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SUBJECT: LER 89-013-00:on 890508,potential inoperability of redundant
 120 V safety related devices due to DGV conditions.

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WASHINGTON PUBLIC POWER SUPPLY SYSTEM

P.O. Box 968 • 3000 George Washington Way • Richland, Washington 99352

Docket No. 50-397

June 7, 1989

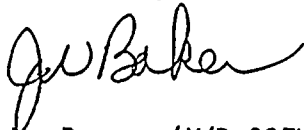
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Subject: NUCLEAR PLANT NO. 2
LICENSEE EVENT REPORT NO. 89-013

Dear Sir:

Transmitted herewith is Licensee Event Report No. 88-013 for the WNP-2 Plant. This report is submitted in response to the report requirements of 10CFR50.73 and discusses the items of reportability, corrective action taken, and action taken to preclude recurrence.

Very truly yours,



C.M. Powers (M/D 927M)
WNP-2 Plant Manager

CMP:lg

Enclosure:
Licensee Event Report No. 89-013

cc: Mr. John B. Martin, NRC - Region V
Mr. C.J. Bosted, NRC Site (M/D 901A)
INPO Records Center - Atlanta, GA
Ms. Dottie Sherman, ANI
Mr. D.L. Williams, BPA (M/D 399)

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PDR ADCK 05000397
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LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Washington Nuclear Plant - Unit 2	DOCKET NUMBER (2) 0 5 0 0 0 3 9 7	PAGE (3) 1 OF 0 7
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TITLE (4) Potential Inoperability of Redundant 120-Volt Safety Related Devices Due to Degraded Grid Voltage Conditions

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)
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OPERATING MODE (9) 5	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)	
	20.406(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 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)			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)		TELEPHONE NUMBER	
NAME	AREA CODE		
R.E. Fuller, Compliance Engineer	510	937 71-127917	

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)											
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC		

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

On May 8, 1989, preliminary calculations indicated a potential common mode failure of redundant 120-Volt safety related devices to operate from the two redundant electrical divisions (Divisions I and II) and Division III (High Pressure Core Spray (HPCS)) due to degraded grid voltage conditions coincident with design basis loads. This condition was discovered by a contractor while verifying by calculation the operability of control devices on AC/DC control power circuits at the minimum predicted voltage in response to the INPO Significant Event Report SER 80-83.

Three Problem Evaluation Requests were initiated describing the potential inoperability of safety related 120-Volt devices under degraded grid voltage conditions and design basis bus loading. An engineering assessment determined that, if this condition existed and was recognized, sufficient time would be available to the Reactor Operators to transfer to an acceptable power source in the unlikely event a degraded grid voltage condition occurred. The plant immediate corrective action was to disable the trip function in one channel of the degraded voltage transfer relays in Division I and II and raise the set point to alarm in the control room at a higher degraded grid voltage condition. The annunciator response procedures were modified to require manual transfer to an acceptable power source if the bus degraded to the new annunciator level.

The root causes of the potential failure of 120-Volt safety related components to perform their safety function due to degraded grid voltage coincident with design basis bus loads include: 1) less than adequate design criteria to limit voltage drops between the 480-Volt level and the 120-Volt level of the power system, and 2) less than adequate review of the design criteria used to limit the voltage drop at the 120-Volt level.

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

Abstract (continued)

The corrective actions include: 1) Engineering Standards will be modified to reflect the appropriate design criteria of the 120-Volt systems, and 2) Voltage regulators will be installed on the power supply to nine 120-Volt safety related power panels to maintain voltage within the rated operability range of all of the components powered by these power panels at supply voltages down to the operating point of the degraded voltage transfer relays.

The actual safety significance is unknown as determination of the actual minimum operational voltage was not conducted. However, the probability of potential inoperability of redundant 120-Volt safety related devices developing into an unacceptable safety significant event is very low. Since this condition did not actually occur, this condition did not threaten the health and safety of the public or Plant personnel.

Plant Conditions

- a) Power Level - 0%
- b) Plant Mode - 5 (Refueling)

Event Description

On May 8, 1989, preliminary calculations indicated a potential common mode failure of redundant 120-Volt safety related devices to operate from the two redundant electrical divisions (Divisions I and II) and Division III (High Pressure Core Spray (HPCS)) due to degraded grid voltage conditions coincident with design basis loads. This condition was discovered while verifying by calculation the operability of control devices on AC/DC control power circuits at the minimum protected voltage in response to the INPO Significant Event Report SER 80-83. These are preliminary calculations performed on a sample basis by a contractor.

The preliminary calculations determined the voltage level at the load end of eleven (11) branch circuits on Instrument and Control Power Panel PP-7A-E under Design Basis loading to be less than the minimum voltage required to assure operability of all safety related devices on that circuit. For example, the voltage level at the end of Circuit 12 was calculated to be 99.5 volts. The manufacturers' rated minimum voltage to assure operability of all load devices on that circuit ranged between 102 and 105.3 volts. This degraded voltage condition was calculated to occur when the supply voltage at the 4160 Volt Division I bus is at the safety minimum operating point of the three degraded voltage transfer sensor relays of 3696 Volts (E-RLY-27/7/3, 4, & 5). Due to the large number of components that this condition applied to, no effort was made to determine the actual minimum voltages required by each device.

As can be seen from Figure 1, a schematic of the AC Distribution System for WNP-2, the startup (TR-S) and normal (TR-N1) transformers supply all of the safety related 4160-Volt buses (i.e., Divisions I, II, & III) and the backup transformer (TR-B) supplies the Divisions I and II safety related power buses. As a result, the calculated inoperability condition could be common mode to redundant 120-Volt circuits with safety related devices in all three divisions.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104
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Based upon the original design criteria for acceptable voltage drops between the Motor Control Center (MCC) and the power panel and the end of the circuit, a window of vulnerability was estimated for the 120-Volt devices between the minimum rated operating voltage at the 120-Volt level and the setpoint for the degraded voltage transfer sensor relays at the 4160-Volt bus. This was calculated to be approximately three percent of the nominal 4160-Volt bus voltage above the present transfer sensor relay setpoint. Specifically, the window of vulnerability at the 4160-Volt bus would be between approximately 3696 Volts and 3820 Volts.

Immediate Corrective Action

Three Problem Evaluation Requests (PERs) were initiated. The first PER identified some contactors within the Division III (HPCS) Motor Control Center whose operability could not be assured during the described degraded condition. Specific voltage values were defined by Engineering and field testing was performed which demonstrated that the contactors within MC-4A would perform their design function below the equivalent voltage value of the present degraded voltage protection.

The second PER identified a single motor starter within MC-8F (Division II) for WMA-FN-53B whose operability could not be assured during the described degraded condition. This problem will be temporarily eliminated by controlling the fan from the remote shutdown panel. This provides power to the motor starter from a power panel instead of the Motor Control Center control power transformer.

The third PER was initiated informing Plant Management of the potential inoperability of safety related 120-Volt devices under degraded grid voltage conditions and design basis bus loading. An engineering assessment included with the three PERs provided justification for continued refueling operations. The assessment determined sufficient time would be available to the Reactor Operators to transfer to an acceptable power source in the unlikely event a degraded grid voltage condition occurred within the 3% window of vulnerability. Plant Management subsequently informed all Reactor Operators of the potential vulnerability. The assessment conservatively assumed that shutdown cooling and refueling equipment would be inoperable at the degraded voltage transfer relay setpoint.

In addition, one channel of the degraded voltage sensor relays was removed from service and recalibrated to provide annunciation in the control room at the higher minimum bus voltage determined by analysis. The logic inputs from this relay were placed in the tripped condition in order to comply with the associated action statement in the Plant Technical Specifications. The annunciator response procedures were modified to require manual transfer to an acceptable power source if the bus (4160-Volt) degraded to the new annunciator level, above the setpoint of the remaining enabled degraded voltage transfer sensor relays. Also, the new annunciator level provides alarm protection of the 120-volt devices evaluated in the preliminary calculations to be in the worst case voltage drop condition. Although each circuit was not verified, this will provide alarm protection for all 120-volt safety related devices.

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Further Evaluation and Corrective ActionA. Further Evaluation

1. This event is reportable under 10 CFR 50.73(a)(2)(ii) because it is an unanalyzed condition that could significantly compromise plant safety, is outside of the design basis of the plant, and a condition not covered by Plant Procedures. No specific safety related components or systems were identified that would fail to perform their safety function under degraded voltage conditions. However, nine power panels (PP-4A, PP-7A-A-A, PP-7A-E, PP-7A-F, PP-7A-G, PP-8A-A-A, PP-8A-E, PP-8A-F, and PP-8A-G) with redundant safety related components and systems would be affected by the degraded condition. Extensive manpower would have had to have been expended to identify safety devices that would fail their safety function under degraded conditions in order to establish reportability. Therefore, it was conservatively assumed that the instrumentation receiving power from these power panels would be inoperable in this condition, and thus, satisfied the criteria for reportability. Furthermore, Plant Procedures did not address this potential problem.
2. There were no structures, components, or systems inoperable prior to the event which contributed to the event.
3. The root causes of the potential failure of 120-Volt safety related components to perform their safety function due to degraded grid voltage coincident with design basis bus loads include: 1) less than adequate design criteria to limit voltage drops between the 480-Volt level and the 120-Volt level of the power system, and 2) less than adequate review of the design criteria used to limit the voltage drop at the 120-Volt level.
 - a) The original design criteria used to design the power system between the 480-Volt and 120-Volt levels was less than adequate. It did not provide requirements to establish adequate minimum allowable voltage levels to ensure equipment operability at 120-Volt branch circuit ends under design basis loading during a degraded grid voltage condition.
 - b) The design review did not appropriately consider the compatibility of the degraded voltage transfer relay setpoints with the minimum allowable voltage requirements on the nine 120-Volt safety related power panels. Operability calculations were performed on equipment powered from the 4160-Volt buses to the 480-Volt buses for degraded voltage conditions down to the operating point of the degraded voltage transfer relays. However, minimum voltage requirements were not considered for the nine 120-Volt power panels, nor were degraded voltage operability calculations performed on the components and systems powered by these power panels.

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4. Although the operability of 120-Volt safety related devices cannot be assured by calculation, there is considerable conservatism in the assumptions. The power panel PP-7A-E, within Division I, was chosen as a potential worst case based upon the known voltage level at the Motor Control Center (MC-7A) feeding this panel. This panel is powered from panel PP-7A, resulting in multiple branch circuit drops. Panel PP-7A-E has 42 circuits which also include some of the worst case voltage drops. Excessive manpower and resources would be required to verify acceptable voltage conditions at each device point. Therefore, it was assumed that redundant safety related devices on Division II had similar undervoltage conditions. Other conservative assumptions included all other 120-Volt safety related power panels on Divisions I, II, and III would not have adequate voltage to assure device operability, and devices would become inoperable at the manufacturer's minimum rated voltage.

B. Further Corrective Action

1. Engineering Standards will be modified to reflect the appropriate design criteria of the 120-Volt systems.
2. A voltage regulator is being installed on the supply side to each of the nine 120-Volt safety related power panels to maintain voltage within the rated operability range of all of the components powered by these power panels at supply voltages down to the operating point of the degraded voltage transfer relays. This will be completed prior to startup from the current Maintenance and Refueling outage.

Safety Significance

The actual safety significance is unknown because an evaluation of the actual minimum operational voltage was not performed. However, a combination of events would need to occur coincidentally to result in a safety significant event. The combination of events includes a design basis event, a degraded grid voltage condition that remains within the 3% window of vulnerability, and an error on the part of the Reactor Operators to fail to recognize the degraded voltage condition and manually transfer to an acceptable power source.

WNP-2 has never experienced a degraded grid voltage condition of sufficient magnitude and duration that would have the potential for causing the type of event described here. Furthermore, the probability of a degraded grid voltage remaining within the 3% window of vulnerability is even lower. Therefore, the low probability of a design basis event coupled with a low probability of a degraded grid voltage remaining within the 3% window of vulnerability coupled with the probability of Reactor Operator error failing to transfer to an acceptable power source yields a low probability of the consequences of the event being increased by degraded grid voltage conditions. Consequently, the probability of potential inoperability of redundant 120-Volt safety related devices developing into a safety significant event is very low.

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Since this condition did not actually occur, this condition did not threaten the health and safety of the public or Plant personnel.

Similar Events

None

EIIS InformationText ReferenceEIIS Reference

System Component

Plant AC Distribution System	EA	
Class IE Power System (480V and 120V)	EB	
Low Voltage (480V and 120V)	EC	
Class IE Power System (480V and 120V)	ED	
Instrument AC Power System	EE	
Class IE Instrument AC	EF	
Generator Output Power System (Main Generator, 25KV)	EL	
Class IE Power System (120V, Power Panel PP-4A)	EC	PL
Class IE Power System (120V, Power Panel PP-7A-A-A)	EC	PL
Class IE Power System (120V, Power Panel PP-7A-E)	EC	PL
Class IE Power System (120V, Power Panel PP-7A-F)	EC	PL
Class IE Power System (120V, Power Panel PP-7A-G)	EC	PL
Class IE Power System (120V, Power Panel PP-8A-A-A)	EC	PL
Class IE Power System (120V, Power Panel PP-8A-E)	EC	PL
Class IE Power System (120V, Power Panel PP-8A-F)	EC	PL
Class IE Power System (120V, Power Panel PP-8A-G)	EC	PL2

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