NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/85

LICENSEE EVENT REPORT (LER)

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Oyster Creek, Unit 1	0 5 0 0 0 2 1 9	1 OF 1 1

TITLE (4)
Inadvertent Repositioning of Primary Containment Isolation Valves

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(S)
0 6	2 7	8 4	8 4	0 1 7	0 1	1 2	2 4	8 4		0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9): N

POWER LEVEL (10): 0 0 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)

[ ] 20.402(b)	[ ] 20.405(c)	[ ] 50.73(a)(2)(iv)	[ ] 73.71(b)
[ ] 20.405(a)(1)(i)	[ ] 50.36(c)(1)	[X] 50.73(a)(2)(v)	[ ] 73.71(c)
[ ] 20.405(a)(1)(ii)	[ ] 50.36(c)(2)	[X] 50.73(a)(2)(vii)	[ ] OTHER (Specify in Abstract below and in Text, NRC Form 366A)
[ ] 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 (AREA CODE)	
Michael H. Allen, Operations Engineer	6 0 9	9 7 1 - 4 6 1 1

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

CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)

[ ] YES (If yes, complete EXPECTED SUBMISSION DATE) [X] NO

EXPECTED SUBMISSION DATE (15): MONTH | DAY | YEAR

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

A modification was in progress which involved Plant Computer System tie-ins. During the performance of a procedure which involved the tie-in of computer wiring to existing plant circuitry, a neutral electrical lead was required to be lifted. This action caused fifteen (15) primary containment isolation valves, including all four Main Steam Isolation Valves, to reposition. The plant also experienced a half scram at approximately the same time that these valves cycled. The previously lifted neutral electrical lead and a fuse previously removed were re-installed. The primary containment isolation valves which repositioned were then placed in their proper positions by operator action. An Intermediate Range Monitor believed to have caused the half-scram was ranged up-scale, and the neutral electrical lead was once again lifted. The results were the same as before, except that no half-scram occurred. Plant conditions were restored to normal. No violation of the Technical Specifications occurred since primary containment integrity was not required at the time of the incident. The valves repositioned due to an abnormal current flowpath which was established through their solenoids when the neutral lead was lifted. This abnormal flow path has been verified through performance of additional testing on the Containment Isolation Valve control circuitry. A modification of the neutral wiring configuration and a check of the plant safety circuits for similar problems has been conducted. Also, specific cautions for lifting neutral leads have been incorporated into station administrative procedures.

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DATE OF OCCURRENCE

The event occurred on June 27, 1984 at approximately 1400 hours.

IDENTIFICATION OF OCCURRENCE

Fifteen (15) Primary Containment Isolation valves inadvertently repositioned. No violation of the Technical Specifications occurred since primary containment was not required at the time of the incident.

This event is considered to be a reportable event as defined in 10 CFR 50.73(a)(2)(ii), 10 CFR 50.73(a)(2)(v), and 10 CFR 50.73(a)(2)(vii).

CONDITIONS PRIOR TO OCCURRENCE

The reactor was partially fueled and the mode switch was in REFUEL.

DESCRIPTION OF OCCURRENCE

On June 27, 1984, a procedure was being performed for a plant modification involving a new Plant Computer System. A step of this procedure required that a neutral electrical lead connecting a panel 11F neutral to a panel 10F neutral be lifted in panel 11F in the Control Room. This allowed a computer tie-in to the neutral point. Fuse 6F8 in panel 11F was removed in an attempt to de-energize the computer tie-in points. (This also resulted in loss of valve position indication for thirteen (13) containment isolation valves.) When the lead was lifted the Control Room operator observed that the Main Steam Isolation Valve (MSIV) shut alarms cleared, and noted that all four (4) MSIVs indicated open on panel 11F. The plant also experienced a half-scram at approximately the same time. The 'A' MSIVs (NS03A and NS04A) were then observed to shut by control room indications. The control room operator ordered the removed fuse and the previously lifted neutral electrical lead re-installed. By re-installing the fuse, valve position indication for thirteen (13) of the Containment Isolation Valves (CIV) was restored, and the operators noted that the following valves had repositioned:

Valve	Description	Initial Position	Final Position
V-24-29	Recirc. loop sample valve	Shut	Open
V-24-30	Recirc. loop sample valve	Shut	Open
V-22-28	Drywell sump valve	Open	Shut
V-22-1	Drywell Equip. Drain Tank Valve	Open	Shut
V-28-17	Torus vent valve	Shut	Open
V-28-18	Torus vent valve	Shut	Open
V-28-47	Torus vent valve	Shut	Open
V-26-16	Reactor bldg. to Torus Vacuum Brkr	Open	Shut
V-26-18	Reactor bldg. to Torus Vacuum Brkr	Open	Shut
V-27-3	Drywell Purge Valve	Shut	Open
V-27-4	Drywell Purge Valve	Shut	Open
NS03A	Main Steam Isolation Valve	Shut	Open then shut
NS04A	Main Steam Isolation Valve	Shut	Open then shut
NS03B	Main Steam Isolation Valve	Shut	Open
NS04B	Main Steam Isolation Valve	Shut	Open

Many of these valves are redundant components for isolation of various penetrations into the drywell. The valves were restored to their normal positions by operator action (except the Reactor Building to Torus Vacuum Breakers, which re-opened automatically when the lead was re-installed). The GSS believed that the half-scram was caused by a spiking Intermediate Range Monitor (IRM), and had the IRM ranged up-scale. The control room operators were uncertain as to the cause of valve repositioning, and since primary containment integrity was not required, it was decided to lift the neutral electrical lead again to verify its effect on the CIVs. Fuse 6F8 was left installed so that valve position indication remained available. The results were the same as the first time the lead was lifted except that no half-scram occurred, and uncertainties exist as to whether the 'A' MSIVs (NS03A, NS04A) opened. The neutral lead was re-installed, the computer termination completed, and the repositioned valves were restored to their normal positions by operator action (again, except for the Reactor Building to Torus Vacuum Breakers, which re-opened automatically.) The Startup and Test group analyzed the control circuitry to determine the cause of the inadvertent valve repositioning, and submitted a memorandum describing the event to Plant Engineering. A Plant Deviation report was then written, and a four-hour report was made to the NRC. The computer modification had intentionally been scheduled to be performed during plant outages to allow tie-ins to safety-related circuits and to minimize impact on plant operations.

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APPARENT CAUSE OF OCCURRENCE

The apparent cause of the occurrence is attributed to the following:

a. The neutral side of the seal-in relays for the affected solenoid operated valves are connected together in a neutral string with a single wire supplying this string (in panel 10F) from panel 11F. Interruption of this neutral cross-tie causes the neutral string in panel 10F to develop a potential with respect to the 11F neutral.

b. Improper de-energization of the electrical circuit of concern. The procedure used for the computer termination should have required either:

   1. The use of a temporary jumper to maintain the neutral in panel 10F.

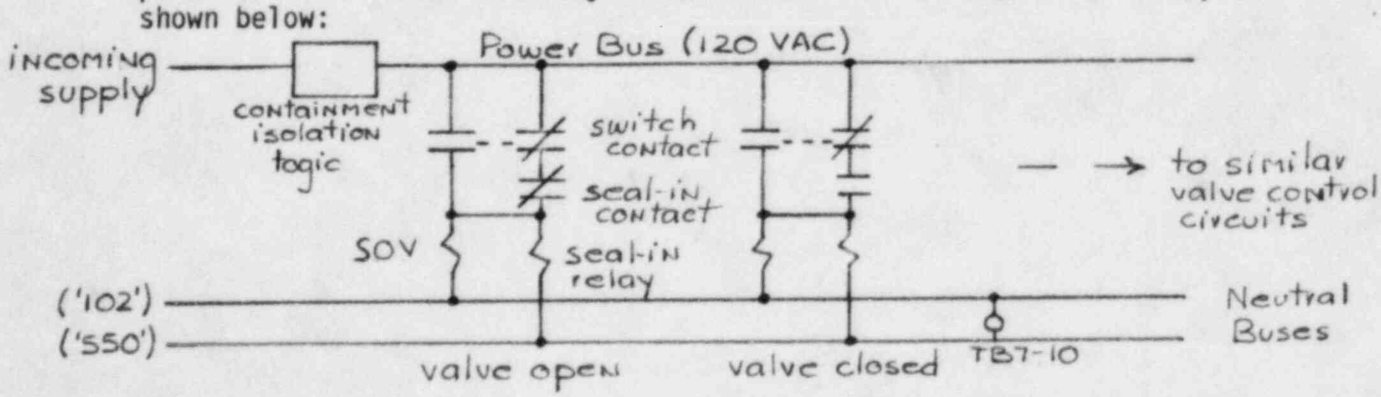
   2. De-energization of all power sources connected to the neutral involved in this event, rather than just the one from fuse 6F8.

ANALYSIS OF OCCURRENCE and SAFETY ASSESSMENT

I. Analysis of Occurrence

A. Theory

The computer tie-in previously discussed required that the neutral feed from panel 11F to panel 10F be interrupted due to the lifting of the '102' lead (11F neutral) from contact 10 of Terminal Board '7' (TB7-10) in panel 11F. The other contact on TB7-10 remained connected to the 10F neutral bus (referred to as the '550' neutral string). Since the '550' neutral string was disconnected from the panel 11F neutral, it was now possible for a voltage potential to develop between the two neutrals. As a result of a containment isolation switch relay modification conducted in 1981, the basic valve control circuit consisted of an SOV connected to the 11F neutral ('102') in parallel with a seal-in relay connected to the 10F neutral ('550'), as shown below:



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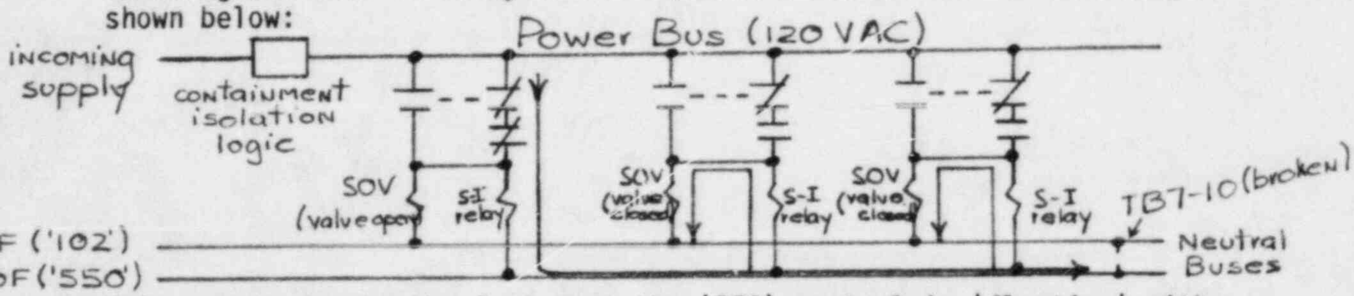
A total of 18 containment isolation valves (including MSIVs) have seal-in relays connected to the '550' neutral string. During normal operation with the valve open, the seal-in relay and SOV are energized. The seal-in contact is held shut by the energized seal-in relay. When power is interrupted to the control circuit, the SOV and seal-in relay de-energize, and the valve closes. Since the seal-in contact is now open, restoration of power will not cause the valve to automatically re-open. (The operator must place valve control switch to the 'open' position.) This was the intent of the 1981 control circuit modification. There is only one connection between the '102' bus and the '550' neutral string. This occurs at TB7-10. If the connection at this point is interrupted, an abnormal current flowpath can result from an energized seal-in relay (valve open) through a de-energized seal-in relay and SOV (valve shut) to the 11F neutral, as shown below:



This occurs due to the fact that the '550' neutral is 'floating' with respect to the 11F neutral once the TB7-10 connection is broken, and the current flow seeks a neutral (11F) through a seal-in relay and SOV in series. If sufficient voltage drop occurs across the seal-in relay for a closed valve, (determined by the number of valves initially open) the seal-in relay will energize. This shuts the seal-in contact for the closed valve, which allows full bus voltage to be applied across the SOV, resulting in the opening of the valve. Since the seal-in relays for all 18 valves are connected to the '550' neutral, all valves will open when the threshold voltage drop across their seal-in relays is reached. This theory explains the phenomena which occurred during the computer point termination on the day of the event.

B. Special Functional Test

1. Overview

After a review of the event it was decided that further testing was necessary to confirm the valve position anomalies that occurred during the computer tie-in. Specifically, detailed circuit analysis could not explain why some valves had repositioned as reported. Also, the testing was necessary to ensure that the abnormal current flow path does not prevent or override Primary Containment Isolation. A special functional procedure was developed and conducted by Plant Engineering on July 13, 1984 to meet these requirements.

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2. Description

The procedure consisted of three parts; Test I, Test II, and Test III (a retest for lifted electrical leads.) Each part is fully described below:

A. Test I

i) The objectives of Test I were to:

(a) Verify that the interrupted neutral between panel 10F and 11F during a containment isolation signal would not cause any containment isolation valves to reposition (assuming only one out of the possible five valves is in the 'bypass' position, as described later);

(b) Verify that with one valve in 'bypass' the interrupted neutral had no effect on the containment isolation reset function; and

(c) Determine the number of reopened CIVs necessary for the inadvertent opening phenomena to occur after the containment isolation signal is cleared and reset.

ii) Test I began with as many Containment Isolation Valves (CIV) open as possible. Valves which were mechanically upcoupled or that lacked position indication in the Control Room had their position checked by measurement of the voltage drop across the valve's solenoid.

A containment isolation signal was inserted causing all containment isolation valves to shut as expected. Valve V-6-395 (instrument air isolation) was placed in 'bypass' causing it to open. The 10F neutral feed from panel 11F was interrupted by lifting the same neutral lead that caused the event, and voltage difference was monitored between the 10F and 11F neutrals. The containment isolation signal was cleared and reset. Up to this point, no valves had repositioned. The Clean Up System motor operated valves (MOV) were opened. Voltage between neutrals did not change significantly. The following Solenoid Operated Valves (SOV) were then opened sequentially in the order given: V-27-1 thru V-27-4 (drywell ventilation valves), and V-28-17 (torus ventilation valve). As each valve was opened, the voltage between neutrals increased 7 to 8 volts.

Upon opening V-28-17, all other SOVs associated with the interrupted 10F neutral feed (a total of eighteen valves) simultaneously opened with no operator action. The voltage

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difference between panel 10F and panel 11F neutrals just prior to opening V-28-17 was 38 volts. Data collected indicates that approximately 39 to 46 volts bewteen neutrals is necessary to cause the phenomena to occur. Significant seal-in relay chattering and arcing was noted. This is believed to have occurred because all eighteen solenoids energized (for the eighteen valves of concern) leaving no current flowpath from the seal-in relays to the 11F neutral. The seal-in relays then began to de-energize, which also caused de-energization of the associated solenoids. This continued until a sufficient current path to the 11F neutral was again available and all seal-in relays (and solenoids) again became energized. This cycle occurred continuously thus leading to relay chattering and arcing. Blinking valve position indicator lights were noted on panel 11F for the two recirculation loop sample valves V-24-29 and V-24-30. The indicating lights responded in this manner due to the fact that each is electrically connected in parallel with its valve's seal-in relay. Thus, the indicating lights were affected by the same voltage transients as the seal-in relays for these two valves. The neutral feed to panel 10F was re-established, and the relay chattering and arcing stopped.

iii) This test demonstrated that the broken 10F neutral feed to the '550' neutral string will not by itself override a containment isolation signal (with only one of the five valves which can be bypassed in 'bypass') and that at least five SOVs must be re-opened in the post accident recovery phase (i.e. after isolation signals have cleared and been reset) before all affected SOVs will open. It also shows that the reset function is not bypassed due to the interrupted neutral with only V-6-395 in 'bypass'.

B. Test II

i) The objectives of Test II were to:

a. Verify that a containment isolation signal inserted after interruption of the 10F/11F neutral of concern would cause all CIVs to shut; and

b. Verify that a representative sample of the affected SOVs actually reposition when the neutral is interrupted.

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ii) Test II was performed with the same CIVs initially open as in Test I, except that the outboard MSIVs and the Reactor Building to Torus Power Vacuum Breakers were initially open in the first part and shut in the second part of this test, and the inboard MSIVs were initially shut in the first part of this test. The neutral feed to panel 10F was interrupted twice (once for each valve lineup mentioned above), causing all SOVs associated with this neutral to open (or remain open). Chattering and arcing in the seal-in relays was again noted, as well as an additional blinking light on panel 11F. (The V-6-395 power available light.) This light is connected in parallel with the V-6-395 seal-in relay, and experiences the same voltage transients as the relay unless the valve is bypassed open. Operators were previously stationed to observe the MSIVs in the Trunnion Room and the Reactor Building to Torus Power Vacuum Breakers on the 23 foot elevation of the Reactor Building. Local valve movement confirmed the remote valve position indication in the Control Room for the outboard MSIVs. The Reactor Building to Torus Power Vacuum Breakers did not reposition by local or remote valve position indication in either part of this test when the lead was lifted. A containment isolation signal was inserted after the lead was lifted the second time causing all valves to shut. The 10F neutral feed was re-established, and the containment isolation signal was cleared and reset. During these last two steps no changes in valve position occurred.

iii) This test demonstrated that a containment isolation signal will shut all CIVs regardless of the status of the panel 11F to panel 10F neutral tie of concern (assuming no SOVs are initially in 'bypass'). It also verified that the valves are actually repositioning during the interrupted neutral phenomena. It further resolves the initial question as to whether the Reactor Building to Torus Power Vacuum Breakers actually moved on the day of the event, since circuit analysis could not explain this phenomena. (They have no seal-in relays connected to the 10F neutral bus).

C. <u>Test III</u>

i) The objective of this test was to verify the integrity of the Containment Isolation Control Circuitry after re-installation of the 10F/11F neutral feed.

ii) A containment isolation signal was inserted with as many CIVs initially open as possible. This caused all valves to shut as expected. The isolation signal was then cleared and reset.

iii) This retest demonstrated that the control circuitry was operating properly. All valves were then returned to the positions recorded prior to the performance of this procedure.

D. Follow-up Test

A test to study the transient phenomenon occurring in the Containment Isolation Valve control circuitry was performed on September 7, 1984.

i) This test included opening five SOVs with the 'bypass' feature to determine if the remaining thirteen SOVs connected to the neutral of concern would open with a containment isolation signal still present. Test results indicate that none of the containment isolation valves (CIV) will open inadvertently in this situation.

ii) The test also included an attempt to open selected CIVs while a containment isolation signal was present and the five SOVs with the 'bypass' feature were bypassed open. Test results demonstrated that the valves which were initially closed did not change their positions.

E. Conclusions

The results of all testing strongly support the theory that interruption of the 10F neutral feed sets up an abnormal current flow path which causes all SOVs associated with that neutral to open. Testing also demonstrates that the possibility of loss of primary containment integrity may have existed during the post-accident recovery phase (after the containment isolation signal has been cleared and reset) when five or more containment isolation SOVs have been manually re-opened (with the neutral interrupted). However, the modification performed to the neutral bus has precluded this situation. The repositioning of all valves during testing could be explained by analysis of the respective valve control circuit.

II. Safety Assessment

The primary containment isolation system is designed to rapidly terminate the release and mitigate the consequences of postulated accidents involving the reactor primary system. It provides a barrier against uncontrolled release of fission products to the environs in the event of a break in the reactor coolant system.

On the day of the occurrence, the safety significance of the event was minimal since primary containment integrity was not required. With the drywell and reactor vessel heads removed, the secondary containment system provides primary containment.

The condition of the interrupted 10F/11F neutral link would not by itself have prevented containment isolation and would not have caused the CIVs to re-open upon reset of the containment isolation signal provided that less than five valves had been re-opened after reset of the signal.

The safety significance would have become greater had this event occurred at power. During power operation, primary containment integrity is required. The possible consequences of inadvertent containment isolation valve opening would be more severe during the design basis Loss of Coolant Accident (LOCA). Functional testing indicates that the 18 CIVs of concern could have opened during the post-accident recovery phase (after the containment isolation signal has been cleared and reset) if a minimum of five SOVs with seal-in relays connected to the '550' neutral bus were re-opened, and the 10F/11F neutral buses became disconnected at point TB7-10. Although the consequences of the design basis accident may be more severe if these CIVs were to open during the post-accident phase, the following mitigating circumstances must be considered:

a. The probability of 10F/11F neutral interruption at the same time as the design basis accident is small.

b. The post-accident recovery phase tends to be less severe than the accident phase since reactor water level has been re-established and drywell pressure has decreased to a relatively low value.

CORRECTIVE ACTION

The immediate corrective action was to re-install the lifted neutral lead. A functional test was pefomed on July 13, 1984 to demonstrate that insertion of a primary containment isolation signal while the 10F/11F neutral tie is interrupted will cause all CIVs to shut, and that interrupting the neutral tie while a primary containment isolation signal is present will not result in valve repositioning (assuming only one valve is in the 'bypass' mode).

Further testing was performed on September 7, 1984 which obtained data for analysis of the transient phenomenon occurring in the CIV control circuitry, and demonstrated that the five SOVs with the 'bypass' feature will not override a containment isolation signal when these valves are bypassed open.

Other solutions which were implemented are detailed below:

a. An independent contractor analyzed the CIV control circuit anomaly. The results of their analysis is in agreement with the GPUN analysis.

b. Specific cautions for lifting neutral leads were incorporated into station administrative procedures.

c. An independent contractor performed a study of the plant safety systems and concluded that the potential for both redundant trains of any other safety system to fail due to one broken wire is not present.

d. A modification of the Containment Isolation Valve Control Circuit Neutral Bus in panels 10F/11F and 12XR was performed. This modification converted the existing neutral bus into a ring bus arrangement. This change eliminates the possibility of inadvertent opening of the CIVs due to a broken/lifted wire in the neutral bus. The modification was successfully tested on October 4, 1984.

GPU Nuclear

GPU Nuclear Corporation
Post Office Box 388
Route 9 South
Forked River, New Jersey 08731-0388
609 971-4000
Writer's Direct Dial Number:

December 24, 1984

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

Dear Sir:

Subject: Oyster Creek Nuclear Generating Station
Docket No. 50-219
Licensee Event Report

This letter forwards one (1) copy of Licensee Event Report (LER) No. 84-017, Revision 1.

Very truly yours,

Peter B. Fiedler
Vice President and Director
Oyster Creek

PBF:dam
Enclosures

cc: Dr. Thomas E. Murley, Administrator
Region I
U.S. Nuclear Regulatory Commission
631 Park Avenue
King of Prussia, PA 19405

NRC Resident Inspector
Oyster Creek Nuclear Generating Station
Forked River, NJ 08731

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