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Clinton Power Station

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U.S. Nuclear Regulatory Commission
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Clinton Power Station
Facility Operating License No. NPF-62
NRC Docket No. 50-461

Subject: Licensee Event Report No. 2002-001-00

Enclosed is Licensee Event Report (LER) No. 2002-001-00: Lack of barriers to limit impact of grid disturbance during reverse feed of new Main Power Transformers results in trip of the Static VAR Compensators, auto-start of emergency diesel generator and Shutdown Service Water System pump. This report is being submitted in accordance with the requirements of 10CFR50.73.

Respectfully,



M. J. Pacilio
Vice President
Clinton Power Station

RSF/blf

Enclosures

cc: Regional Administrator - NRC Region III
NRC Senior Resident Inspector – Clinton Power Station
Office of Nuclear Facility Safety - Illinois Department of Nuclear Safety

IE22

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LICENSEE EVENT REPORT (LER) (See reverse for required number of digits/characters for each block)											
FACILITY NAME (1) Clinton Power Station		DOCKET NUMBER (2) 05000461	PAGE (3) 1 OF 4								
TITLE (4) Lack of barriers to limit impact of grid disturbance during reverse feed of new Main Power Transformers results in trip of Static VAR Compensators, auto-start of emergency diesel generator and Shutdown Service Water System pump											
EVENT DATE (5)		LER NUMBER (6)		REPORT DATE (7)		OTHER FACILITIES INVOLVED (8)					
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER	
04	25	2002	2002	- 001	- 00	06	23	02	None	05000	
OPERATING MODE (9) 5		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply) (11)									
POWER LEVEL (10) 000		20.2201(b)	20.2203(a)(3)(ii)		50.73(a)(2)(ii)(B)		50.73(a)(2)(ix)(A)				
		20.2201(d)	20.2203(a)(4)		50.73(a)(2)(iii)		50.73(a)(2)(x)				
		20.2203(a)(1)	50.36(c)(1)(i)(A)		X	50.73(a)(2)(iv)(A)		73.71(a)(4)			
		20.2203(a)(2)(i)	50.36(c)(1)(ii)(A)		50.73(a)(2)(v)(A)		73.71(a)(5)				
		20.2203(a)(2)(ii)	50.36(c)(2)		50.73(a)(2)(v)(B)		OTHER Specify in Abstract below or in NRC Form 366A				
		20.2203(a)(2)(iii)	50.46(a)(3)(ii)		50.73(a)(2)(v)(C)						
		20.2203(a)(2)(iv)	50.73(a)(2)(i)(A)		50.73(a)(2)(v)(D)						
		20.2203(a)(2)(v)	50.73(a)(2)(i)(B)		50.73(a)(2)(vii)						
		20.2203(a)(2)(vi)	50.73(a)(2)(i)(C)		50.73(a)(2)(viii)(A)						
		20.2203(a)(3)(i)	50.73(a)(2)(ii)(A)		50.73(a)(2)(viii)(B)						
LICENSEE CONTACT FOR THIS LER (12)											
NAME M. G. McMenamin, Station Engineering						TELEPHONE NUMBER (Include Area Code) (217) 937-3469					
COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)											
CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX		
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 15 single-spaced typewritten lines) (16)											
<p>A reverse feed was initiated through new Main Power Transformers (MPTs) to support removing the Reserve Auxiliary Transformer (RAT) power source for maintenance. A few seconds after closing the switchyard breaker, protective relaying for the Static VAR Compensators (SVC) actuated due to inrush harmonic currents that originated from the MPTs as a result of MPT energization. This tripped the RAT and Emergency Reserve Auxiliary Transformer (ERAT) SVCs to off. Without the SVC support, the ERAT output voltage dropped below the second level undervoltage setpoint, causing the Division 3 bus to transfer to the on-site source, resulting in an auto-start of the Division 3 Emergency Diesel Generator (DG). After the Division 3 DG re-energized the bus, the Div 3 essential Shutdown Service Water pump auto-started in response to a low system pressure signal. Operators entered the Off-Normal Procedure for Loss of AC Power, and suspended core alterations and movement of irradiated fuel assemblies. The causes of this event were the absence of barriers to limit the impact of the grid disturbance and the design review for the new MPTs did not identify the potential for grid disturbance impacts. The procedures for the reverse feed activity and the electrical review standard will be revised to prevent recurrence.</p>											

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NARRATIVE (If more space is required, use additional copies of NRC Form 366A) (17)

PLANT CONDITIONS PRIOR TO THE EVENT:

Unit: 1; Event Date: 04/25/02; Event Time: 0513 Central Daylight Time
 MODE: 5 (REFUELING); Reactor Power: 000;
 Reactor Coolant System Temperature: 80 to 120 Degrees Fahrenheit Band; Pressure: Zero pounds per square inch

DESCRIPTION OF EVENT

On April 25, 2002, during Clinton Power Station's eighth refueling outage (C1R08) reactor core alterations were in progress. Shutdown cooling was being provided by the B Fuel Pool Cooling and Cleanup System [DA], the A nonessential Service Water System (WS) [KG] pump [P] was in service, the Reserve Auxiliary Transformer (RAT) [XFMR] fed by the 345 kilovolt (kV) grid was supplying Divisions 1 and 2 safety buses [BU] and the Emergency Reserve Auxiliary Transformer (ERAT) fed by the 138 kV grid was supplying the Division 3 safety bus. The Division 1 Emergency Diesel Generator [EK] [DG] was inoperable and unavailable.

The RAT and ERAT have Static VAR Compensators (SVC) connected to their 4.16 kV output to maintain voltage within acceptable limits. During the refueling outage, new higher volt-ampere rated Main Power Transformers (MPTs) were installed as part of an extended power uprate modification. The new MPTs were not previously energized at Clinton Power Station.

At about 0513 hours, a reverse feed was initiated from the switchyard through the new MPTs to support removing the RAT power source for maintenance. Operators closed the switchyard breaker per the reverse feed procedure and within a few seconds, protective SVC relaying actuated and the RAT and ERAT SVCs tripped to off unexpectedly. The large magnetizing inrush current at the start of the reverse feed caused voltage drops in the 345 kV and 138 kV switchyards and generated harmonic currents, resulting in the SVC units tripping offline. The trip of the SVCs was as designed but was not an expected response to the reverse feed activity.

Without the SVC support, and based on the tap ratio selected for the ERAT, the output voltage to the 4 kV bus dropped below the second level undervoltage relay [27] setpoint and did not recover above the reset point within 15 seconds. This resulted in the safety-related Division 3, 4.16 kV bus being transferred to the on-site source. The transfer included tripping/blocking the off-site source breakers, an automatic start of the Division 3 DG, and (after the DG reached nominal voltage and frequency), closing the DG output breaker to energize the Division 3 bus. The operation of the degraded voltage relay was as designed.

The RAT output voltage did not drop below the degraded voltage relay setpoint due to the transformer tap ratios selected and its different grid source. The ERAT is fed from the 138 kV grid while the RAT is fed from the 345 kV grid. Accordingly the Divisions 1 and 2 safety buses remained fed from the offsite source.

After the Division 3 DG re-energized the bus, the Division 3 essential Shutdown Service Water System (SX) [BI] pump automatically started in response to a low system pressure signal. The Division 3 SX pump is designed to automatically start in response to a Loss Of Coolant Accident (LOCA) or to a pressure drop in the WS System. During this event, no LOCA signal occurred and the WS System continued to operate. The transmitter [PT] and auxiliary relay [RLY] that sense a drop in WS system pressure from a loss of WS pumps and start the SX pump are fed from the Division 3 alternating current (AC) bus. The loss of voltage that resulted from tripping the offsite sources caused the pressure transmitter to revert to its

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fail-safe position and closed the contact to pick up the auxiliary relay. Upon return of power, the relay energized and sealed in the start signal for the SX pump motor [MO] prior to the pressure transmitter loop fully restoring the signal and opening the contact that energized the auxiliary relay. This caused the SX pump to start and run on the Division 3 bus.

In response to this event, operators conservatively declared offsite power sources inoperable and entered the Off-Normal Procedure for Loss of AC Power.

At 0527 hours, operators notified the Refuel Senior Reactor Operator to suspend core alterations and movement of irradiated fuel assemblies in primary and secondary containment.

At 0550 hours, operators verified offsite power availability. The ERAT SVC was re-energized by 0818 hours and the RAT SVC was re-energized by 0834 hours. The Division 3 Diesel Generator was removed from the bus at 1053 hours. The Division 3 SX system was secured and returned to standby status at 1204 hours.

Condition Report (CR) 105267 was initiated to track the investigation and resolution of this event.

No other automatic or manually initiated safety system responses were necessary to place the plant in a safe and stable condition. Other inoperable equipment or components did not directly affect this event.

CAUSE OF EVENT

This event has two root causes. The physical root cause of this event is the absence of barriers to limit the impact of the grid disturbance when the new MPTs were energized.

The process root cause of this event is the design review for the new MPTs did not identify the potential for grid disturbance during initial energization of the MPTs.

The pressure sensing circuit for initiation of the Division 3 SX pump operated as designed but did not operate as intended on the loss of power, resulting in the automatic start of the SX pump.

SAFETY ANALYSIS

This event is reportable under the provision of 10CFR50.73(a)(2)(iv)(A) due to the automatic actuations of the Division 3 emergency diesel generator and the Division 3 essential Shutdown Service Water System.

This event had low risk. The plant has to be shutdown in order to initiate the reverse feed configuration. While shutdown, the potential does not exist for many of the accidents analyzed in Chapter 15 of the Updated Safety Analysis Report. In this instance, both offsite sources were conservatively declared inoperable based on the trip of the SVCs; however, the RAT remained connected to the 345 kV switchyard and all loads being fed from the RAT, both safety and non-safety, remained energized during the event. Although the SVCs tripped off, the existing switchyard voltage kept the RAT 4.16 kV bus voltages at acceptable levels. In addition the Division 2 emergency diesel generator remained operable, in standby, during this event. Accordingly all equipment required for safe operation of the

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plant during shutdown had offsite and onsite power available.

The Clinton Power Station Technical Specification Bases recognize that "Connection and operation of the SVC(s) is dictated by the existing need for voltage support of the offsite electrical power source(s) based on prevailing grid conditions. Thus, OPERABILITY of the offsite electrical power source(s) is normally supported by, but is not necessarily dependent on, connection and operation of the SVC(s)." Therefore, while the RAT SVC was not connected to the bus, the bus could still be capable of supplying its connected loads. Although a specific site analysis was not performed for the conditions present at the time of this event, previous analyses covering plant operation (prior to the installation of the SVCs) would indicate that the switchyard voltage present at the time of the event was sufficient to supply site emergency loads, if required, without having to shift to the on-site sources.

During this event, the Division 3 AC bus transferred to the on-site source based on operation of the degraded voltage relay. This response represented proper operation of plant equipment based on the output voltage of the ERAT after the SVC tripped offline. Per Technical Specification 3.8.2, the Division 3 emergency diesel generator fulfilled the requirement for power to the Division 3 bus in this instance. Accordingly, if the High Pressure Core Spray System [BG] (HPCS) pump had been required operable at the time of this event, the Division 3 emergency diesel generator would have maintained it in operable status. However, during this event, the HPCS pump and the Division 3 power sources were not required to be operable.

Since all required equipment had power supplied to it in accordance with the requirements of Technical Specification 3.8.2, this event did not represent an increased risk condition.

No safety system functional failures occurred during this event.

CORRECTIVE ACTION

The procedure used to control the reverse feed activity, CPS 3501.01C001, "Generator Backfeed Checklist", will be revised to include guidance on how to establish barriers to limit the impact of grid disturbance prior to initiating reverse feed through the MPTs in the future. (ATI 105267-24) By limiting the impact of the grid disturbance, the loss of power that resulted in the automatic start of the SX pump will be avoided.

The electrical review standard will be revised to include a requirement to review the 345 kV grid stability and voltage support capability when performing a modification or addition to the 345 kV system. (ATI 105267-25)

PREVIOUS OCCURRENCES

LER Number	Title
None	

COMPONENT FAILURE DATA

Manufacturer	Nomenclature	Model Number	Manufacturer Part Number
None			