

Duke Power Company
Catawba Nuclear Station
P.O. Box 256
Clover, SC 29710

(803)831-3000



DUKE POWER

March 21, 1991

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

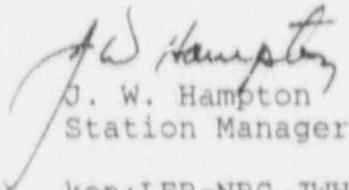
Subject: Catawba Nuclear Station
Docket No. 50-413
LER 413/91-08

Gentlemen:

Attached is Licensee Event Report 413/91-08, concerning INABILITY TO MAINTAIN CONTROL ROOM PRESSURE DURING LOSS OF POWER EVENTS DUE TO DESIGN DEFICIENCY RESULTING IN ENTRY OF TECHNICAL SPECIFICATION 3.0.3.

This event was considered to be of no significance with respect to the health and safety of the public.

Very truly yours,


J. W. Hampton
Station Manager

ken:LER-NRC.JWH

cc: Mr. S. D. Ebner
Regional Administrator, Region II
U. S. Nuclear Regulator Commission
101 Marietta Street, NW, Suite 2900
Atlanta, GA 30323

M & M Nuclear Insurers
1221 Avenues of the Americas
New York, NY 10020

R. E. Martin
U. S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, D. C. 20555

INPO Records Center
Suite 1500
1100 Circle 75 Parkway
Atlanta, GA 30339

Mr. W. T. Orders
NRC Resident Inspector
Catawba Nuclear Station

9103270265 910320
PDR ADCCK 05000413
S PDR

IE22

11

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Catawba Nuclear Station, Unit 1	DOCKET NUMBER (2) 0 5 0 0 0 4 1 1 3	PAGE 3 1 OF 0 8
------------------------------------------------------	----------------------------------------	--------------------

TITLE (4) Inability to Maintain Control Room Pressure During Loss of Power Events Due to Design Deficiency Resulting in Entry of Technical Specification 3.0.3

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)		
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES		DOCKET NUMBER (3)
0 2	1 9	9 1 9 1	1 9 1	0 0 8	0 0	0 3	2 0	9 1	CNS, Unit 2		0 5 0 0 0 4 1 4
THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 5 (Check one or more of the following) (11)											

OPERATING MODE (9) 1	20 402(a)	20 406(e)	50 73(a)(2)(iv)	73.71(b)
POWER LEVEL (10) 1 0 0	20 406(a)(1)(ii)	50 38(e)(1)	50 73(a)(2)(v)	73.71(c)
	20 406(a)(1)(iii)	50 38(e)(2)	50 73(a)(2)(vi)	OTHER (Specify in Abstract below and in Text NRC Form 366A)
20 406(a)(1)(iv)	50 73(a)(2)(ii)	50 73(a)(2)(viii)(A)		
20 406(a)(1)(v)	X 50 73(a)(2)(iii)	50 73(a)(2)(viii)(B)		
20 406(a)(1)(vi)	50 73(a)(2)(iii)	50 73(a)(2)(ix)		

LICENSEE CONTACT FOR THIS LER (12)		TELEPHONE NUMBER	
NAME C. L. Hartzell, Compliance Manager	AREA CODE 8 0 3	8 3 1	- 3 6 6 5

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

CAUSE	SYSTEM	COMPONENT	MANUFAC TURER	REPORTABLE TO NPROS	CAUSE	SYSTEM	COMPONENT	MANUFAC TURER	REPORTABLE TO NPROS

SUPPLEMENTAL REPORT EXPECTED (14)	EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
<input type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE)	<input checked="" type="checkbox"/> NO			

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

On February 19, 1991, at 1700 hours, Units 1&2 were in Mode 1, Power Operation. Catawba was notified by McGuire Nuclear Station about a condition that may affect operability of the Control Room Ventilation System (VC). Station personnel investigating the problem discovered that the VC intake valves would close on a Loss Of Offsite Power (LOOP) event. Existence of an unanalyzed condition was declared; NRC notification was made within one hour. A compensatory action was developed to ensure that the intake valves would be opened promptly following a LOOP event. Problem Investigation Report (PIR) 0-C91-0072 was initiated on February 20. While Design Engineering was developing a permanent solution, it was discovered on February 25 that an emergency generator trip after one minute, following a Loss Of Cooling Accident and a LOOP event, would result in closed intake valves that could not be opened within the required time frame. PIR 0-C91-0086 was initiated at 1605 hours entering the station into Technical Specification (T/S) 3.0.3, Limiting Conditions for Operation. T/S 3.0.3 was exited when a waiver of T/S was received, allowing the intakes to be opened and deenergized. This incident has been attributed to a Design Deficiency in that as the system was designed, the required time frame to reopen the valves was not analyzed. The isolation circuits have been removed from the VC system and the intake valves were energized.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)	
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
Catawba Nuclear Station, Unit 1	0500041491	0	08	00	02	OF 08

TEXT (If more space is required, use additional NRC Form 365A's) (17)

BACKGROUND

The Control Room Area Ventilation [EIIS:UC] (VC) and Chilled Water [EIIS:UE] (YC) Systems combine to form one system which is designed to maintain a suitable environment in the following plant areas at all times: Control Room (C/R), Cable [EIIS:CON] Room, Battery [EIIS:BTRY] Rooms, Switchgear Rooms, Motor [EIIS:MO] Control Center (MCC) Rooms, and the Electrical Penetration [EIIS:PEN] Rooms at elevation 594+0. The VC/YC System is shared between both Units. There are two 100% redundant trains of VC/YC equipment. Each is capable of being powered by Unit 1 or Unit 2 Essential Auxiliary Power, but under normal conditions both trains are aligned to Unit 1. Two Diesel Generators [EIIS:GEN] (D/Gs) are provided per Unit to energize the Essential Auxiliary Power buses during emergency conditions.

Pressurization of the C/R and C/R Area is accomplished by the induction of outside air into the air handling systems serving these areas by way of filter [EIIS:FLT] trains and associated fans [EIIS:BLO]. The two outside air intakes are at two separate locations and consists of isolation valves [EIIS:V], a tornado damper, a radiation monitor, two chlorine detectors [EIIS:XT] and a smoke detector in each intake. The radiation monitors and the chlorine and smoke detectors are arranged so as to close their respective air intake valves upon detection of radiation, chlorine or smoke. Train separation provides for one shut-off valve in each intake to be Train A and the other to be Train B. The duct for the outside air intakes is arranged so that the Train A and Train B filter trains can take air from either intake location. This allows the operator to switch to the alternate intake if one should become contaminated.

Technical Specification (T/S) 3.7.6 specifies that two independent trains of VC/YC shall be operable during all operational modes. If one train becomes inoperable while either Unit is in Mode 4, Hot Shutdown, or above, the inoperable train must be restored to operability within seven days, or the operating Units must be shutdown. If both Units are below Mode 4 and one train is inoperable, the train must be restored to operability within seven days or the operable train must be operated in the FILTER mode. If both trains are inoperable, or with the operable train not capable of being powered by an operable emergency power source, all core alterations and positive reactivity changes must be suspended on both Units. The requirement for an operable emergency power source is only stated in T/S 3.7.6 specifically for Units operating below Mode 4.

Technical Specification 3.0.3 is required to be entered when the Unit is operating in a condition prohibited or not covered by Technical Specifications. This condition exists when a Limiting Condition for Operation is not met as provided in the associated Action Requirements. It requires that within one hour action shall be initiated to place the Unit in a Mode in which the specification does not apply by placing it, as applicable, in:

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1) Catawba Nuclear Station, Unit 1	DOCKET NUMBER (2) 0 5 0 0 0 4 1 4 9 1	LER NUMBER (6)			PAGE (3)	
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
		9 1	0 0 8	0 0	0 3	OF 0 8

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

- a) At least Hot Standby in the next 6 hours,
- b) At least Hot Shutdown within the following 6 hours, and
- c) At least Cold Shutdown within the subsequent 24 hours.

The Catawba Nuclear Station T/S 3.0.3 interpretation states that the purpose of the one hour is to allow for preparation of an orderly shutdown before initiating a change in plant operation. It further states that if the equipment problem can be resolved within three (3) hours, no load reduction is necessary as this still leaves sufficient time to shutdown in a controlled and orderly manner and well within the specified maximum cooldown rate and within the cooldown capabilities of the facility assuming only the minimum required equipment is operable. The Compliance Duty Engineer (or alternate) is to be informed of the situation such that he will understand why T/S 3.0.3 was entered and power was not reduced, so the NRC Resident Inspectors can be informed of the situation. This discussion with the Compliance Duty Engineer is in addition to the normal discussions with the Station Manager/ Duty Station Manager.

Station Directive 3.1.14, Operability Determination, provides guidance on establishing Compensatory Actions to maintain system/equipment operability. Enclosure 2, Operability Policy for Previously Identified Items, identifies the concerns that must be evaluated prior to initiating Compensatory Actions to insure an unreviewed safety question does not exist.

- 1) A procedure or other written instruction is available to direct the manual operation.
- 2) The individual designated to perform the function has been trained/qualified.

A maximum of three working days is allowed to complete the analysis necessary to determine if an operating system is currently operable or not. Ten days are allowed to determine if a system was previously operable or not.

EVENT DESCRIPTION

On February 19, 1991, at 1700 hours, with Units 1&2 in Mode 1, Power Operation, McGuire Nuclear Station (MNS) Compliance notified Catawba Nuclear Station (CNS) Compliance that the MNS VC system outside air intakes would close upon a Loss Of Offsite Power (LOOP) event. Discussion of the concern continued involving DE, Catawba Performance, and Catawba Compliance personnel.

At approximately 2100 hours, cognizant station personnel agreed that a potential unanalyzed condition existed because the VC system could not satisfy the requirements of General Design Criteria (GDC) 19, Control Room Habitability Requirements under the postulated scenario. The decision was made to implement compensatory measures to reopen the valves from the C/R if an event occurred in order to ensure that GDC 19 requirements would be met. The one hour notification to the Nuclear Regulatory Commission (NRC) was made. Appropriate action was taken to develop and approve the compensatory measures.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1) Catawba Nuclear Station, Unit 1	DOCKET NUMBER (2) 0 5 0 0 0 4 1 4 9 1	LER NUMBER (8)			PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
		— 0	0 8	— 0 0	0 4	OF	0 8

TEXT (If more space is required, use additional NRC Form 386A's) (17)

At 0315 hours on February 20, the compensatory measures were implemented, approximately 6 hours after the determination that the VC system would not have met GDC 19 requirements. At the time, Compliance personnel did not consider the VC system to be inoperable as it was not clear that the unanalyzed condition made VC inoperable under the T/S requirement. Therefore, entry into T/S 3.0.3 was not made at that time. However, corrective action in the form of compensatory measures were put in place within the time frame allowed by T/S 3.0.3.

On February 20, at 0315 hours, the compensatory measures were implemented to open the intake valves within three minutes following a LOOP event. Problem Investigation Report (PIR) O-C91-0072 was initiated at 1700 hours to evaluate the applicability of the concern to Catawba.

On February 25, at 1400 hours, a meeting was held with station management, DE, and the on site Nuclear Regulatory Commission (NRC) to discuss concerns about the VC system. During a comprehensive VC system review, Performance had identified an additional, potential failure condition involving a LOOP/LOCA followed by a diesel trip after one minute. The discussion considered the credibility of the postulated scenario. At 1605 hours, DE concluded that the event was credible and that GDC 19 could not be met under those conditions. Both VC trains were declared inoperable but functional. PIR O-C91-0086 was initiated and T/S 3.0.3 was entered. Discussions began on the request of a Waiver Of Compliance for T/S related to closure of the intakes. The waiver would allow for the intakes to be placed in the open position with the power removed.

At 1625 hours, the unit managers, shift supervisors, and duty managers were notified about the entry into T/S 3.0.3. The Technical Specification Action Item Log (TSAIL) was appropriately updated to reflect the condition of the VC system. Compliance and the NRC were already aware of this condition.

At 1650 hours, notifications were made to prepare for both Units to begin reducing loads.

At 1705 hours, the duty Chemistry supervisor was notified to restrict movement of Chlorine bottles until further notice. This was in anticipation of the waiver being granted.

At 1715 hours, Performance duty personnel were notified to anticipate shutdown.

At 1715 hours, station management and the NRC discussed the request for the waiver of compliance. A verbal waiver was granted with the written waiver expected to arrive later in the evening.

At 1800 hours, it was determined that load reduction would not start as planned. Load reduction plans were placed on hold and would resume in case the waiver was rejected.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (2)			PAGE (3)	
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
Catawba Nuclear Station, Unit 1	0 5 0 0 0 4 1 4 9 1	—	0 0 8	—	0 0	0 5 OF 0 8

TEXT (if more space is required, use additional NRC Form 386A's) (17)

At 2225 hours, the written waiver was received. Both trains of VC were declared operable and the units exited T/S 3.0.3. All four VC air intake valves were tagged open with power removed. The original compensatory action to open the valves within the three minute time period was removed. The waiver specified that no more than one 150 pound Chlorine bottle be moved on site at a time. The shift manager instructed that all duty supervisors provide notification before moving any Chlorine. Chemistry red tagged the individual bottles on the service water intake.

On February 27, Urgent Modification CN-50422 was initiated to remove the smoke detector and radiation monitor isolation circuits from the VC system. The modification began on February 28, per Work Request 13782 NSM and was completed on March 6, 1991.

CONCLUSION

This incident is attributed to Design Deficiency in that as the system was designed, the time frame required to reopen the air intakes to avoid potentially exceeding GDC 19 Criteria for C/R habitability was not analyzed. No administrative controls were identified as necessary to make this happen. Secondly, the design of the system under the dose analysis as written did not take into account the consequences of a single failure of an intake where the isolation circuitry fails it closed, nor was guidance provided as to what would be required to avoid exceeding GDC 19 criteria.

The VC system remained functional throughout this event with proper C/R pressure and temperature being maintained. However, the ability of the VC system to establish and maintain a positive pressure within the required nine minute time frame during a LOOP and LOCA event, along with an emergency diesel generator trip after one minute, was negated by the design of the isolation circuit. Had a LOOP and LOCA event occurred prior to the modification, the isolation circuits would have provided a close signal to the intake valves. The intakes would have remained open until the diesel generator (D/G) provided power to the intake isolation valves and the valve would have closed, isolating the intake. If a D/G would have tripped after one minute of operation, the isolation valves on the affected train could not have been opened in time to avoid exceeding GDC 19. Therefore, the VC System was technically inoperable since plant startup.

The original compensatory action was developed to open the intake valves from the C/R by overriding the smoke and radiation interlocks within three minutes to ensure that GDC 19 limits would not be exceeded. Operations procedures used to operate VC were revised to ensure that the VC/VC System was reset and operating properly following a LOCA event. The override circuits located in the C/R could not have functioned in the event of emergency diesel generator failure due to the fact that the VC isolation valves would be deenergized. Station management met with the NRC to request a waiver of compliance to T/S items related to closure of the VC intakes. The waiver was granted and the intake valves were deenergized in the open position. A Nuclear Station Modification was initiated which removed the smoke and radiation

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1) Catawba Nuclear Station, Unit 1	DOCKET NUMBER (2) 0 5 0 0 0 4 1 4 9 1	LER NUMBER (6)			PAGE (3)	
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
		9 1	0 0 8	0 0	0 6	OF 0 8

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

isolation circuits from the intake valve interlocks. Smoke detectors which tripped the C/R Air Handling Units were also removed during this modification since these interlock circuits were powered from the same interruptible power supply. Now that the modifications are complete, the intake valves are energized with the Chlorine monitors initiating the automatic isolations. Operator action and evaluation will be required to isolate the affected intake upon receipt of a smoke or radiation alarm.

The dose analysis used for the February 20 compensatory action was recalculated to acknowledge that a single failure on an intake valve may close the "clean" intake (or less contaminated intake) during a LOCA event leaving the more contaminated intake open. The dose analysis now assumes that the clean intake is isolated for the first ten hours, then both intakes are assumed to be opened, allowing credit for dilution by the "clean" intake. OPS Emergency Procedures and Operating Procedures were revised to require an eight hour surveillance of the intakes. This allows two hours to reopen a spuriously isolated intake, manual opening of an intake, and evaluation prior to reopening after a spurious chlorine isolation.

Subsequent corrective actions include the implementation of the original compensatory action to override the intake isolation, deenergizing the isolation valves to ensure that they remain open, restricting movement of Chlorine within the plant boundary, and implementation of the modification which removed the smoke and radiation isolation circuits from the VC intake valves. In responding to the identified concerns, T/S 3.0.3 was not entered at approximately 2100 hours on February 19 because inoperability of both trains of VC was not recognized at that time. However, action taken at that time was directed toward restoring the VC system to operability and was completed within the time limits of T/S 3.0.3 and satisfied the action requirements of T/S 3.0.3.

A review of the OEP database has revealed numerous design deficiencies over the last 24 months. There have been similar occurrences where the VC system failed to pressurize the C/R due to a design oversight. However, these previous events are not considered to be similar. Therefore, this incident is not considered to be reoccurring.

CORRECTIVE ACTIONS

SUBSEQUENT

- 1) Discussions were held with Compliance regarding operability of the VC System.
- 2) Developed compensatory actions to override smoke or radiation isolations within three minutes after a LOOP event.
- 3) Obtained a NRC waiver of compliance for T/S related to closure of the VC intake valves.
- 4) Deenergized the VC intake valves to ensure that they remained open.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1) Catawba Nuclear Station, Unit 1	DOCKET NUMBER (2) 0 5 0 0 0 4 1 4 9 1	LER NUMBER (6)			PAGE (3)	
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
		0	08	00	07	GF 0 8

TEXT (If more space is required, use additional NRC Form 306A's) (17)

- 5) Restricted movement of Chlorine within the plant boundary.
- 6) Implemented a modification to remove the smoke and radiation isolation circuit from the VC intake valves and removed smoke detector circuits which tripped the C/R air handling units.
- 7) VC intake valves were reenergized after modifications were complete.
- 8) Operations procedures were revised to reflect that operator action/evaluation is now required to isolate the affected intake upon receipt of a smoke or radiation alarm.

SAFETY ANALYSIS

Based on a problem identified at MNS, CNS identified a similar concern regarding the isolation of the control room outside air intakes on a LOOP. This problem would prevent sufficient outside air flow to pressurize the control room until an intake could be manually opened.

Following a simultaneous LOOP and LOCA, the outside air isolation valves are re-energized by the D/G load sequencer. However, loss of control power to the smoke or radiation isolation circuits of the VC System intakes causes the valves to close. This situation prevents pressurization of the control room and will impact the calculated operator dose. However, as long as the outside air isolation valves are opened within nine minutes, the calculated Design Bases Accident (DBA) control room operator thyroid dose would not exceed the GDC 19 dose limit (30 REM thyroid). Therefore, manual compensatory measures were defined and implemented so that the outside air isolation valves would be opened by the operator immediately following a simultaneous LOOP and LOCA event.

Further investigation of this problem identified an additional concern with the isolation circuits. A combination of the LOOP and LOCA scenario described above and the failure of an Emergency Diesel Generator could also prevent post-accident pressurization of the control room. If the diesel generator providing power to the outside air isolation valves failed after the isolation valves went closed, but before manual operator action could be taken to open the valve, the outside air isolation valves could not be opened quickly enough to prevent the calculated DBA thyroid dose from exceeding GDC 19 limits.

The VC System was technically inoperable because control room pressurization may not be available immediately following a simultaneous LOOP and LOCA accident. This lack of proper pressurization impacts the DBA control room dose analysis and shows that the GDC 19 thyroid limit would be exceeded if pressurization was not restored within nine minutes following the accident. However, due to conservatism in the dose analysis, the realistic safety significance of control room pressurization immediately following an accident is minimal. The most important conservatism relative to this problem concerns the assumption of an instantaneous release of 25% of the core inventory of iodines to containment.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1) Catawba Nuclear Station, Unit 1	DOCKET NUMBER (2) 0 5 0 0 0 4 1 4 9 1	LER NUMBER (6)			PAGE (3)	
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
		91	008	00	08	OF 08

TEXT (If more space is required, use additional NRC Form 388A's) (17)

This nonmechanistic assumption leads to an unrealistically large calculated dose to the thyroid during the period when the control room would be unpressurized. Studies have shown that even for a large break LOCA (without Emergency Core Cooling System) it would take at least 15-30 minutes to heat up the core and begin releasing a significant amount of fission products. Even if activity had been released and infiltrated into the control room, the area radiation monitors would have alarmed the operators to back and restore pressurization. (Damper position indication is available in the control room.) Additionally, analyses for CNS show that the combination of all ESF systems, i.e., containment sprays, ice condenser, HEPA and carbon filters, and most importantly the containment itself, serve to keep offsite and onsite doses well below regulatory limits. Therefore, the safety significance of this concern is minimal.

Because, during a simultaneous LOOP and LOCA, the possibility existed that a single failure could have precluded the ability to pressurize the control room, Design Engineering recommends that the VC System be considered inoperable in the past. However, the conservative assumptions used in the dose analysis indicate that any realistic increase in dose would have been minimal. This condition was applicable to both Unit 1 and 2 since initial start-up.