLED CONDITION WHILE DRAINING RCS OR AT REDUCED RCS INVENTORY.

5. ASSURE BACKUP COOLING EQUIPMENT

a. IN ADDITION TO NORMAL CHR SYSTEM, PROVIDE SEVERAL INDEPENDENT MEANS OF ADDING INVENTORY TO THE RCS DURING REDUCED INVENTORY OPERATION.

b. WATER ADDITION RATE OF EACH MEANS TO BE SUFFICIENT TO MAINTAIN CORE IN A COVERED CONDITION.

6. CONTROL HOT AND COLD LEG CLOSURE.

ESSENTIALLY DO NOT SIMULTANEOUSLY BLOCK ALL HOT LEGS UNLESS A VENT PATH IS PROVIDED TO THE REACTOR VESSEL UPPER PLENUM THAT IS LARGE ENOUGH TO PREVENT RCS PRESSURIZATION.

7. DISCUSS DIABLO CANYON EVENT WITH OPERATIONS STAFF

a. EVENT
b. LESSONS LEARNED
c. IMPLICATIONS FOR LICENSEE PLANT

C. PROGRAMMED ENHANCEMENTS

1. INSTRUMENTATION
2. PROCEDURES
3. EQUIPMENT
4. ANALYSES
5. TECHNICAL SPECIFICATIONS

PROCEDURES ARE CONSIDERED TO REPRESENT THE LARGEST EFFORT, FOLLOWED BY ANALYSES. WE HAVE MINIMIZED INSTRUMENTATION RECOMMENDATIONS TO THE MINIMUM BELIEVED NECESSARY, AND WE ANTICIPATE EXISTING EQUIPMENT IS SUFFICIENT TO MEET RECOMMENDATIONS.

B. EXPEDITIOUS ACTIONS

1. CONTAINMENT CLOSURE
2. RCS TEMPERATURE
3. RCS LEVEL
4. DO NOT PERTURB RCS
5. BACKUP EQUIPMENT
6. HOT AND COLD LEG CLOSURE
7. DISCUSS DIABLO CANYON IMPLICATIONS WITH OPERATIONS STAFF

C. PROGRAMMED ENHANCEMENTS

1. INSTRUMENTATION
2. PROCEDURES
3. EQUIPMENT
4. ANALYSES
5. TECHNICAL SPECIFICATIONS

C. PROGRAMMED ENHANCEMENTS

1. INSTRUMENTATION
   a. RCS LEVEL
   b. RCS TEMPERATURE
   c. DHR SYSTEM MONITORING
   d. ABNORMAL CONDITION INDICATIONS

1. INSTRUMENTATION — GENERAL

RELIABLE INDICATIONS TO BE PROVIDED IN THE CONTROL ROOM UNDER NORMAL AND ACCIDENT CONDITIONS WHENEVER IRRADIATED FUEL IS IN REACTOR VESSEL.

RELIABLE MEANS THE ITEM CAN BE REASONABLY EXPECTED TO PERFORM ITS INTENDED FUNCTION. CONTROL GRADE WILL GENERALLY MEET THIS REQUIREMENT. UNDER SOME CIRCUMSTANCES, A LESSER QUALITY IS SUFFICIENT.

1. INSTRUMENTATION -- cont

a. RCS LEVEL

PROVIDE TWO INDEPENDENT RCS LEVEL INDICATIONS IN THE CONTROL ROOM.

b. RCS TEMPERATURE

CONTINUOUSLY DISPLAY TWO TEMPERATURE INDICATIONS WHENEVER REACTOR VESSEL HEAD IS LOCATED ON TOP OF THE REACTOR VESSEL.

1. INSTRUMENTATION — cont

c. DHR MONITORING

PROVIDE THE CAPABILITY OF MONITORING DHR SYSTEM PERFORMANCE WHENEVER A DHR SYSTEM IS IN USE FOR COOLING THE RCS.

d. ABNORMAL CONDITION INDICATIONS

PROVIDE VISUAL AND AUDIBLE INDICATIONS OF ABNORMAL CONDITIONS IN TEMPERATURE, LEVEL, AND DHR SYSTEM PERFORMANCE.

2. PROCEDURES

a. DEVELOP AND IMPLEMENT PROCEDURES THAT COVER NORMAL OPERATION OF NSSS, CONTAINMENT AND SUPPORTING SYSTEMS UNDER CONDITIONS WHERE COOLING NORMALLY PROVIDED BY DHR SYSTEMS.

b. PROVIDE EMERGENCY PROCEDURES THAT COVER ABOVE IDENTIFIED AREAS IF AN OFF—NORMAL CONDITION DEVELOPS.

c. PROVIDE ADMINISTRATIVE CONTROLS TO SUPPORT PROCEDURES AND ALL RECOMMENDED ACTIONS.

3. EQUIPMENT

a. PROVIDE ADEQUATE, RELIABLE EQUIPMENT FOR RCS COOLING AND FOR AVOIDING A LOSS OF RCS COOLING.

b. PROVIDE PERSONNEL COMMUNICATIONS.

c. PROVIDE ADDITIONAL EQUIPMENT TO MITIGATE A LOSS OF DHR OR A LOSS OF RCS INVENTORY SHOULD THESE OCCUR.

4. ANALYSES

a. PROVIDE BASIS FOR PROCEDURES, INSTRUMENTATION, EQUIPMENT OPERATION, AND CONTAINMENT.

b. ENCOMPASS THERMODYNAMIC AND CONFIGURATION CONDITIONS WHICH CAN BE REASONABLY ENCOUNTERED.

c. EMPHASIZE DEVELOPMENT OF COMPLETE UNDERSTANDING OF NSSS BEHAVIOR DURING NONPOWER OPERATING REGIONS OF INTEREST.

5. TECHNICAL SPECIFICATIONS

IDENTIFY TECHNICAL SPECIFICATIONS IMPACTED BY ABOVE RECOMMENDED ACTIONS AND SUBMIT APPROPRIATE CHANGES.

III. FUTURE STAFF ACTION

STAFF IS STUDYING OPTIONS TO IMPLEMENT RECOMMENDATIONS IN BEST MANNER. THESE RANGE FROM VOLUNTARY LICENSEE RESPONSE TO ORDERS.

CONCLUSIONS

WE'VE COVERED THE ISSUE, THE BACKGROUND AS WE SEE IT, RECOMMENDED CORRECTIVE ACTIONS, AND THE OPTIONS WE ARE CONSIDERING.

WE WELCOME INDUSTRY REPRESENTATIVE RESPONSE TO MOST RAPIDLY ACHIEVE THE DUAL OBJECTIVES OF:

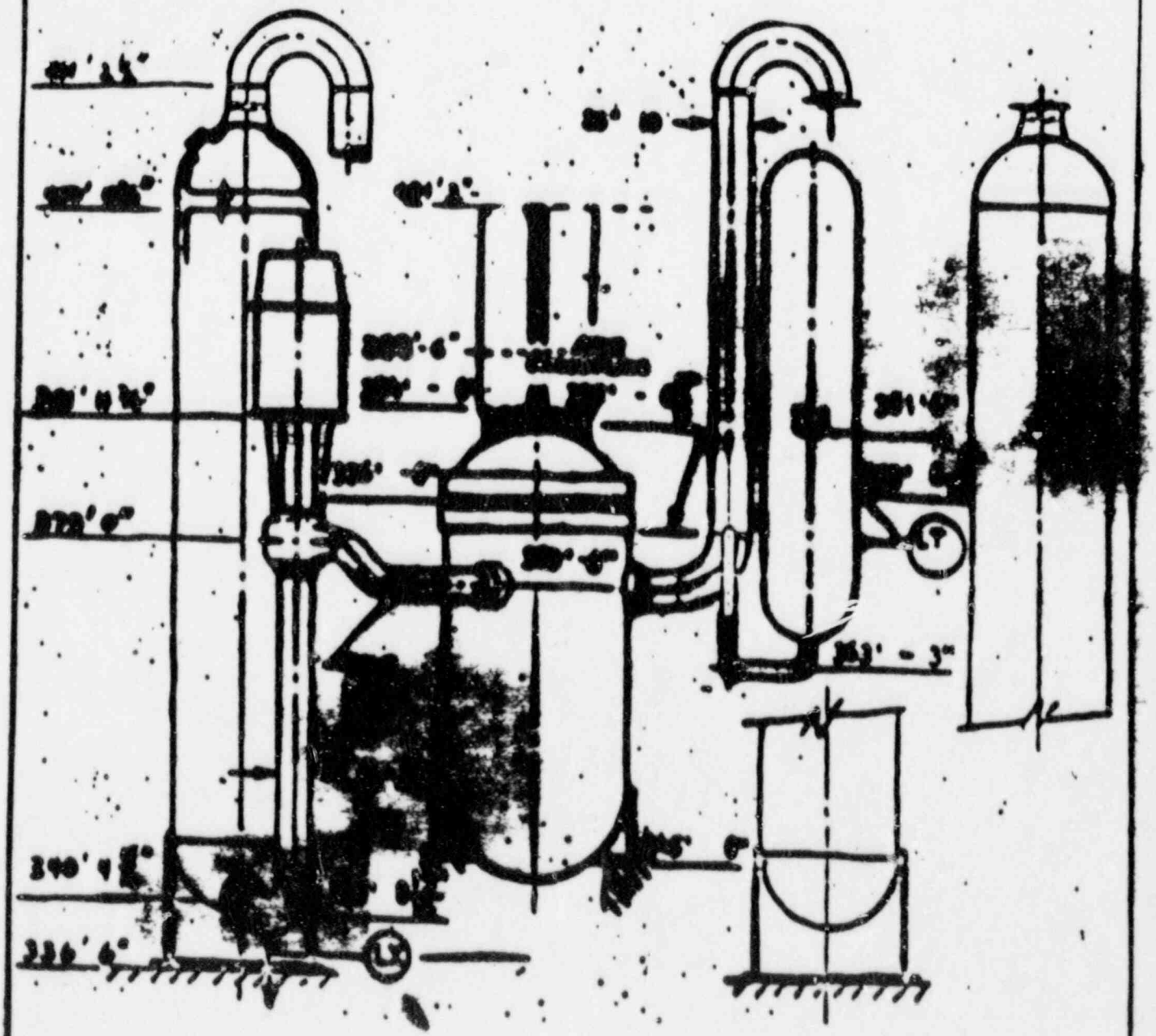
1. SHORT TERM PROTECTION FROM A RELEASE DUE TO A CORE DAMAGE ACCIDENT AND

2. LONG TERM RESOLUTION OF THE PROBLEMS ASSOCIATED WITH OPERATION DURING CONDITIONS WHERE COOLING BY DHR SYSTEMS IS DESIRED.

Enclosure 3

ATTACHMENT G

GENERAL REFERENCE POINTS



B&W NSS LESS SUSCEPTIBLE TO LOSS OF DHR DUE TO MID LOOP OPERATIONS

- MINIMUM LEVEL REQUIRED FOR MAINTENANCE IS APPROXIMATELY 30 INCHES ABOVE DHR DROP LINE

- OTSG DESIGN PROVIDES POSITIVE MEANS OF VENTING RCS THUS PROVIDING A STABLE LEVEL INDICATION DURING DRAIN DOWN

- REACTOR COOLANT INJECTED INTO CF NOZZLES (WHICH ARE HIGHER ELEVATIONS THAN HOT LEG NOZZLES) DIRECTLY INTO INLET PLENUM THUS ELIMINATING LEVEL CHANGES DUE TO WATER FLOW

B&W NSS LESS SUSCEPTIBLE TO LOSS OF DHR DUE TO MID LOOP OPERATIONS (CONT'D)

- INCORE THERMOCOUPLES EXIT THROUGH BOTTOM OF RV THUS INCREASING PROBABILITY THAT CORE EXIT THERMOCOUPLES WOULD BE AVAILABLE DURING DRAINED DOWN OPERATIONS

- REACTOR VESSEL INTERNAL VENT VALVES ELIMINATES CONCERN ABOUT UPPER VESSEL PRESSURIZATION FORCING RV LEVEL DOWN

Programmed enhancements for the longer term include permanent improved instrumentation, analyses, and technical specification changes where impacts are identified with respect to the recommended enhancements.

B&W plants are less vulnerable to core uncovery while drained down because the core flood check valves prevent differential pressure from developing across the internals and therefore prevent early core uncovery due to steam pressurization. Also, B&W plants do not drain down to the mid-loop level often. Other differences are shown on Enclosure 3.

The B&W Owners Group felt that, because of these differences and the fact that only momentary losses of DHR flow have occurred at B&W plants, B&W plants should either be excluded from the letter NRC is considering or the more forgiving design appropriately noted.

The Group also recommended that the usual Technical Specification definition of containment closure (for fuel movement) should be adequate for a definition of containment closure in the event of a total loss of decay heat removal ability.

original signed by

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Division of Reactor Projects - III,
IV, V and Special Projects

Enclosure:
1. Attendees
2. Staff Viewgraphs
3. B&W Design Differences

cc: w/enclosures
See next page

DISTRIBUTION

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EJordan	

DRSP/PDV	DRSP/D:PDV
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7/27/88	7/28/88

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