



UNITED STATES  
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001

May 8, 1996

APPLICANT: GE Nuclear Energy (GE)  
FACILITY: Advanced Boiling Water Reactor (ABWR)  
SUBJECT: SUMMARY OF MEETING HELD ON MAY 1, 1996, TO DISCUSS CHANGES TO THE DESIGN CONTROL DOCUMENT (DCD) FOR THE GE ABWR

On Wednesday, May 1, 1996, the Nuclear Regulatory Commission (NRC) staff met with GE to discuss 10 proposed changes to the ABWR DCD that were submitted in an April 16, 1996, letter to the staff. The meeting consisted of an introduction of the participants (Attachment 1), opening remarks, and a presentation by GE on the bases for the proposed changes to the DCD (Attachment 2). Breakout sessions were held for reactor systems branch issues and plant systems branch issues. Based on staff feedback, some modifications to the proposed DCD changes were identified (Attachment 3).

GE opened the meeting by summarizing the first-of-a-kind-engineering (FOAKE) work on the ABWR. GE stated that the FOAKE work was nearing completion, and was expected to formally end by September 1996. GE stated that additional changes resulting from FOAKE were possible, but would provide further information regarding this in a letter to the staff in the near future. GE also discussed the process used by GE to ensure that changes resulting from FOAKE were consistent with the ABWR DCD. Essentially, the GE system engineer proposing to change the design utilized a "50.59-like" approach to determine the impact on the design. The changes were then reviewed by a Change Control Board consisting of selected GE engineering personnel.

Further, GE stated that although the changes necessary to meet the NRC's rules and regulations were submitted in its April 16, letter, some additional changes were being "inventoried" for post-certification consideration. These changes would be made by GE if allowed by the design certification rule or they could be made by a combined license applicant or holder. The staff recommended submitting the inventoried changes for staff review prior to design certification to resolve these issues for future applicants, and GE stated that it would consider the matter. The staff also discussed with GE whether the rule needed to be renoticed in the Federal Register as a result of these DCD changes. The NRC's Office of the General Counsel (OGC) had determined this was not necessary, but recognized that the determination might be challenged in the future. Consequently, the NRC asked GE whether it wanted to renotify the rule, which could cause a delay in issuance of the rule. GE informed the NRC that it would consider the matter and would request renoticing if GE believed this were necessary.

The staff reviewed all 10 proposed changes in the April 16, submittal. Based on discussions at the meeting, some modifications to the proposed DCD changes for technical specifications, reactor core isolation cooling system, fire

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analysis, and heating, ventilation, and air conditioning systems were identified. In addition, GE decided to withdraw the proposed changes related to methods for analyzing the blockage of emergency core cooling system suction strainers. GE determined that the deletion of the numerical value from the analyses portion of the inspections, tests, analyses, and acceptance criteria could be subject to misinterpretation during plant construction, and therefore preferred the existing design documentation.

original signed by:

Thomas H. Boyce, Senior Project Manager  
Standardization Project Directorate  
Division of Reactor Program Management  
Office of Nuclear Reactor Regulation

Docket No. 52-001

Attachments: As stated

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GE Nuclear Energy

cc: Mr. Joseph Quirk  
GE Nuclear Energy  
175 Curtner Avenue, MC-782  
San Jose, CA 95125

Mr. Joseph R. Egan  
Egan & Associates, P.C.  
2300 N Street, N.W.  
Washington, DC 20037-1138

Mr. Rob Wallace  
GE Nuclear Energy  
1299 Pennsylvania Avenue, N.W.  
Suite 1100  
Rockville, MD 20852

Director, Criteria & Standards Division  
Office of Radiation Programs  
U.S. Environmental Protection Agency  
401 M Street, S.W.  
Washington, DC 20460

Mr. Sterling Franks  
U.S. Department of Energy  
NE-42  
Washington, DC 20585

Mr. Ronald Simard, Director  
Advanced Reactor Programs  
Nuclear Energy Institute  
1776 Eye Street, N.W., Suite 400  
Washington, DC 20006

Marcus A. Rowden, Esq.  
Fried, Frank, Harris, Shriver & Jacobson  
1001 Pennsylvania Avenue, N.W.  
Suite 800  
Washington, DC 20004

Docket No. 52-001

Mr. Steven A. Hucik  
GE Nuclear Energy  
175 Curtner Avenue, MC-780  
San Jose, CA 95125

Barton Z. Cowan, Esq.  
Eckert Seamans Cherin & Mellott  
600 Grant Street 42nd Floor  
Pittsburgh, PA 15219

Mr. B. A. McIntyre  
Advanced Plant Safety & Licensing  
Westinghouse Electric Corporation  
Energy Systems Business Unit  
Box 355  
Pittsburgh, PA 15230

ATTENDANCE LIST FOR MEETING  
WITH GE NUCLEAR ENERGY  
CONCERNING PROPOSED CHANGES TO THE  
ABWR DESIGN CONTROL DOCUMENT  
MAY 1, 1996

<u>NAME</u>	<u>ORGANIZATION</u>
TOM BOYCE	NRC/NRR/PDST
TED QUAY	NRC/NRR/PDST
JERRY WILSON	NRC/NRR/PDST
JOE QUIRK	GE-ABWR CERTIFICATION
MARC ROWDEN	FRIED, FRANK-GE
RAMAN RAGHAVAN	BECHTEL/GE
CRAIG SAWYER	GE NUCLEAR ENERGY
LOWELL CLAASSEN	GE NUCLEAR ENERGY
ANGELA CHU	NRC/NRR/TSB
JANAK H. RAVAL	NRC/NRR/SPLB
RONALD M. YOUNG	NRC/NRR/SPLB
GEORGE THOMAS	NRC/NRR/SRXB
ALAN BEARD	GE-NE
JIM LYONS	NRC/NRR/SPLB



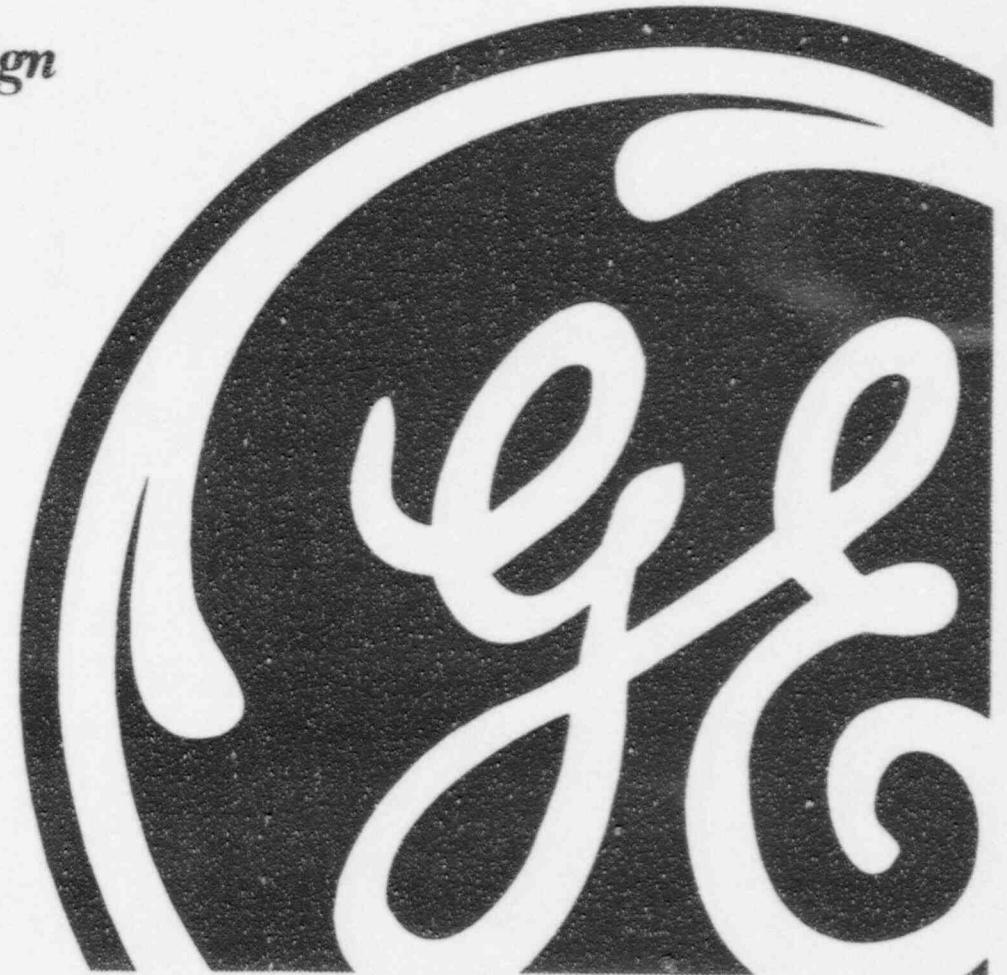
*GE Nuclear Energy*

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*Guidelines for Pre-Certification  
Design Changes to the ABWR Design*

*J. F. Quirk  
Nuclear Plant Projects*

*May 1, 1996*



# GUIDELINES FOR ABWR DESIGN CHANGES

## **PRIOR TO COMPLETION OF DESIGN CERTIFICATION PROCEEDINGS**

- EVERY EFFORT TO MAINTAIN DETAILED DESIGN WITHIN THE BOUNDARIES OF TIER 1 AND TIER 2 OF DCD
- CHANGES TO TIER 1 OR TIER 2 COULD RESULT IN HIGH RISK OF COMPLICATIONS IN DC PROCEEDINGS
- CONSEQUENTLY, GE WILL NOT PROPOSE A TIER 1 OR TIER 2 CHANGE UNLESS CHANGE IS NECESSARY TO:
  - PROVIDE ADEQUATE PROTECTION TO PUBLIC HEALTH AND SAFETY
  - BRING TIER 1 OR TIER 2 INTO COMPLIANCE WITH APPLICABLE REGULATIONS IN EFFECT AT FDA ISSUANCE
  - CORRECT AN ERROR OR DEFICIENCY WHEN NECESSARY TO MAKE THE DESIGN FUNCTIONALLY OPERABLE (AS INTENDED)
- GE WILL, HOWEVER, IDENTIFY PROPOSED DESIGN CHANGES THAT MEET §50.59-TYPE CRITERIA AND WOULD PROVIDE SUBSTANTIAL BENEFIT IN SAFETY, RELIABILITY OR ECONOMY OR ALIGNMENT WITH URD

## GUIDELINES FOR ABWR DESIGN CHANGES (CONTINUED)

- SUCH PROPOSED §50.59-TYPE CHANGES WILL BE SUBMITTED TO CCB AS CANDIDATES TO BE "INVENTORIED" FOR POST-CERTIFICATION CONSIDERATION
  - BY COL APPLICANTS/LICENSEES
  - AS VENDOR-PROPOSED §50.59-TYPE GENERIC CHANGES SHOULD DC RULE SO PROVIDE OR PART 52 BE AMENDED (SEE BELOW)
- A PRELIMINARY EVALUATION ASSESSING THE SAFETY SIGNIFICANCE IS INCLUDED AS AN INTEGRAL PART OF INVENTORIED CHANGE
- SUCH CHANGES ONLY ACCEPTED FOR COMPELLING REASONS
- CURRENTLY, COMMISSION WOULD ALLOW §50.59-TYPE CHANGES BY COL APPLICANTS AND LICENSEES ONLY
- INDUSTRY COMMENTS ON THE DCR PROPOSED THAT NRC AUTHORIZE VENDOR-SPONSOR TO MAKE SUCH §50.59-TYPE CHANGES
- IF THE INDUSTRY IS UNSUCCESSFUL IN THIS, IT WILL SEEK ENABLING RULEMAKING OF PART 52 TO PROVIDE SUCH AUTHORIZATION.

DOCUMENTATION TO SUPPORT SSAR DEVIATION RESOLUTION  
50.59-LIKE CHECK LIST

BASED ON THE AVAILABLE INFORMATION, WILL THE PROPOSED DEVIATIONS FROM THE ABWR SSAR DESCRIBED IN ECA 0000000,  
REV 0, TITLED " \_\_\_\_\_ " RESULT IN THE FOLLOWING :

- |   | YES                      | NO                       |
|---|--------------------------|--------------------------|
| 1. WILL A CHANGE TO THE TECHNICAL SPECIFICATIONS BE REQUIRED?   | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. WILL THE PROBABILITY OF OCCURRENCE OF AN ACCIDENT PREVIOUSLY EVALUATED<br>IN THE SSAR BE INCREASED?  | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. WILL THE RADIOLOGICAL CONSEQUENCE OF AN ACCIDENT PREVIOUSLY EVALUATED<br>IN THE SSAR BE INCREASED?   | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. WILL THE PROBABILITY OF A MALFUNCTION OF A SAFETY-RELATED STRUCTURE, SYSTEM<br>OR COMPONENT PREVIOUSLY EVALUATED IN THE SSAR BE INCREASED? | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. WILL THE RADIOLOGICAL CONSEQUENCE OF A MALFUNCTION PREVIOUSLY EVALUATED<br>IN THE SSAR BE INCREASED?                                       | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. WILL THE POSSIBILITY OF AN ACCIDENT OF A DIFFERENT TYPE THAN PREVIOUSLY<br>EVALUATED IN THE SSAR BE INCREASED?                             | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. WILL THE POSSIBILITY OF A MALFUNCTION OF A DIFFERENT TYPE THAN PREVIOUSLY<br>EVALUATED IN THE SSAR BE CREATED?                             | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. WILL THE MARGIN OF SAFETY AS DEFINED AS THE BASIS FOR ANY TECHNICAL<br>SPECIFICATION BE REDUCED?   | <input type="checkbox"/> | <input type="checkbox"/> |

PROVIDE A BRIEF EXPLANATION FOR ANY 'YES' ANSWER BELOW:

SIGNED \_\_\_\_\_

(RESPONSIBLE ENGINEER)



***Proposed Changes to ABWR Design Control Document***

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***ABWR Certification***

**Change Package No. 1**

***Raman Raghavan  
Bechtel National Inc  
May 1996***



## ***Change Package No. 1***

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### **Eliminate Hot Water Heating for RB and RWB HVAC**

- ***Change the Reactor Building and Radwaste Building HVAC Systems to use***
  - *electric heating in place of hot water water heating*
  - *split the single intake configuration into three to provide redundancy*
  - *use high efficiency filters in place of medium grade bag-type filters*
- ***The change will provide air intake redundancy to satisfy system maintenance needs***
- ***Use of electric heating will avoid in-service freezing***

# ***Change Package No. 1***

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## **REASONS**

- ***Eliminate Pumping of Hot Water from RB to/from TB***
- ***Eliminate Spreading of Contamination from RCW***
- ***Eliminate Long High Energy Steam Piping from TB***
- ***Avoid In-service Freezing of Coils - HVAC Systems are exposed to outside environments***
- ***Three (3) 50% Capacity Units for On-line Maintenance***
- ***Enhance Reliability and maintainability***

# ***Change Package No. 1***

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## **SAFETY CONSIDERATIONS**

- ***No need for a change to Technical Spec***
- ***No increase in probability of occurrence of an accident previously evaluated***
- ***No increase in radiological consequence of an accident previously evaluated***
- ***No increase in probability of a malfunction of a safety-related SSC previously evaluated***

# ***Change Package No. 1***

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## **SAFETY CONSIDERATIONS (Cont'd)**

- ***No increase in radiological consequence of a malfunction previously evaluated***
- ***No increase in possibility of an accident of a different type than previously evaluated***
- ***No creation of possibility of a malfunction of a different type than previously evaluated***
- ***No reduction in margin of safety as defined as the basis for any Technical Spec***

***Proposed Changes to ABWR Design Control Document***

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***ABWR Certification***

**Change Package No. 2**

***Raman Raghavan  
Bechtel National Inc  
May 1996***



## ***Change Package No. 2***

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### **Additional Chiller/Pump Set**

- ***Additional Chiller/Pump Set for the HVAC Emergency Cooling Water System***
  - ***Provides functional redundancy to avoid the loss of cooling for the CB and RB Safety-Related Electrical Equipment Area HVAC Systems, potentially challenging electrical equipment environmental qualification temperature limits***
  - ***Redundancy satisfies system maintenance needs***

## ***Change Package No. 2***

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### ***Additional Chiller/Pump Set***

#### **REASONS**

- ***Add redundant HECW System Division A consistent with Divisions B and C to perform on-line maintenance***
- ***Maintain controlled environment in Class 1E equipment rooms in Division 1 of RB and CB while a chiller/pump set is under maintenance***



## ***Change Package No. 2***

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### **Additional Chiller/Pump Set**

- ***No need for a change to Technical Spec***
- ***No increase in probability of occurrence of an accident previously evaluated***
- ***No increase in radiological consequence of an accident previously evaluated***
- ***No increase in probability of a malfunction of a safety-related SSC previously evaluated***

## ***Change Package No. 2***

---

### **Additional Chiller/Pump Set**

- ***No increase in radiological consequence of a malfunction previously evaluated***
- ***No increase in possibility of an accident of a different type than previously evaluated***
- ***No creation of possibility of a malfunction of a different type than previously evaluated***
- ***No reduction in margin of safety as defined as the basis for any Technical Spec***

***Proposed Changes to ABWR Design Control Document***

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***ABWR Certification***

**Change Package No. 3**

***Raman Raghavan  
Bechtel National Inc  
May 1996***



## ***Change Package No. 3***

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### ***Change of Smoke Removal Method and Duct Connections***

- ***Change the Smoke Removal Method for Three HVAC Systems (for RB-SREE, CRHA and CB-SREA)***
  - ***Comply with the accepted method prescribed by the industrial standards (ASHRAE and NFPA)***
- ***Replace centrifugal fans with vaneaxial fans as necessary for space conservation***
- ***Service FMCRD Panel Rooms from Divisions A and B of RB-SREE HVAC system, instead of Divisions B and C***

## ***Change Package No. 3***

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### **REASONS**

- ***Positive exhaust ventilation method is preferred rather than pressurization method of smoke removal from rooms served by HVAC Systems***
  - *Include dedicated smoke removal fan in RB-SREE HVAC System*
  - *Activate both exhaust fans of CRHA and CB-SREA HVAC Systems*
- ***Distribute cooling load evenly by assigning FMCRD Panel Rooms to Divisions A and B***
- ***Reconfigure ductwork to allow single point cross-connect from return to exhaust ductwork except for Rooms of DGs, day tanks, chillers and batteries having direct exhausts***

## ***Change Package No. 3***

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### **SAFETY CONSIDERATIONS**

- ***No need for a change to Technical Spec***
- ***No increase in probability of occurrence of an accident previously evaluated***
- ***No increase in radiological consequence of an accident previously evaluated***
- ***No increase in probability of a malfunction of a safety-related SSC previously evaluated***

## ***Change Package No. 3***

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### **SAFETY CONSIDERATIONS (Cont'd)**

- ***No increase in radiological consequence of a malfunction previously evaluated***
- ***No increase in possibility of an accident of a different type than previously evaluated***
- ***No creation of possibility of a malfunction of a different type than previously evaluated***
- ***No reduction in margin of safety as defined as the basis for any Technical Spec***

***Proposed Changes to ABWR Design Control Document***

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***ABWR Certification***

**Change Package No. 4**

***Raman Raghavan  
Bechtel National Inc  
May 1996***





## ***Change Package No. 4***

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### **Reassign MCR Exhaust Fan Designations**

- ***Reassign the Main Control Room HVAC exhaust fans ("B" as "C" and "C" as "B") according to their respective divisional space***
  - ***Eliminates potential divisional cross-over of cooling and power***

# ***Change Package No. 4***

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## **REASONS**

- ***Eliminate Potential for breaching fire barriers and fire proofing the ductwork***
- ***Enhance exhaust fan performance due to less complexity in ductwork***

## ***Change Package No. 4***

---

### **SAFETY CONSIDERATIONS**

- ***No need for a change to Technical Spec***
- ***No increase in probability of occurrence of an accident previously evaluated***
- ***No increase in radiological consequence of an accident previously evaluated***
- ***No increase in probability of a malfunction of a safety-related SSC previously evaluated***

## ***Change Package No. 4***

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### **SAFETY CONSIDERATIONS (Cont'd)**

- ***No increase in radiological consequence of a malfunction previously evaluated***
- ***No increase in possibility of an accident of a different type than previously evaluated***
- ***No creation of possibility of a malfunction of a different type than previously evaluated***
- ***No reduction in margin of safety as defined as the basis for any Technical Spec***

***Proposed Changes to ABWR Design Control Document***

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***ABWR Certification***

**Change Package No. 6**

***Raman Raghavan  
Bechtel National Inc  
May 1996***



## ***Change Package No. 6***

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### **Independence of Power for Each Pair of Motor-Operated Isolation Dampers**

- ***CRHA Isolation Damper Power Source***
  - *Provide power for each pair of perimeter isolation dampers from two independent Class 1E power sources*
  - *Assures necessary alignment of dampers and prevention of infiltration of unfiltered air in case of emergency and loss of one division of power*
- ***Add a cross-tie between two inlet ducts of Emergency Filtration Unit on Tier 1 figure for consistency with Tier 2***

## ***Change Package No. 6***

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### **REASONS**

- ***Comply with single failure criteria***
- ***Motor-operated dampers fail as-is***

# ***Change Package No. 6***

---

## **SAFETY CONSIDERATIONS**

- ***No need for a change to Technical Spec***
- ***No increase in probability of occurrence of an accident previously evaluated***
- ***No increase in radiological consequence of an accident previously evaluated***
- ***No increase in probability of a malfunction of a safety-related SSC previously evaluated***



## ***Change Package No. 6***

---

### **SAFETY CONSIDERATIONS (Cont'd)**

- ***No increase in radiological consequence of a malfunction previously evaluated***
- ***No increase in possibility of an accident of a different type than previously evaluated***
- ***No creation of possibility of a malfunction of a different type than previously evaluated***
- ***No reduction in margin of safety as defined as the basis for any Technical Spec***

***Proposed Changes to ABWR Design Control Document***

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***ABWR Certification***

**Change Package No. 2**

***Raman Raghavan  
Bechtel National Inc  
May 1996***



## ***Change Package No. 2***

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### ***Additional Chiller/Pump Set***

- ***Additional Chiller/Pump Set for the HVAC Emergency Cooling Water System***
  - ***Provides functional redundancy to avoid the loss of cooling for the CB and RB Safety-Related Electrical Equipment Area HVAC Systems, potentially challenging electrical equipment environmental qualification temperature limits***
  - ***Redundancy satisfies system maintenance needs***

## ***Change Package No. 2***

---

### **Additional Chiller/Pump Set**

#### **REASONS**

- ***Add redundant HECW System Division A consistent with Divisions B and C to perform on-line maintenance***
- ***Maintain controlled environment in Class 1E equipment rooms in Division 1 of RB and CB while a chiller/pump set is under maintenance***

## ***Change Package No. 2***

---

### **Additional Chiller/Pump Set**

- ***No need for a change to Technical Spec***
- ***No increase in probability of occurrence of an accident previously evaluated***
- ***No increase in radiological consequence of an accident previously evaluated***
- ***No increase in probability of a malfunction of a safety-related SSC previously evaluated***

## ***Change Package No. 2***

---

### **Additional Chiller/Pump Set**

- ***No increase in radiological consequence of a malfunction previously evaluated***
- ***No increase in possibility of an accident of a different type than previously evaluated***
- ***No creation of possibility of a malfunction of a different type than previously evaluated***
- ***No reduction in margin of safety as defined as the basis for any Technical Spec***

***Proposed Changes to ABWR Design Control Document***

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***ABWR Certification***

**Change Package No. 3**

***Raman Raghavan  
Bechtel National Inc  
May 1996***



## ***Change Package No. 3***

---

### ***Change of Smoke Removal Method and Duct Connections***

- ***Change the Smoke Removal Method for Three HVAC Systems (for RB-SREE, CRHA and CB-SREA)***
  - ***Comply with the accepted method prescribed by the industrial standards (ASHRAE and NFPA)***
- ***Replace centrifugal fans with vaneaxial fans as necessary for space conservation***
- ***Service FMCRD Panel Rooms from Divisions A and B of RB-SREE HVAC system, instead of Divisions B and C***



# ***Change Package No. 3***

---

## **REASONS**

- ***Positive exhaust ventilation method is preferred rather than pressurization method of smoke removal from rooms served by HVAC Systems***
  - *Include dedicated smoke removal fan in RB-SREE HVAC System*
  - *Activate both exhaust fans of CRHA and CB-SREA HVAC Systems*
- ***Distribute cooling load evenly by assigning FMCRD Panel Rooms to Divisions A and B***
- ***Reconfigure ductwork to allow single point cross-connect from return to exhaust ductwork except for Rooms of DGs, day tanks, chillers and batteries having direct exhausts***

## ***Change Package No. 3***

---

### **SAFETY CONSIDERATIONS**

- ***No need for a change to Technical Spec***
- ***No increase in probability of occurrence of an accident previously evaluated***
- ***No increase in radiological consequence of an accident previously evaluated***
- ***No increase in probability of a malfunction of a safety-related SSC previously evaluated***

## ***Change Package No. 3***

---

### **SAFETY CONSIDERATIONS (Cont'd)**

- ***No increase in radiological consequence of a malfunction previously evaluated***
- ***No increase in possibility of an accident of a different type than previously evaluated***
- ***No creation of possibility of a malfunction of a different type than previously evaluated***
- ***No reduction in margin of safety as defined as the basis for any Technical Spec***

***Proposed Changes to ABWR Design Control Document***

---

***ABWR Certification***

**Change Package No. 4**

***Raman Raghavan  
Bechtel National Inc  
May 1996***



## ***Change Package No. 4***

---

### **Reassign MCR Exhaust Fan Designations**

- ***Reassign the Main Control Room HVAC exhaust fans ("B" as "C" and "C" as "B") according to their respective divisional space***
  - ***Eliminates potential divisional cross-over of cooling and power***

# ***Change Package No. 4***

---

## **REASONS**

- ***Eliminate Potential for breaching fire barriers and fire proofing the ductwork***
- ***Enhance exhaust fan performance due to less complexity in ductwork***

## ***Change Package No. 4***

---

### **SAFETY CONSIDERATIONS**

- ***No need for a change to Technical Spec***
- ***No increase in probability of occurrence of an accident previously evaluated***
- ***No increase in radiological consequence of an accident previously evaluated***
- ***No increase in probability of a malfunction of a safety-related SSC previously evaluated***

## ***Change Package No. 4***

---

### **SAFETY CONSIDERATIONS (Cont'd)**

- ***No increase in radiological consequence of a malfunction previously evaluated***
- ***No increase in possibility of an accident of a different type than previously evaluated***
- ***No creation of possibility of a malfunction of a different type than previously evaluated***
- ***No reduction in margin of safety as defined as the basis for any Technical Spec***



***Proposed Changes to ABWR Design Control Document***

---

***ABWR Certification***

**Change Package No. 6**

***Raman Raghavan  
Bechtel National Inc  
May 1996***



## ***Change Package No. 6***

---

### **Independence of Power for Each Pair of Motor-Operated Isolation Dampers**

- ***CRHA Isolation Damper Power Source***
  - *Provide power for each pair of perimeter isolation dampers from two independent Class 1E power sources*
  - *Assures necessary alignment of dampers and prevention of infiltration of unfiltered air in case of emergency and loss of one division of power*
- ***Add a cross-tie between two inlet ducts of Emergency Filtration Unit on Tier 1 figure for consistency with Tier 2***

# ***Change Package No. 6***

---

## **REASONS**

- ***Comply with single failure criteria***
- ***Motor-operated dampers fail as-is***

## ***Change Package No. 6***

---

### **SAFETY CONSIDERATIONS**

- ***No need for a change to Technical Spec***
- ***No increase in probability of occurrence of an accident previously evaluated***
- ***No increase in radiological consequence of an accident previously evaluated***
- ***No increase in probability of a malfunction of a safety-related SSC previously evaluated***

## ***Change Package No. 6***

---

### **SAFETY CONSIDERATIONS (Cont'd)**

- ***No increase in radiological consequence of a malfunction previously evaluated***
- ***No increase in possibility of an accident of a different type than previously evaluated***
- ***No creation of possibility of a malfunction of a different type than previously evaluated***
- ***No reduction in margin of safety as defined as the basis for any Technical Spec***

*Proposed Changes to ABWR Design Control Document*

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*ABWR Certification*

**Change Package No. 7**

*Lowell Claassen  
GE Nuclear Energy  
May 1996*



## ***Change Package No. 7***

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### ***Eliminate RCIC Rupture Disks and Exhaust Line***

- ***Rupture disks in earlier BWRs were for protection of low pressure turbine case***
- ***Existence of rupture disks with opening pressure below reactor pressure in ABWR is not consistent with ISLOCA requirements***
- ***Delete rupture disks to correct inconsistency regarding ISLOCA***
- ***Increase design pressure of piping and valves in turbine exhaust line***

# ***Change Package No. 7***

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## **REASONS**

- *Rupture disks would open at the design pressure*
- *This is inconsistent with ISLOCA requirements*
- *Increase design pressure to eliminate need for rupture disks*
  - *Increase of piping design pressure ensures compliance with ASME Code*
- *Eliminate potential source of ISLOCA*



## ***Change Package No. 7***

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### **SAFETY CONSIDERATIONS**

- ***No need for a change to Technical Spec***
- ***No increase in probability of occurrence of an accident previously evaluated***
- ***No increase in radiological consequence of an accident previously evaluated***
- ***No increase in probability of a malfunction of a safety-related SSC previously evaluated***

## ***Change Package No. 7***

---

### **SAFETY CONSIDERATIONS (Cont'd)**

- ***No increase in radiological consequence of a malfunction previously evaluated***
- ***No increase in possibility of an accident of a different type than previously evaluated***
- ***No creation of possibility of a malfunction of a different type than previously evaluated***
- ***No reduction in margin of safety as defined as the basis for any Technical Spec***

*Proposed Changes to ABWR Design Control Document*

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*ABWR Certification*

**Change Package No. 8**

*Lowell Claassen  
GE Nuclear Energy  
May 1996*



## ***Change Package No. 8***

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### ***Increase Design Pressure of FMCRD Scram Piping***

- ***Design is to be based on equipment events rather than plant events***
- ***Water hammer effects included in increase of design pressure***
- ***Change ensures compliance with ASME Code***

# ***Change Package No. 8***

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## **REASONS**

- *Original design based on HCU charging pressure*
- *Scram valve opening suspected of pressure load increase*
- *Design study indicated potential water hammer loads*
- *Water hammer loads confirmed and quantified by test*
- *Pressure wave is amplified in piping on return from FMCRD*
- *New design pressure ensures compliance with ASME Code*

## ***Change Package No. 8***

---

### **SAFETY CONSIDERATIONS**

- ***No need for a change to Technical Spec***
- ***No increase in probability of occurrence of an accident previously evaluated***
- ***No increase in radiological consequence of an accident previously evaluated***
- ***No increase in probability of a malfunction of a safety-related SSC previously evaluated***

## ***Change Package No. 8***

---

### **SAFETY CONSIDERATIONS (Cont'd)**

- ***No increase in radiological consequence of a malfunction previously evaluated***
- ***No increase in possibility of an accident of a different type than previously evaluated***
- ***No creation of possibility of a malfunction of a different type than previously evaluated***
- ***No reduction in margin of safety as defined as the basis for any Technical Spec***

***Proposed Changes to ABWR Design Control Document***

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***ABWR Certification***

**Change Package No. 9**

***Craig Sawyer  
GE Nuclear Energy  
May 1996***





## ***Change Package No. 9***

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### **Use Higher Strength Material for Cladded Shells of RPV Pedestal and Tunnels**

- ***Use a higher strength material for the cladded shells of***
  - *Lower drywell access tunnels*
  - *RPV pedestal (wetted portion)*
- ***The change is based on considerations for cladability and strength to withstand high thermal stresses***

# ***Change Package No. 9***

---

## **REASONS**

- ***Wetted portion of RPV Pedestal shell requires cladability with stainless steel***
  - *A572 is not cladable*
  - *Use A533, Type B, Class 2*
- ***Access Tunnel shells have high thermal stresses as predicted by detailed structural analyses***
  - *A516, Grade 70 has a low yield strength of 38 ksi at room temperature (RT)*
  - *Use A533, Type B, Class 2, which has yield strength of 70 ksi at RT*

## ***Change Package No. 9***

---

### **SAFETY CONSIDERATIONS**

- ***No need for a change to Technical Spec***
- ***No increase in probability of occurrence of an accident previously evaluated***
- ***No increase in radiological consequence of an accident previously evaluated***
- ***No increase in probability of a malfunction of a safety-related SSC previously evaluated***

## ***Change Package No. 9***

---

### **SAFETY CONSIDERATIONS (Cont'd)**

- ***No increase in radiological consequence of a malfunction previously evaluated***
- ***No increase in possibility of an accident of a different type than previously evaluated***
- ***No creation of possibility of a malfunction of a different type than previously evaluated***
- ***No reduction in margin of safety as defined as the basis for any Technical Spec***

***Proposed Changes to ABWR Design Control Document***

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***ABWR Certification***

**Change Package No. 10**

***Craig Sawyer  
GE Nuclear Energy  
May 1996***



## ***Change Package No. 10***

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### **Changes to Technical Specifications**

- ***Change Reference from "UHS" to "RSW Inlet Temperature to RCW/RSW Heat Exchanger"***
- ***Lower the Technical Specification temperature for the "RSW inlet temperature" from 35 °C to 33.3 °C***

# ***Change Package No. 10***

---

## **REASONS**

- ***Facilitates Tech. Spec. Temperature measurement through use of permanently installed temperature elements in the RSW inlet pipe to the RCW/RSW heat exchangers***
- ***Lowers the Tech. Spec. Temperature to 33.3 °C to ensure the RSW inlet temperature does not exceed 35 °C during a LOCA***
- ***Sets the Tech. Spec. Temperature sufficiently above the expected maximum normal operation RSW inlet temperature of 32.8 °C to minimize potential of reaching the Tech. Spec. limit during normal operation***

# ***Change Package No. 10***

---

## **SAFETY CONSIDERATIONS**

- ***Technical Specification change required***
- ***No increase in probability of occurrence of an accident previously evaluated***
- ***No increase in radiological consequence of an accident previously evaluated***
- ***No increase in probability of a malfunction of a safety-related SSC previously evaluated***

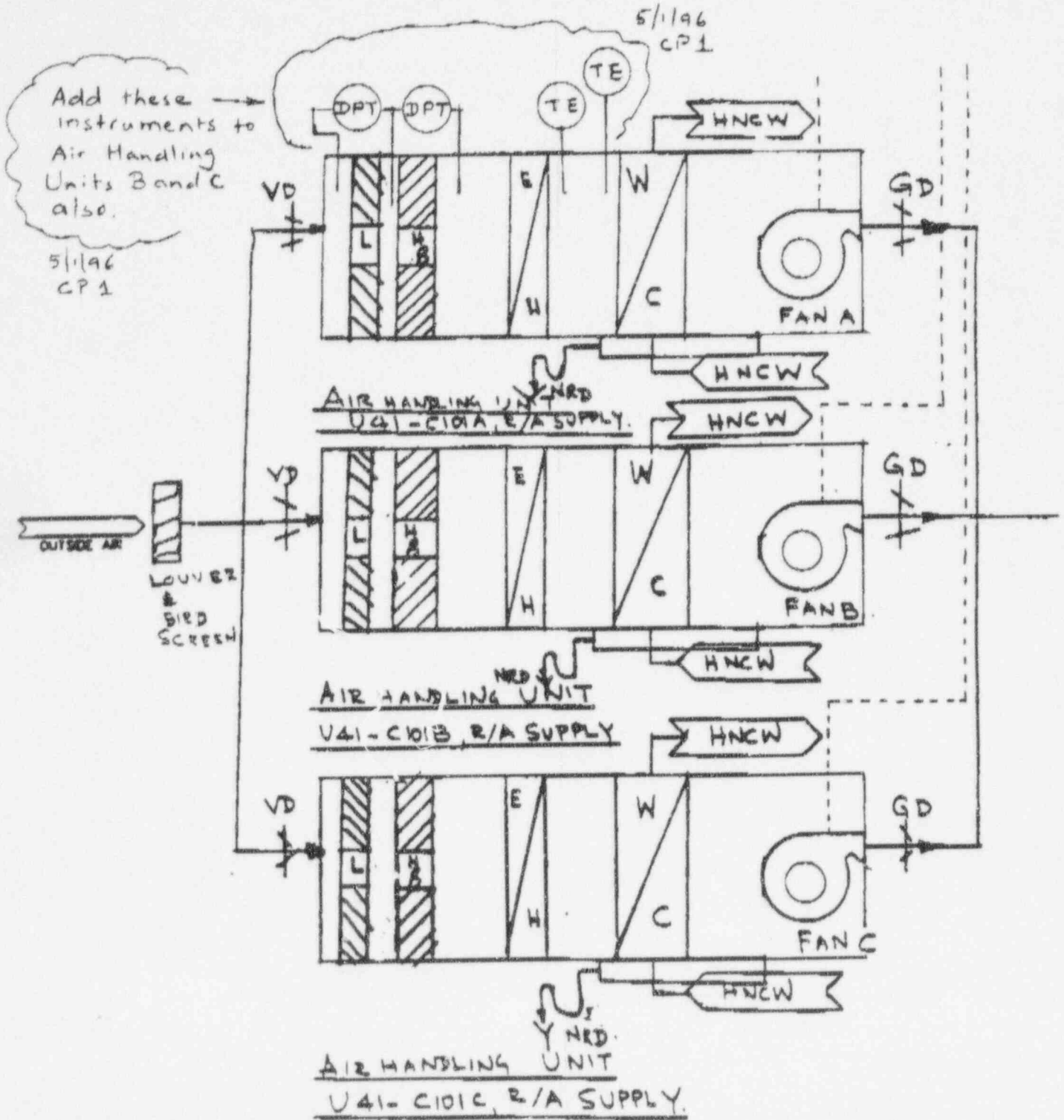


## ***Change Package No. 10***

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### **SAFETY CONSIDERATIONS (Cont'd)**

- ***No increase in radiological consequence of a malfunction previously evaluated***
- ***No increase in possibility of an accident of a different type than previously evaluated***
- ***No creation of possibility of a malfunction of a different type than previously evaluated***
- ***No reduction in margin of safety as defined as the basis for any Technical Spec***



Legend:  
 ..L : Low Efficiency  
 ..HB : High Efficiency

Insert 9.4-3/1  
FOR

FIGURE 9.4-3 SECONDARY CONTAINMENT HVAC SYSTEM (Sheet 1 of 3)  
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**ABWR****Design Control Document/Tier 2****Table 1.9-1 Summary of ABWR Standard Plant  
COL License Information (Continued)**

Item No.	Subject	Subsection
9.23	Diesel Generator Cooling Water System Design Flow and Heat Removal Requirements	9.5.13.6
9.24	Fire Rating for Penetration Seals	9.5.13.7
9.25	Diesel Generator Requirements	9.5.13.8
9.26	Applicant Fire Protection Program	9.5.13.9
9.27	<u>HVAC Pressure Calculations</u> <i>not used</i>	9.5.13.10
9.28	Plant Security System Criteria	9.5.13.11
9.29	Not Used	9.5.13.12
9.30	Diesel Fuel Refueling Procedures	9.5.13.13
9.31	Portable and Fixed Emergency Communication Systems	9.5.13.14
9.32	Identification of Chemicals	9.5.13.15
9.33	NUREG/CR-0660 Diesel Generator Reliability Recommendations	9.5.13.16
9.34	Sound-Powered Telephone Units	9.5.13.17
9.35	Fire-Related Administrative Controls	9.5.13.18
9.36	Periodic Testing of Combustion Turbine Generator (CTG)	9.5.13.19
9.37	Operating Procedures for Station Blackout	9.5.13.20
9.38	Quality Assurance Requirements for CTG	9.5.13.21
10.1	Low Pressure Turbine Disk Fracture Toughness	10.2.5.1
10.2	Turbine Design Overspeed	10.2.5.2
10.3	Turbine Inservice Test and Inspection	10.2.5.3
10.4	Procedures to Avoid Steam Hammer and Discharge Loads	10.3.7.1
10.5	MSIV Leakage	10.3.7.2
10.6	Radiological Analysis of the TGSS Effluents	10.4.10.1
11.1	Plant-Specific Liquid Radwaste Information	11.2.5.1
11.2	Compliance With Appendix I to 10CFR50	11.3.11.1
11.3	Plant-Specific Solid Radwaste Information	11.4.3.1
11.4	Calculation of Radiation Release Rates	11.5.6.1
11.5	Compliance with the Regulatory Shielding Design Basis	11.5.6.2
11.6	Provisions for Isokinetic Sampling	11.5.6.3
11.7	Sampling of Radioactive Iodine and Particulates	11.5.6.4

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~~flow split between rooms in the fire area. Total flow will vary somewhat as the volume damper is adjusted, due to the sloping characteristic of the supply/recirculation fan.~~

~~If a fire is detected in a fire area, a dual damper adjusts to convert the system from a recirculation system to a once-through system by opening a discharge path to the atmosphere upstream of the volume damper in the recirculation return duct. The damper also closes off the recirculation return duct to block recirculation of combustion products. This allows the pressure in the fire area experiencing the fire to decay back to the duct loss above atmospheric pressure. The recirculation fans continue to operate in the once-through mode to supply cool, clean air to cool and remove~~

~~smoke from the area experiencing the fire. The HVAC Systems in the fire areas not experiencing a fire continue to operate in their normal fashion so that the pressure in the other fire areas remains at the normal approximately 6.4 mm of water positive value. This assures that air leakage through any openings in the fire barriers surrounding the fire is to the fire.~~

~~The magnitude of the differential pressure which must be maintained across a fire barrier to provide adequate smoke control varies with the intensity of the fire and the room height. For this reason, it is a COL license information requirement (Subsection 9.5.13.10) that the required differential pressure value for each barrier be calculated during the detailed design phase and the HVAC Systems be designed to provide the required pressure. Normally the differential pressure would not have to be more than about 4.6 mm of water, and it most likely would be less.~~

~~If a HVAC system operating in its normal mode is not capable of supplying the required differential pressure, there are corrective options available to the detail designer. It may be necessary to specify that during a fire situation, both recirculation fans must be run in each fire area not experiencing the fire. If this is still not adequate, it may then be necessary to supply motor-operated volume dampers in place of the manually adjustable dampers in the recirculation return lines to temporarily increase zone pressures in the fire areas not experiencing a fire. It is an COL license information requirement (Subsection 9.5.13.10) that the required pressures be calculated during the detailed design phase, the HVAC Systems be designed to provide the required pressure, and that the capability be confirmed during pre-operational testing.~~

~~Entry to a fire is gained from an adjacent fire area which by design is at a positive pressure with respect to the area experiencing the fire. The pressure differential is sufficient to provide adequate velocity through the open door to carry the combustion products back into the zone of the fire. The flow through the open door into the area of the fire and out the area of the fire's exhaust duct system is maintained by the positive pressure of the non-fire area. Because of the low-loss exhaust duct system, a flow reversal could occur in the exhaust duct of the area without the fire. A portion, or even the entire, recirculation flow for the fire area without the fire will reverse flow through the~~

~~and by the operation of smoke removal mode in the fire area.~~

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Upon manual initiation of the smoke removal mode, the recirculation damper is closed, the exhaust fans are stopped, and the smoke removal fan is started in conjunction with the supply fan for 100% outside air purging. In the Control Building, the recirculation damper is closed and both the exhaust fans are operated in conjunction with the supply fan for smoke removal.

~~entry room return register and through the open door into the zone experiencing the fire. This not only prevents the flow of combustion products to the non fire area but provides a plume of clean, cool air for fire suppression personnel to follow into the area of the fire. It gives them a tenable environment from which to work.~~

fire fighting squad

~~Since the HVAC Systems are manually switched over to a once-through system during a fire, there is no direct mixing of smoke from room to room within the fire area. There may be some leakage through normal HVAC seals and other cracks or openings in the walls. The venting provided by the unrestricted exhaust system prevents pressurization of the fire area, and thus minimizes smoke leakage to rooms adjacent to the fire.~~

~~The HVAC supply and exhaust systems are designed so that they will continue to vent the fire area experiencing a fire, regardless of the intensity or magnitude of the fire. Except within the Reactor Building secondary containment, there are no fire dampers in the HVAC Systems for the Reactor or Control buildings. This is possible because~~

~~there are no HVAC penetrations of building internal walls between safety-related fire areas so that no fire dampers are required for internal HVAC ducts.~~

fire dampers in the

In order to maintain the objective of smoke and heat removal during a fire situation, the HVAC supply and exhaust duct openings in the exterior walls of the Reactor building do not have fire dampers. The walls are designated as three-hour fire barriers and would normally require fire dampers for HVAC duct penetrations. Fire dampers could close due to heat from an internal fire, however. Internal fires are a more serious threat to the plant than external fires.

Omission of the fire dampers in the supply ducts is deemed acceptable because:

- (1) Each HVAC/fire area has a separate intake structure.
- (2) The intake structures are dispersed around the perimeters of the buildings.
- (3) Not Used
- (4) Isolation valves are provided and could be manually closed should there be a challenge due to an external fire.
- (5) Each intake serves one fire area and, therefore, one division only except for the control room. The two redundant divisions are in separate fire areas. The control room fire area is separate from all other fire areas and the safe shutdown function is backed up by the remote shutdown panel.

Omission of the fire dampers in the exhaust ducts is deemed acceptable because:

- (1) Each HVAC/fire area has a separate exhaust.

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- (2) Diesel generator selection shall include prudent component design with dust tight enclosures. Construction guidelines shall include provisions for minimizing accumulation of dust and dirt into equipment. These shall be in accordance with recommendations 2.a, 2.b, 2.d and 5 of NUREG/CR-0660 (Subsection 9.5.6.3).
- (5) The diesel generator operating procedure shall include provisions to avoid as much as possible or otherwise restrict the no-load or low-load operation of the engine/generator for prolonged periods of time; or operate the engine at nearly full-load following every no-load or low-load (20% or less) operation lasting for a period of 30 minutes or more (Subsection 8.3.1.1.8).

#### 9.5.13.9 Applicant Fire Protection Program

The following areas are out of the ABWR Standard Plant design scope for the fire protection program, and shall be included in the COL applicant's fire protection program:

- (1) Main transformer
- (2) Equipment entry lock
- (3) Fire protection pumphouse
- (4) Ultimate heat sink

The COL applicant's fire protection program shall comply with the SRP Section 9.5.1, with ability to bring the plant to safe shutdown condition following a complete fire burnout of a fire area/division without a need for recovery (Subsection 9.5.1).

#### 9.5.13.10 HVAC Pressure Calculations

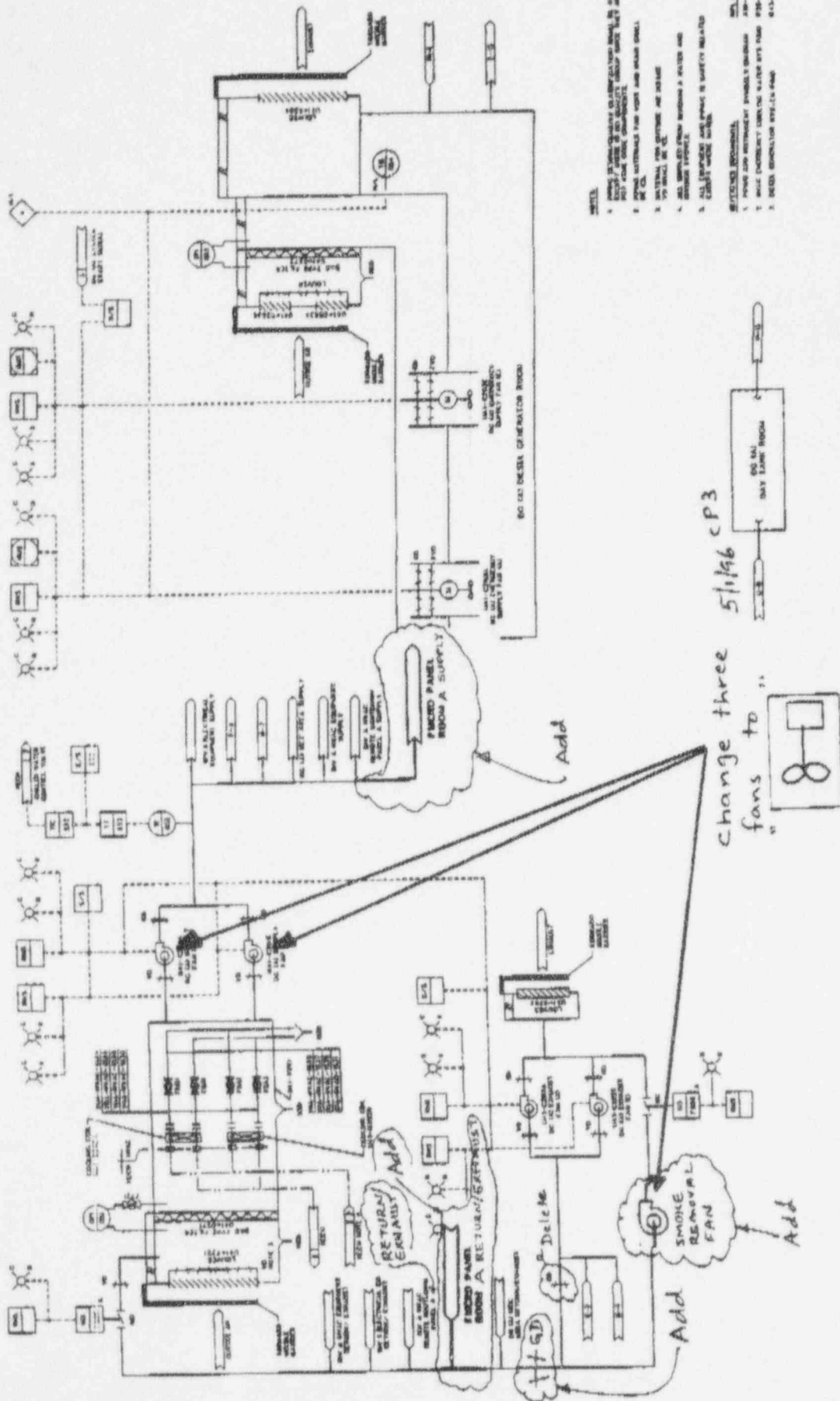
*not used*

The COL applicant shall provide pressure calculations and confirm capability during preoperational testing of the smoke control mode of the HVAC systems as described in Subsection 9.5.1.1.6.

#### 9.5.13.11 Plant Security Systems Criteria

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The COL applicant's design of the security system (Subsection 9.5.2) shall include an evaluation of its impact on plant operation, testing, and maintenance. This evaluation shall assure that the security restrictions for access to equipment and plant regions is compatible with required operator actions during all operating and emergency modes



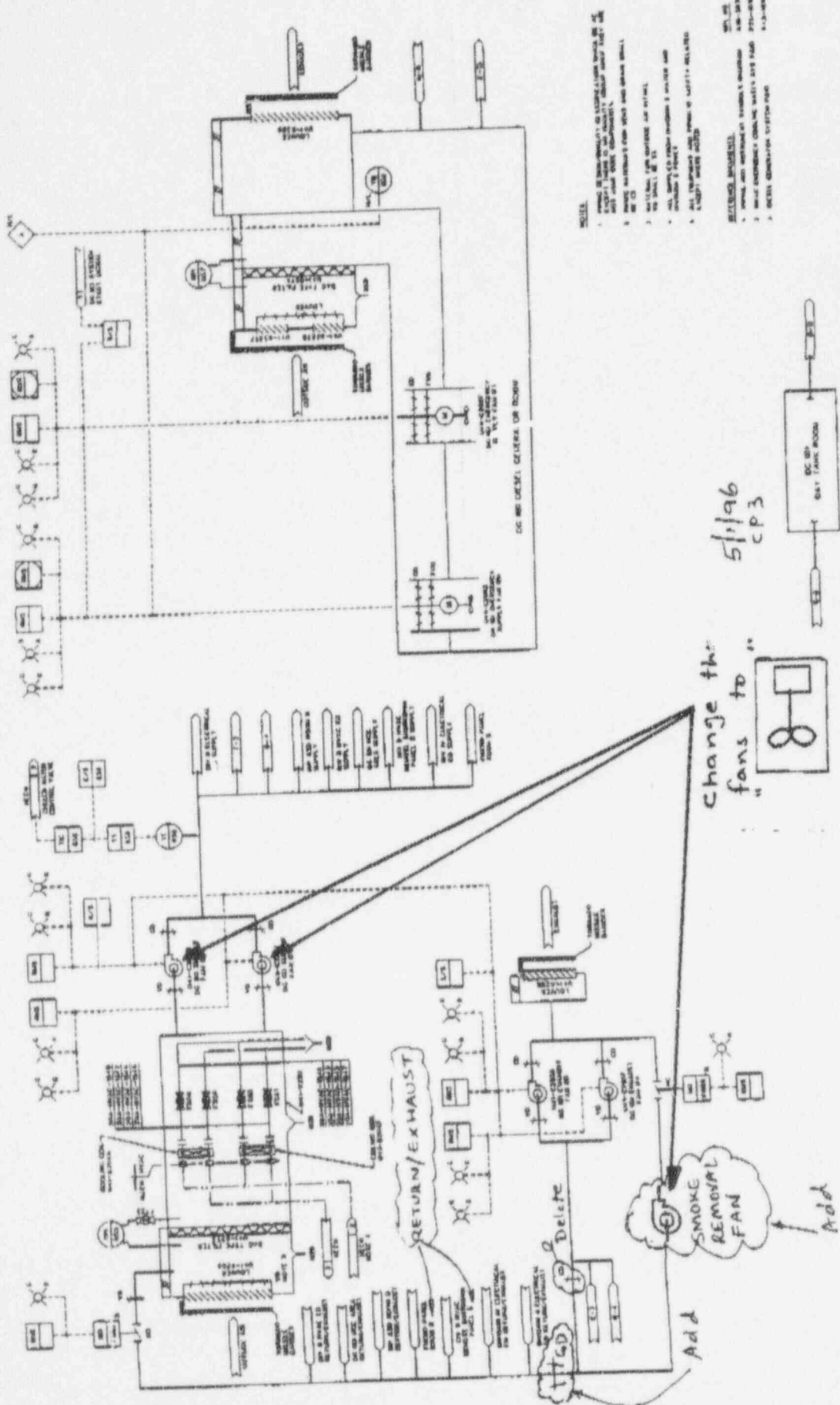
- NOTES:**
1. VERIFY ALL WORKING CONDITIONS AND MATERIALS ARE AS SHOWN ON THIS DRAWING. VERIFY ALL WORKING CONDITIONS AND MATERIALS ARE AS SHOWN ON THIS DRAWING.
  2. VERIFY ALL WORKING CONDITIONS AND MATERIALS ARE AS SHOWN ON THIS DRAWING.
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- REVISIONS:**
1. REVISED DRAWING BY: [Name]
  2. REVISED DRAWING BY: [Name]
  3. REVISED DRAWING BY: [Name]

R/B S/R ELECTRICAL EQUIPMENT HVAC 1A1

FIGURE 9.4-4 R/B SAFETY-RELATED ELECTRICAL EQUIPMENT HVAC SYSTEM (Sheet 1 of 3)

AWR ENY/PT/2

71-54.3



- NOTES**
1. ALL EQUIPMENT TO BE INSTALLED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC) AND ALL APPLICABLE LOCAL, STATE AND FEDERAL REGULATIONS.
  2. ALL EQUIPMENT TO BE INSTALLED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC) AND ALL APPLICABLE LOCAL, STATE AND FEDERAL REGULATIONS.
  3. ALL EQUIPMENT TO BE INSTALLED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC) AND ALL APPLICABLE LOCAL, STATE AND FEDERAL REGULATIONS.
  4. ALL EQUIPMENT TO BE INSTALLED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC) AND ALL APPLICABLE LOCAL, STATE AND FEDERAL REGULATIONS.
  5. ALL EQUIPMENT TO BE INSTALLED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC) AND ALL APPLICABLE LOCAL, STATE AND FEDERAL REGULATIONS.
- LEGEND**
1. SMOKE EXHAUST
  2. SMOKE REMOVAL FAN
  3. SMOKE EXHAUST
  4. SMOKE EXHAUST
  5. SMOKE EXHAUST

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change the fans to "8"



R/B S/R ELECTRICAL EQUIPMENT HVAC (B)





conduit in the raised floor areas. Cable contained in conduit or enclosed trays are not considered to contribute to the combustible loading for the room.

The divisional panels are physically separated as much as practical and located above the divisional electrical equipment rooms. The cabling from the divisional electrical equipment rooms will be routed to the Safety System Logic Control (SSLC) cabinets with Divisions I and III on one side of the operator area and Divisions II and IV located on the opposite side of the operator area.

There is a suspended ceiling but only cables associated with lighting and the fire alarm system are routed above the false ceiling. The cables are in conduit.

Paper within the control room complex is required to be stored in approved containers (file cabinets, cabinets, waste baskets) except when in use.

**9A.4.2.5 Floor Five El 12300 mm** B

**9A.4.2.5.1 Control Room HVAC "C" Exhaust Duct Chase (Rm No. 522)**

- (1) Fire Area—~~FC4310~~ 42.20
- (2) Equipment: See Table 9A.6-8

Safety-Related	Provides Core Cooling
Yes, DY <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">2</span>	No

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CPA

- (3) Radioactive Material Present—None.
- (4) Qualification of Fire Barriers—Rm No. 522 is defined as a vertical section of HVAC chase extending from the ceiling of the control room, formed by the floor located at the 12300 mm elevation, to the floor of Rm No. 629 located at the 17150 mm elevation. All four walls are designated as fire barriers and are of three hour fire-resistive concrete construction. Access to Rm No. 522 from the 12300 mm level is provided by a three hour, fire-resistive removable panel.
- (5) Combustibles Present—(NCLL Applies)

Type	Fire Loading Total Heat of Combustion (MJ)
Cable in trays	727 MJ/m <sup>2</sup> NCLL (727 MJ/m <sup>2</sup> maximum average) applies

**9A.4.2.5.12 Control Room HVAC "B," Exhaust Duct Chase (Rm No. 595)**

- (1) Fire Area—FC~~4220~~ 4310
- (2) Equipment: See Table 9A.6-4

Safety-Related	Provides Core Cooling
Yes, <u>D3</u>	No, See Remarks.

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- (3) Radioactive Material Present—None.
- (4) Qualification of Fire Barriers—Rm No. 595 is defined as a vertical section of HVAC chase extending from the ceiling of the control room, formed by the floor at the 12300 mm elevation, to the 17150 mm elevation. Walls common to Rm No. 512 (FC1110), Rm No. 532 (FC1310) Rm No. 593 (FC1310) and Rm No. 506 (FC5110) are designated fire barriers and are of three hour fire-resistive concrete construction. Access to Rm No. 595 is provided by a removable panel.
- (5) Combustibles Present—(NCLL Applies)

Type	Fire Loading Total Heat of Combustion (MJ)
None	727 MJ/m <sup>2</sup> NCLL (727 MJ/m <sup>2</sup> maximum average) applies

- (6) Detection Provided—Class A Supervised POC detection system in the room and manual pull alarm station at 6.50-J.75.
- (7) Suppression Available:

Type	Location/Actuation
Standpipe and hose reel	4.0-J.1 & 6.60-J.67 on the 17150 level/Manual
ABC hand extinguishers	4.0-J.1 & 6.60-J.67/ Manual

- (8) Fire Protection Design Criteria Employed:
  - (a) The function is located in a fire-resistive enclosure.
  - (b) Fire detection and suppression capability is provided and accessible.

- (10) Consequences of Fire Suppression—Suppression extinguishes the fire. Refer to Section 3.4, "Water Level (Flood) Design," for the drain system.
- (11) Design Criteria Used for Protection Against Inadvertent Operation, Careless Operation or Rupture of the Suppression System:
  - (a) Refer to Section 3.4, "Water Level (Flood) Design," for the drain system.
  - (b) Provision of raised supports for the equipment
  - (c) Location of manual suppression system in an area external to the room containing the safety-related equipment
  - (d) ANSI B31.1 standpipe (rupture unlikely)
- (12) Fire Containment or Inhibiting Methods Employed:
  - (a) The functions are located in a separate fire-resistive enclosure.
  - (b) The means of detection, suppression and alarming are provided and accessible.
  - (c) Fire stops are provided for cable tray and piping penetrations through rated-fire barriers.
- (13) Remarks—This equipment is also required to function to support equipment required for remote shutdown and therefore is in a fire area separate from the control room and its HVAC equipment.

The exhaust fans do not provide any cooling function. They only serve a purge function which is not necessary to the cooling function of the HVAC System.

**9A.4.2.6.6 Control Room HVAC Exhaust "C" (Rm Nos. 626, 628, 629 and 663)**

- (1) Fire Area—FC~~4910~~ ~~4220~~
- (2) Equipment: See Table 9A.6-3

Safety-Related	Provides Core Cooling
Yes, D3 <del>2</del>	No

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- (3) Radioactive Material Present—None.
- (4) Qualification of Fire Barriers—The building exterior wall common to Rm Nos. 663 and the steam tunnel, wall also common to Rm Nos. 620, 626, 628 and 663 are fire barrier of three hour fire-resistive concrete construction. The two interior walls common to adjacent fire area EC1210 are of three hour fire

- (9) Consequences of Fire—Postulated fire assumes loss of function. Even though access to rooms 612, 636, 631, 634 and 651 are not possible, the equipment in these rooms are functional (they are in a different fire area). Alternate means is provided by CRHVAC "B".
- (10) Consequences of Fire Suppression—Suppression extinguishes the fire. Refer to Section 3.4, "Water Level (Flood) Design," for the drain system.
- (11) Design Criteria Used for Protection Against Inadvertent Operation, Careless Operation or Rupture of the Suppression System:
  - (a) Refer to Section 3.4, "Water Level (Flood) Design," for the drain system.
  - (b) ANSI B31.1 standpipe (rupture unlikely)
- (12) Fire Containment or Inhibiting Methods Employed:
  - (a) The functions are located in a fire-resistive enclosure.
  - (b) The means of detection, suppression and alarming are provided and accessible.
  - (c) Fire stops are provided for cable tray and piping penetrations through rated fire barriers.
- (13) Remarks—safety-related cooling for multiple divisions is provided by redundant systems. The equipment on level 17150 in this fire area provides one division of cooling for the multi-divisional control room.

**9A.4.2.6.10 Control Room HVAC Exhaust "B" (Rm Nos. 614) ~~616 and 654~~**

- (1) Fire Area—FC<sup>4316</sup>~~4220~~
- (2) Equipment: See Table 9A.6-3

Safety-Related	Provides Core Cooling
Yes, DZ ← 3	No, See Remarks.

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- (3) Radioactive Material Present—None.
- (4) Qualification of Fire Barriers—All walls in this area are interior walls. The walls common to fire area FC1110 and FC1310 are designated as fire barriers and are of three hour fire-resistive concrete construction. The remaining interior walls are not fire barriers. The ceiling is a building exterior wall and is also of three hour fire-resistive concrete construction. The floor is common to

MPa A																			
TEMP °C	-	80	80	80	80	80	80	185	SAT	SAT	103	80	80	80	110	71	71	71	80
Max/Min TEMP °C	-	77/10	77/10	77/10	77/10	77/10	77/10	185/18	185/18	121/18	121/18	77/10	77/10	77/10	121/18	77/18	77/18	77/18	77/10

MODE E TEST MODE SUCTION FROM SUPPRESSION POOL, REACTOR  
AT HIGH PRESSURE, SUPPRESSION POOL AT LOW PRESSURE

POSITION ○	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
FLOW SEE NOTE 2	-	182	188	-	-	-	182	-	14.15	14.1	14.1	8	8	8	0.03	-	0.005	6	-
PRESS MPa A	-	*	*	-	0.10	0.14	0.14	7.17	*	*	0.12	0.52	*	0.31	*	0.07	*	*	*
TEMP °C	-	35	35	-	35	35	35	285	SAT	SAT	103	35	35	35	110	48	48	48	35
Max/Min TEMP °C	-	77/10	77/10	-	77/10	77/10	77/10	285/18	285/18	121/18	121/18	77/10	77/10	77/10	121/18	77/18	77/18	77/18	77/10

(SEE NOTE 8)

POSITION ○	1A-2A	2-2B	3-3A	3A-3B	6-7	8A-8	10-11	11-11A	3-12	12-13	13-14	15	17	18-20	3-18	18-18A	18A-21	3-20	20-21
PEAK PRESS MPa B	N/A	N/A	12.85	NOTE 13	N/A	10.35	N/A	N/A	12.85	N/A	N/A	N/A	N/A	N/A	12.85	12.85	N/A	12.85	N/A
DESIGN MPa B	2.82	2.82	11.77	8.82	0.31	8.82	2.82	0.98	11.77	2.82	2.82	0.78	0.31	1.37	11.77	11.77	0.31	11.77	0.31
DESIGN TEMP °C	77	77	77	302	77	302	185	104	77	77	77	121	88	88	77	77	104	77	104
ESTIMATED LINE SIZE mmA	200	200	150	150	200	200	350	350	50	50	50	25	40	50	50	50	50	100	100

8.62 5/1/96 CP7

302 5/1/96 CP7

PEAK PRESSURE—IS THE MAXIMUM PRESSURE ANTICIPATED DURING A TRANSIENT PERIOD WITH ALL OF THE CONTRIBUTING ELEMENTS AT A MAXIMUM. IT WOULD BE EXPECTED TO OCCUR LESS THAN 1% OF SYSTEM OPERATING TIME.

FIGURE 5.4-9 REACTOR CORE ISOLATION COOLING SYSTEM PFD (Sheet 2 of 2)

ABWR DCD/Tier 2

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21-102

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P.14/33



**Table 5.4-2 Design Parameters for RCIC System Components**

(1) RCIC Pump Operation (C001)		
Flow rate	Injection flow - 182 m <sup>3</sup> /h Cooling water flow - 4 to 6 m <sup>3</sup> /h Total pump discharge - 188 m <sup>3</sup> /h (includes no margin for pump wear)	
Water temperature range	10° to 60°C, continuous duty 40° to 77°C, short duty	
NPSH	7.3m minimum	
Developed head	900m at 8.22 MPaA reactor pressure 186 m at 1.14 MPaA reactor pressure	
Maximum pump shaft power	675 kW at 900m developed head 125 kW at 186m developed head	
Design pressure	11.77 MPaG	
(2) RCIC Turbine Operation (C002)		
	High Pressure Condition	Low Pressure Condition
Reactor pressure (saturated temperature)	8.19 MPaA	1.14 MPaA
Steam inlet pressure	8.12 MPaA, minimum	1.03 MPaA, minimum
Turbine exhaust pressure	0.11 to 0.18 MPaA, maximum	0.11 to 0.18 MPaA, maximum
Design inlet pressure	8.62 MPaG at saturated temperature	
Design exhaust pressure	8.62 MPaG at saturated temperature	
(3) RCIC leakoff orifices (D017, D018)		
Flow element (FE007)	Sized for 3.2 mm diameter minimum to 4.8 mm diameter maximum	
Flow at full meter differential pressure	250 m <sup>3</sup> /h	
Normal temperature	10 to 77°C	
System design pressure/temperature	8.62 MPaG/302°C	
Maximum unrecoverable loss at normal flow	0.031 MPa	
Installed combined accuracy (Flow element, Flow transmitter and Flow indicator)	±2.5% at normal flow and normal	

8.62

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CP7





**GE Nuclear Energy**

ABWR

Date 5/3/96

Fax No. \_\_\_\_\_

To

Angela Chu, NRC OTSB  
301 415 2279

cc: J. Fox

This page plus 1 page(s)

From

Cal Tang

Mail Code \_\_\_\_\_  
175 Curtner Avenue  
San Jose, CA 95125

Phone

(408) 925- 6901

FAX

(408) 925-1193  
or (408) 925-1687

Subject Revised Markup of T.S. Page 3.5-6

Message Angela,

In SR 3.5.1.6, the number 1.04 needs  
to be changed to 1.03 to be consistent  
with LCO Applicability Statement.  
This was a roundoff error when converting  
from psi to MPaG. I assumed that  
this is not a problem with you unless  
I hear from you.

Thanks,

Cal Tang

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.5.1.6</p> <p><i>1.03 ←</i></p> <p><i>(changed to be consistent with number in LCO statement)</i></p> <p>NOTE Not required to be performed until 12 hours after reactor steam dome pressure is <math>\geq 1.04</math> MPaG.</p> <p>Verify, with RCIC steam supply pressure <math>\leq 1.14</math> MPaG, the RCIC pump can develop a flow rate <math>\geq 182</math> m<sup>3</sup>/h against a system head corresponding to reactor pressure.</p>	<p>18 months</p>
<p>SR 3.5.1.7</p> <p>NOTE Vessel injection may be excluded.</p> <p>Verify each ECCS subsystem actuates on an actual or simulated automatic initiation signal.</p>	<p>18 months</p>
<p>SR 3.5.1.8</p> <p>NOTE Valve actuation may be excluded.</p> <p>Verify the ADS actuates on an actual or simulated automatic initiation signal.</p>	<p>18 months</p>
<p>SR 3.5.1.9</p> <p>NOTE Not required to be performed until 12 hours after reactor steam dome pressure is <math>\geq 6.55</math> MPaG.</p> <p>Verify each ADS valve opens when manually actuated.</p>	<p>18 months on a STAGGERED TEST BASIS for each valve solenoid</p>

## BASES

SURVEILLANCE  
REQUIREMENTS  
(continued)SR 3.5.1.9

LCO 3.3.1.1 and LCO 3.3.1.4 overlap this Surveillance to provide complete testing of the assumed safety function.

The Frequency of 18 months on a STAGGERED TEST BASIS ensures that both solenoids for each ADS valve are alternately tested. The Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown that these components usually pass the SR when performed at the 18 month Frequency, which is based on the refueling cycle. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

## REFERENCES

1. DCD Tier 2, Section 6.3.2.
2. DCD Tier 2, Section 15.6.4.
3. DCD Tier 2, Section 15.6.5.
4. DCD Tier 2, Section 15.6.6.
5. 10 CFR 50, Appendix K.
6. DCD Tier 2, Section 6.3.3.
7. 10 CFR 50.46.
8. DCD Tier 2, Section 6.3.3.9.
9. DCD Tier 2, Section 190.9.
10. DCD Tier 2, Section 7.3.1.1.1.2.
11. 10 CFR 50, Appendix A, GDC 33.
12. DCD Tier 2, Section 6.7.
13. DCD Tier 2, Section 9.5.11.

(continued)

BASES

LCO  
(continued)

d. The associated piping, valves, instrumentation, and controls required to perform the safety related function are OPERABLE.

OPERABILITY of the UHS is based on a maximum RSW water temperature of [33.3]°C at the inlet to the RCW/RSW heat exchangers with OPERABILITY of each division requiring a minimum water level at or above elevation [mean sea level (equivalent to an indicated level of ≥ [ ] m) and six OPERABLE spray networks].

The isolation of the RCW/RSW System to components or systems may render those components or systems inoperable, but does not affect the OPERABILITY of the RCW/RSW System.

*The maximum Rsw water temperature of [33.3]°C will insure that the peak temperature at the inlet to the Rsw/Rcw heat exchangers will not exceed the designed value of 35°C during a LOCA.*

*add above sentence for rev. 3*

APPLICABILITY

In MODES 1, 2, and 3, the RCW/RSW System and UHS are required to be OPERABLE to support OPERABILITY of the equipment serviced by the RCW/RSW System and UHS, and are required to be OPERABLE in these MODES.

In MODES 4 and 5, the OPERABILITY requirements of the RCW/RSW System and UHS are specified in LCOs 3.7.2, "RCW/RSW and UHS-Shutdown" and 3.7.3, "RCW/RSW and UHS-Refueling".

ACTIONS

A.1

If one RCW pump and/or one RSW pump and/or one RCW/RSW heat exchanger and/or one [spray network] in the UHS in the same division is inoperable, action must be taken to restore the inoperable component(s), and thus the division affected, to OPERABLE status within 14 days. In this condition sufficient equipment is still available to provide cooling water to the required safety related components and sufficient heat removal capacity is still available to adequately cool safety related loads, even assuming the worst case single failure. Therefore, continued operation for a limited time is justified.

The 14-day Completion Time is reasonable, based on the low probability of an accident occurring during the 14 days that one or more components are inoperable in one division, the number of available redundant divisions, the substantial

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**ABWR**

**9.4.5.2.3 Safety Evaluation**

All equipment is located completely in a Seismic Category I structure that is tornado-missile, and flood protected. All equipment is designed to Engineered Safety Feature requirements.

**9.4.5.2.4 Inspection and Testing Requirements**

All major components are tested and inspected as separate components prior to installation to ensure design performance. The system is preoperationally tested in accordance with the requirements of Chapter 14.

Each HVAC System is periodically tested to assure availability upon demand. Equipment layout provides easy access for inspection and testing.

**9.4.5.2.5 Instrumentation Application**

Instrumentation and controls for the Secondary Containment Safety-Related Equipment HVAC System are designed for manual or automatic operation when safety-related equipment starts. Also, manual override from pushbutton stations in the main control room or at the MCC serving the unit.

**9.4.5.3 Reactor Building Non-Safety-Related Equipment HVAC System**

**9.4.5.3.1 Design Bases**

**9.4.5.3.1.1 Safety Design Bases**

The Non-safety-related Equipment HVAC System has no safety-related function as defined in Section 3.2. Failure of the system does not compromise any safety-related component and does not prevent safe reactor shutdown.

**9.4.5.3.1.2 Power Generation Design Bases**

The Non-safety-related Equipment HVAC System is designed to provide an environment with controlled temperature and humidity to insure both the comfort and safety of plant personnel and the integrity of equipment and components.

**9.4.5.3.2 System Description**

The R/B Non-Safety-Related HVAC System consists of six fan-coil units and four air handling units. The following rooms are cooled by the HVAC System:

- ~~Fan-Coil Units~~
- (1) ~~PCVLT measurement room~~
- (2) ISI room (A)

Related to  
 CP5 (Page 2  
 of Tier 1)  
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Rev. 0

**ABWR****Design Control Document/Tier 2**~~(5) ISI room (B)~~<sup>2</sup>~~(4) CRD replacement control room~~<sup>9</sup>~~(5) RIP/CRD/FMCRD Repair area~~<sup>2</sup>~~(6) Plant stack radiation monitor room~~<sup>2</sup>~~Air Handling Units~~<sup>2</sup>~~(1) R/B suppression pool cleanup unit~~<sup>3</sup> SPCU pump room~~(2) R/B Plant Outage Workers Room/Refueling Machine Control Room~~<sup>4 b</sup>~~(3) R/B Fuel pool cooling unit A~~<sup>5</sup>~~(4) R/B Fuel pool cooling unit B~~<sup>6</sup>

These rooms are cooled by the Secondary Containment HVAC System during normal conditions. The units are open ended and recirculate cooling air within the space served. Space heat is removed by cooling water passing through the coil section. HVAC normal cooling water or divisional RCW is used as the cooling medium. The units are fed from the non-divisional power source. Humidity is not specifically maintained at a set range, but is automatically determined by the surface temperature of the cooling coil. Drain pan discharge (condensate) is routed to a drain sump located within the room.

#### 9.4.5.3.3 Safety Evaluation

Operation of the R/B Non-safety-related Equipment HVAC System is not a prerequisite to assurance of either of the following:

- (1) Integrity of the reactor coolant pressure boundary
- (2) Capability to safely shut down the reactor and to maintain a safe shutdown condition

However, the system does incorporate features that provide reliability over the full range of normal plant operations.

#### 9.4.5.3.4 Inspection

The system is designed to permit periodic inspection of important components, such as fans, motors, belts, coils, and valves, to assure the integrity and capability of the system.

See notation  
on p. 9.4-21

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*Air Handling*

**Table 9.4-4i HVAC System Component Descriptions—Non-Safety-Related Fan Coil Units (Response to Question 430.243)**

<i>Air Handling</i> Non-Safety-Related Fan Coil Units	Quantity	Capacity (MJ/h)
Main Steam Tunnel	2	628.02
Refueling Machine Control Room	1	83.74
ISI Room	<del>2</del> 1	54.43
MG Set Room	2	1047.96
C/B Non-Safety-Related Electric Room	1	211.01
R/B F <sup>2</sup> C Room	2	28.47
CRD <sup>Control</sup> <del>Replacement</del> Room	1	18.42
RIP/CRD/FMCRD Repair Area	2	18.42
PGV LT Measurement Room	1	0.042
Plant Stock Monitor Room	1	0.046
R/B SPCU <sup>Pump</sup> Room	1	42.29

\* The COL applicant shall supply equipment lists for the Service Building HVAC and the Radwaste Building HVAC System. See Subsection 9.4.10.1 for the Service Building, and 9.4.10.2 for the Radwaste Building.

*See notation on P. 9.4-2*





**ABWR**

- (2) Fire barrier walls which are of the special construction described in Subsection 9A.3.6 or of other approved construction types bearing a UL (or equal) label for a three-hour rating.
- (3) Fire doors, which are required to have a UL (or equal) label certifying that they have been tested for a three hour-rating per ASTM E152, including a hose stream test.
- (4) Both ends of all electrical and piping penetrations between the divisions and between a division and a non-division should be qualified to the same standard and tested to ASTM E119.
- (5) Not Used
- (6) Fire dampers, which are required for any HVAC duct penetrating a fire barrier, must have a rating of three hours. The only fire dampers separating divisions are in the HVAC duct for secondary containment (six total). The plant arrangement minimizes fire dampers.
 

*Related to CP3  
This page was faxed  
to the NRC on 8/2/95  
with markup of FIER P. 9-65*
- (7) Columns and support beams, which are required to be of reinforced concrete construction or enclosed or coated to provide a three-hour rating if of steel construction.
- (8) Backup of the fire barrier penetration seals by the HVAC Systems when the HVAC Systems are operating in the smoke removal mode. This backup feature is accomplished in the Reactor and Control Buildings by maintaining a positive static pressure for the redundant divisional fire areas with respect to the fire area with the fire. Leakage is into the fire impacted area under sufficient static pressure to confine smoke and heat to the fire area experiencing the fire, even if there is a major mechanical failure of the penetration seal.
- (9) AC independent water addition (ACIWA) can be connected to the reactor building fire protection system header. Sufficient Fire Water pressure and flow should be available to perform the intended function. Refer to Subsection 5.4.7.1.1.10, AC-Independent Water Addition.

**9.5.1.1.4 Combustible Loading**

Allowable combustible loadings for the plant were established as follows (see Appendix 9B, Subsection 9B.2.3 for additional details):

- (1) 1454 MJ/m<sup>2</sup> of room area, maximum allowable average exposed combustible loading without an automatic fire suppression system. This is termed the normal combustible loading limit (NCLL).

### 3.8.3.6.2 Reactor Pedestal

The materials conform to all applicable requirements of ANSI/AISC N690 and ACI 349 and comply with the following:

(excluding the portions submerged in the suppression pool)

Item	Specification
Inner and outer shells	ASTM A441 or A572
Internal stiffeners	ASTM A441 or A572
Concrete fill	$f'_c = 27.56$ MPa
Outer shell submerged in the suppression pool <del>Stainless steel clad</del>	SA-240 Type 304 L clad ASTM A533 with Type B, Class 2

### 3.8.3.6.3 Reactor Shield Wall

The materials conform to all applicable requirements of ANSI/ASIC N690 and ACI 349 and comply with the following:

Item	Specification
Inner and outer shells	ASTM A441 or A572
Internal stiffeners	ASTM A441 or A572
Concrete fill	$f'_c = 27.56$ MPa minimum

### 3.8.3.6.4 Drywell Equipment and Pipe Support Structure

The materials conform to all applicable requirements of ANSI/AISC N690 and comply with the following:

Item	Specification
Structural steel and connections	ASTM A36
High strength structural steel plates	ASTM A572 or A441
Bolts, studs, and nuts (dia. > 19 mm)	ASTM A325
Bolts, studs, and nuts (dia. ≤ 19 mm)	ASTM A307

**3.8.3.6.5 Other Internal Structures**

The materials conform to all applicable requirements of ANSI/AISC N690 and comply with the following:

Item	Specification
Miscellaneous platforms	Same as Subsection 3.8.3.6.4
Lower drywell equipment tunnel	ASTM A516 Grade 70 or SA-240 Type 304 L clad <i>AS338 with</i>
Lower drywell personnel tunnel	ASTM A516 Grade 70 or SA-240 Type 304 L clad <i>AS338 with</i>
Lower drywell floor fill material	A material other than limestone concrete

*Type B, Class 2* (handwritten note pointing to the top of the table)

*Type B, Class 2* (handwritten note pointing to the bottom of the table)

**3.8.3.7 Testing and Inservice Inspection Requirements**

A formal program of testing and inservice inspection is not planned for the internal structures except the diaphragm floor, reactor pedestal, and lower drywell access tunnels. The other internal structures are not directly related to the functioning of the containment system; therefore, no testing or inspection is performed.

Testing and inservice inspection of the diaphragm floor, reactor pedestal and lower drywell access tunnels are discussed in Subsection 3.8.1.7.

**3.8.3.8 Welding Methods and Acceptance Criteria for Structural and Building Steel**

Welding activities shall be accomplished in accordance with written procedures and shall meet the requirements of the American Institute of Steel Construction (AISC) Manual of Steel Construction. The visual acceptance criteria shall be as defined in American Welding Society (AWS) Structural Welding Code D1.1 and Nuclear Construction Issue Group (NCIG) Standard, "Visual Weld Acceptance Criteria for Structural Welding at Nuclear Plants", NCIG-01.

**3.8.4 Other Seismic Category I Structures**

Other Seismic Category I structures which constitute the ABWR Standard Plant are the Reactor Building, Control Building and Radwaste Building substructure. Figure 1.2-1 shows the spatial relationship of these buildings. The only other structure in close proximity to these structures is the Turbine Building. It is structurally separated from the other ABWR Standard Plant buildings.