CP&L

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SEP 29 1992

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BRUNSWICK STEAM ELECTRIC PLANT UNIT 1
DOCKET NO. 50-325
LICENSE NO. DRP-71
SUPPLEMENTAL RESPONSE TO LICENSEE EVENT REPORT 1-90-013

Gentlemen:

In accordance with Title 10 of the Code of Federal Regulations, the enclosed Supplement to Licensee Event Report is submitted. This report fulfills the requirement for a written report within thirty (30) days of a reportable occurrence and is submitted in accordance with the format set forth in NUREG-1022, September 1983.

Very truly yours,

J. W. Spencer, General Manager
Brunswick Nuclear Project

ST/

Enclosure

cc: Mr. S. D. Ebneter
Mr. R. H. Lo
BSEP NRC Resident Office

IE22
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NRC FORM 366 U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92
ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Brunswick Steam Electric Plant Unit 1	05000325	1

TITLE (4) CAD System Design Deficiencies

EVENT DATE (5)			LER NUMBER (6)					REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR		SEQ. NO.		REV. NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
07	25	90	90	-	013	-	01	09	29	92	BSEP Unit 2	324

		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)							
OPERATING MODE (9)	1		20.402(b)		20.405(c)		50.73(a)(2)(iv)		73.71(b)
POWER LEVEL (10)	100		20.405(a)(1)(i)		50.36(c)(1)		50.73(a)(2)(v)		73.71(c)
			20.405(a)(1)(ii)		50.36(c)(2)		50.73(a)(2)(vii)		OTHER (Specify in Abstract and Text)
			20.405(a)(1)(iii)		50.73(a)(2)(i)		50.73(a)(2)(viii)(A)		
			20.405(a)(1)(iv)	X	50.73(a)(2)(ii)		50.73(a)(2)(viii)(B)		
			20.405(a)(1)(v)		50.73(a)(2)(iii)		50.73(a)(2)(x)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
Steve F. Tabor, Regulatory Compliance Specialist	(919) 457-2178

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	

SUPPLEMENTAL REPORT EXPECTED (14)				EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
	YES (If yes, complete EXPECTED SUBMISSION DATE)	X	NO				

ABSTRACT (Limit to 1400 spaces, i.e. approximately fifteen single space typewritten lines) (16)

On 7/25/90, it was determined that the CAC/CAD Subsystem did not meet FSAR and design requirements relative to redundancy of power supplies for the vaporizer trains and Division I and II electrical separation criteria for the inlet and the purge/exhaust sides of the CAD Subsystem.

This deficiency has existed since construction of the plant, and is the result of changing regulatory commitments that were made relative to the system not being properly incorporated into the design of the plant. Reviews since construction have not found these discrepancies.

Corrective actions include the development of engineering evaluations to eliminate the immediate concerns and a review of the system to determine long-term resolution. In addition, a review of the involved panel for additional separation concerns will be done as well as a licensing basis review being included as a part of the System Design Basis Document development.

Evaluations have determined that since manual operation of the system is readily achievable, and the system is not needed until well into the accident scenario, the system would have been able to provide its safety function.

The Supplemental Information section contains the changes addressed by revision one to this LER.

INITIAL CONDITIONS

The conditions described in this LER have existed since the original construction of the CAD subsystem. At the time of the determination of the deficiencies, both Unit 1 and Unit 2 were operating at 100% power.

EVENT NARRATIVE

The Containment Atmospheric Control (CAC) Containment Atmospheric Dilution (CAD) Subsystem design does not meet FSAR commitments and design requirements relative to:

1. Redundancy of power supplies for the vaporizer trains.

2. Division I and II electrical separation criteria for the inlet and the purge/exhaust sides of the CAD subsystem.

Attached is a sketch of the CAC/CAD subsystem major components involved in this event.

As a result of questions from the Resident NRC Inspector concerning the CAD subsystem, the CP&L Nuclear Engineering Department (NED) was requested by the Brunswick Technical Support unit to review the adequacy of the CAD subsystem. The request was made based on the fact that certain components within both nitrogen vaporizer loops are powered from the same emergency bus. A tracking LCO was initiated on the system (T2-90-1389) on 7/18/90. The purpose of this LCO was to establish a time frame for evaluating the operability of the CAD Subsystem. As of 7/25/90, operability of the system was indeterminate and active LCO A2-90-1430 was established as a conservative measure. The deficiency of the system relative to the vaporizer power supplies was determined to be reportable at this time and a Red Phone Report was made on 7/25/90 at 1619. EER 90-0170, Rev. 1, was approved on 8/2/90 to identify corrective actions necessary to cancel the active LCO.

Action Item No. 3 from EER 90-0170 was assigned to the Brunswick NED Electrical Unit to perform a design review of the CAD Subsystem to ensure conformance to physical separation criteria. It was determined on 8/9/90 that areas of concern existed on both the inlet and the purge/exhaust sides of the CAD subsystem regarding Division I and Division II physical separation requirements.

The failure to meet the physical separation requirements as described in CP&L Specification No. 048-004 and Updated FSAR Section 8.3.1.4.5 involves cabling associated with the Suppression Pool Purge Exhaust Valve 1/2-CAC-V7 and the Drywell Purge Exhaust Valve, 1/2-CAC-V9. The 1/2-CAC-V9 and V7 are classified as inboard isolation valves. Specification 048-004, Section 2.2.4.4(d) requires that the wiring for inboard valves shall be Division I and for outboard valves Division II. Contrary to this, the power feeds to the inboard valves V7 and V9 are Division II feeds with the Loss of Coolant Accident (LOCA) Group 6 isolation signals for these valves provided from a Division I power source. The outboard valves and the other inboard valve, 1/2-CAC-V172, power feeds and isolation signals are in compliance with Specification 048-004.

A review of the system design basis information was conducted to determine the original basis. Per paragraph 1.2.2, "System Design Basis Document (SDBD)-24, Containment Atmosphere Control System, Redundancy Criteria", the CAD subsystem was designed with redundant valves and vaporizers to ensure operation at the subsystem level in the event of a single failure of any active component. Paragraph 1.2.2 further states that electrical power for critical components is taken from one of the two emergency buses or from the DC Power System. The original design basis for the CAD Subsystem requires a reliable source of power (i.e., DC or emergency AC) to critical components, combined with redundancy on the component level (i.e.,

redundant valves and vaporizers). The power supply criterion states that power be provided from the nearest available source. With respect to separation criteria, paragraph 1.7.6 states that CAD Subsystem electrical equipment has been designed with suitable redundancy so that no single failure of the vaporizer heaters nor solenoid valves render the system inoperable. Neither criteria requires redundant emergency power supplies.

United Engineers and Constructors (UE&C), the architect-engineer for the CAD Subsystem, in a memorandum dated October 15, 1971, indicated that the original draft of UE&C Specification 9527-01-260-1, Hydrogen Control Systems, did not address redundancy of active components in the CAD Subsystem. In order to satisfy the Design Guide 7 redundancy requirements, UE&C indicated that if required to meet licensing concerns, credit could potentially be taken for containment venting through the Standby Gas Treatment System as a back-up in the event of CAD Subsystem failure. UE&C agreed, however, to revise Specification 9527-01-260-1 to require redundancy of active components and critical control functions of the CAD Subsystem, as an added measure of protection.

Section 3.1 of the UFSAR contains the compliance statement for General Design Criterion (GDC)-41. The compliance paragraph states that nitrogen will be added to the containment atmosphere for dilution as required to maintain a nonflammable atmosphere. In addition, the Safety Evaluation Report associated with the Combustible Gas Control Section of the SAR states that the proposed system is designed such that no single active failure can compromise its function. It further states that the system is acceptable for combustible gas control in that it meets the intent of Criterion 41 and the provisions of Regulatory Guide 1.7.

In a letter (NG-77-481) responding to a request by the NRC for additional information concerning de-inerting of the reactor containment dated April 25, 1977, the CP&L response to Question 5 concerning the CAD Subsystem made the following statements:

1. The Containment Atmosphere Dilution (CAD) subsystem is designed to engineering safety features (ESF) standards. All equipment required for CAD service is designed with suitable redundancy and interconnections such that no single failure of an active component will render the system inoperable.

2. All electrical power for critical components in this subsystem is taken from either Division I (Bus E3) or Division II (Bus E4) Emergency Busses.

3. A listing of active components of the CAD Subsystem and their motive power supplies (except for the containment isolation valves) was given. This listing showed the electrical motive power supply for the A vaporizer to be Division I E Bus, and the B vaporizer to be Division II E Bus.

The as-built motive power supply for the A vaporizer is actually a Division II supply, while the B vaporizer is a Division I supply. This condition does not meet the commitments relative to CAD being designed to ESF standards.

LER 2-80-079 referenced a CAD design deficiency relative to the Group 6 isolation override function which did not meet single active failure criteria as stated in the FSAR. The failure of a single relay could have prevented post-LOCA nitrogen injection due to the inability to remotely operate injection valves CAC-V5, V6, V47, V48, V55 and V56. Part of the corrective actions for this event was a schematic review of the CAC/CAD system. This review found no other active components that were outside single failure criteria.

Furthermore, commitments made relative to NUREG-0737 Item II.E.4.1 for installation of a dedicated CAD nitrogen injection system for hydrogen control during a post-accident environment included updating the system to meet Item II.E.4.1 requirements by having a design that is single active failure proof for both containment isolation and operation of the purge system. Plant Modifications 80-133 and 80-134, Dedicated Hydrogen Control, were developed to install the system that was to meet the requirements of NUREG-0737, Item

II.E.4.1, which forms the basis for the current commitments relative to CAD design.

A design review done in preparation of writing of PMs 80-133 and 80-134 identified two design deficiencies relative to the CAC/CAD system. The deficiencies were:

1. The cables from the emergency busses to the MCCs supplying the feed to the CAD vaporizers from the Augmented Off-Gas (AOG) Building were not routed as ESS cable, nor were MCCs in the AOG Building seismically qualified.

2. The cables associated with electrical circuits of certain CAC containment isolation valves were not properly labeled.

PMs 80-133/134 provided design improvements to eliminate the deficiencies noted above. Although the PM noted that the A and B vaporizers were powered from Division II and I, respectively, the significance of this condition was not recognized. The deficiencies with the CAC-V7 and V9 valves were also not recognized during preparation of the PMs.

CAUSE OF EVENT

The original design intent of the CAD Subsystem was to provide a system with redundant mechanical flow paths and reliable, but not necessarily redundant, power supplies. Although the original design and construction was not to ESF standards, the CAD Subsystem was committed to be designed to ESF standards, as part of the licensing process for Unit 2. Reviews done during this time failed to recognize design deficiencies relative to the licensing commitments. Reviews performed for the development of PMs 80-133/134, to meet the commitments of NUREG-0737, Item II.E.4.1, and LER 2-80-079 also failed to identify these deficiencies.

CORRECTIVE ACTIONS

Upon discovery of the potential deficiencies with the CAD Subsystem, a 7-day Tracking LCO was established. Since operability was indeterminate as of 7/25/90, an active LCO was established as a conservative measure. EER No. 90-0170 was written to identify corrective actions necessary to cancel the active LCO. The corrective actions identified in EER 90-170 were:

1. Prepare and perform a procedure to demonstrate the acceptability of manual system operation. Special Procedure (SP) 2-SP-90-024 was developed, and performed satisfactorily on 8/10/90.

2. Revise the Plant Operating Manual to incorporate manual operating procedures for the CAD Subsystem, based on the results of the procedure identified in Item 1 above. Item 2 was completed on 8/21/90.

3. A design review of the CAD Subsystem shall be performed to ensure conformance to physical separation criteria. This review has been performed and documented in EER 90-0182 and in report PID G0153A, CAD Subsystem Division I/Division II Physical Separation Report. These documents showed that physical separation discrepancies did exist in the CAD Subsystem. PM 90-051 has been installed and was declared operable 8/22/90, providing divisional separation in the CAD Vaporizer Heater Control Cabinets. EER 90-0182 performed the following:

   a. Addressed the electrical division separation concerns associated with the

CAD Primary Containment Isolation System (PCIS) valve function in the BSEP Units 1 and 2 Division I Termination Cabinet XU-53.

b. Documented the applicable justifications for continued plant operation with the currently installed CAD PCIS valve wiring divisional separation configurations.

c. Identified the following additional corrective actions necessary to assure appropriate resolution of the identified separation discrepancy:

1) Initiate a Unit 1 Project and complete required corrective actions to resolve the divisionalization problems associated with these valves' circuits, such that compliance with Specification 048-004 is achieved. This item is to be implemented prior to the end of Unit 1 Refuel Outage 8, currently scheduled to begin April 4, 1992.

2) Initiate a Unit 2 Project and complete required corrective actions to resolve the divisionalization problems associated with these valves' circuits, such that compliance with Specification 048-004 is achieved. This item is to be implemented prior to the end of Unit 2 Refuel Outage 10, currently scheduled to begin September 7, 1991.

4. Final long-term resolution to the CAD Subsystem redundant power supply concern shall be identified. Options to be considered include system upgrades or justification of the current design, taking credit for manual system operation. UFSAR revisions will be made to reflect final system configuration, as necessary.

Identification of the long term final resolution to the CAD Subsystem redundant power supply concern was completed 10/30/90. The resolution includes implementation of a modification to achieve redundant CAD Vaporizer Trains, with the A train as Division I and the B train as Division II.

It is believed the separation problems are isolated to the CAD/CAC system, due to the changed design requirements as discussed in the Event Cause section of this LER. However, as an added measure of assurance, wiring in the XU-53 panel will be checked for separation compliance. This panel is especially susceptible to separation problems since it contains both Division I and Division II wiring. Any deficiencies will be corrected as a part of the modifications identified in EER 90-0182. If the check of XU-53 reveals additional problems of a generic nature, the investigation will be expanded, and appropriate corrective actions initiated.

NED is currently developing System Design Basis Documents. As part of the development of these documents, a review of the licensing basis of the plant is to be included, to ensure that the design basis documents reflect the current plant licensing basis.

SAFETY ASSESSMENT

The CAD Subsystem is designed to provide a long-term source of nitrogen following a LOCA, to maintain the oxygen concentration in containment below the Safety Guide 7 limit of 5%. This ensures that combustibility levels are not reached during the event.

As identified in EER 90-0170 and the Updated FSAR, the CAD System "was designed to Engineered Safety Features (ESF) Standards; therefore, all equipment required for CAD service was designed with suitable redundancy and interconnections such that no single failure of an

active component will render the system inoperable." The CAD subsystem design complies with single active failure criteria on a component level (i.e., valves, vaporizer, etc.). With respect to redundancy of power supplies, the CAD Subsystem is not completely protected against single active failure; however, the system is designed to be manually initiated using remote manual valves and controls. There are no automatic initiation features associated with the system.

In the highly unlikely event of a loss of power from Unit Substation E6, CAD Subsystem Loop B can be placed in service by manual operation. Manual operation of the CAD Subsystem vaporizer valves provides adequate and reasonable compensatory action to ensure that the system remains capable of performing its safety-related function, even in the unlikely event of a loss of power from Substation E6.

BNP no longer relies upon containment purge/repressurization as the primary means of hydrogen control due to improvements in containment atmosphere control since installation of nitrogen pneumatic and nitrogen backup systems. Elimination of this reliance diminishes the safety significance of the CAD Subsystem. Based on NEDO-22155 base case assumptions, peak containment oxygen concentrations will be maintained below combustible limits even without dilution by the CAD Subsystem; however, in keeping with the requirements of Generic Letter 84-09, the CAD Subsystem will continue to be maintained as a "safety-grade" system.

Despite the electrical division separation discrepancies that exist within the Division I Termination Cabinet XU-53, the PCIS function of the above noted CAC containment exhaust valves could not have been blocked/defeated. Therefore, past operability of the PCIS was not compromised.

Past CAD Subsystem operability with respect to power supply single failure criteria could have been ensured by manually initiating dilution flow. Although the manual mode of operation was not proceduralized in the past, the capability has always existed. 2-SP-90-024 demonstrated the ease with which manual operation can be facilitated. The actions required are straightforward and within normally expected operator capability. Although the CAD Subsystem is designed to be initiated remotely, the vaporizer temperature indicating controller setpoint must be locally set to match containment bulk average temperature in accordance with normal operating and emergency operating procedures. Therefore, manual operation does not increase operator resource requirements or exposure above that previously analyzed.

In the actual event of a LOCA, concurrent with a loss of an Emergency Unit Substation, it is reasonable to expect that a high priority would be placed on correcting the failure in order to restore power to critical plant components. Containment atmosphere dilution is not postulated to be necessary until approximately 12 hours following an accident. Based on this duration, it is probable that power from the failed Unit Substation would be restored before the need for CAD Subsystem operation, thereby decreasing the likelihood that manual operation would be necessary.

Revision One Supplemental Information

Revision one (1) to this LER extends the corrective action due dates associated with divisionalization of power to the Unit 1 and Unit 2 drywell and suppression pool purge exhaust valves (reference EER 90-0182 as addressed in Corrective Actions Section of this LER). Original due dates of 4/4/92 (Unit 1) and 9/7/91 (Unit 2) have been changed to the end of outage B109R1 (Unit 1) and to the end of outage B211R1 (Unit 2). The additional time is needed because during the exhaust valve power divisionalization project proposal phase, engineering determined that system compliance to the original design criteria would increase the core damage frequency. Consequently other options needed to be researched. Additionally, the necessary modifications must be implemented during unit outages.

A review of the CAC venting subsystem was performed to determine the best solution for the separation problems and for enhancing the operation of the CAC venting subsystem. A project proposal was developed based upon the results of the system review. The project proposal was approved on May 20, 1992. The proposal evaluated and identified the divisional separation problems in control room cabinet XU-53. Additionally, during development of the proposal, divisional separation problems in control room terminal cabinet XU-56 were also identified. The proposal's recommended solution requires that the CAC system divisional separation problems in control room terminal cabinets XU-53 and XU-56 be corrected by providing physical barriers between Division I and II or by analysis as defined by IEEE Standard 384, IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits. In addition the proposal recommends that the new hardened wetwell vent path be used as an additional path for enhancing containment venting in accordance with emergency operating procedures. To enhance the ability to vent post accident, the suppression pool vent valve CAC-V7 power source will be changed from a Division II source to a power source which can be supplied from Division I or Division II. The change in the power source for CAC-V7 will provide an additional path for venting primary containment following an accident. This additional path, which uses the new hardened wetwell vent, is independent of a failure of Division I or Division II power.

The recommended solution will not modify the control circuits for the CAC containment isolation valves such that compliance with Specification 048-004 is achieved. The design philosophy of making inboard containment isolation valves Division I and outboard containment isolation valves Division II, as required by Specification 048-044, works well for valves which are solely containment isolation valves, because it ensures that no single failure (i.e., hot short, open circuit, ground, power failure, etc.) will prevent both the inboard and outboard containment isolation valves from closing. However, this design philosophy does not work as well when the valves have a dual function during an accident and are required to be re-opened after satisfying their containment isolation function. If the inboard and outboard valves are supplied from different divisions, then a single failure of a power source prevents the use of the vent path post accident.

After completion of the project, two post accident vent paths will be available during a loss of Division II AC power and three vent paths will be available during a loss of Division I AC power. If modifications were implemented to make the system conform with specification 048-004, one post accident vent path would be available during a loss of Division I AC power and one vent path would be available during a loss of Division II AC power. Enhancements to the CAC venting capability as defined in the project exceed the original design basis while reducing core damage frequency.

A revision to Specification 048-004 and to the Updated Final Safety Analysis Report will be required to complete the recommended solution.

Due to the length of time required to implement the modifications, the UFSAR will be revised to reflect current plant condition.

Finally, the assurance that NED is including a review of the plant licensing basis as part of the development of the System Design Basis Documents is provided within NED Procedure 3.1.A which requires that a System Design Basis consist of the functional and regulatory requirements the system design must meet and the codes/standards of record that restrain/bound its design. Additionally, NED Procedure 3.1.A requires that licensing documents be researched and the information sorted and housed in a computer data base in an effort to ensure that regulatory requirements are systematically captured in the Design Basis Reconstitution Project.

TEXT (If more space is required, use additional NRC Form 366A's) (17)

EIIS COMPONENT IDENTIFICATION

System/Component	Code
CAC/CAD	BB
PCIS	JM
AOG	WF
DC Power System	EI
CAD Vaporizer	BB/VPR
Emergency Bus	EK/BU
Suppression Pool Purge Exhaust Valve (CAC-V7)	JM/ISV
Drywell Purge Exhaust Valve (CAC-V9)	JM/ISV
Division I Termination Cabinet XU-53	EI/CAB
Nitrogen Pneumatic System	**
Nitrogen Backup System	**

** EIIS System Code Not Available