AmerGen
An Exelon Company

Clinton Power Station
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Clinton, IL 61727

10 CFR 2.201

U-603827

August 16, 2007

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-001

Clinton Power Station, Unit 1
Facility Operating License No. NPF-62
NRC Docket No. 50-461

Subject: Revised Reply to Notice of Violation: EA-06-291

Reference: (1) Letter from J. L. Caldwell (U. S. NRC) to C. M. Crane (Exelon Generation Company, LLC), "Final Significance Determination for a White Finding and Notice of Violation; NRC Inspection Report No. 05000461/2007006 (DRS) for Clinton Power Station," dated February 7, 2007

(2) Letter from Bryan Hanson (AmerGen, Clinton Power Station) to U. S. Nuclear Regulatory Commission, "Reply to Notice of Violation: EA-06-291," dated March 9, 2007 (U-603807)

In referenced letter (1), the NRC provided Exelon Generation Company, LLC (EGC) with the final significance determination for a White finding and an associated Notice of Violation (NOV) of 10 CFR 50, Appendix B, Criterion III, "Design Control," for the AmerGen Energy Company, LLC (AmerGen) Clinton Power Station (CPS), Unit 1.

In referenced letter (2), AmerGen provided the written statement or explanation for the NOV in accordance with 10 CFR 2.201, "Notice of violation."

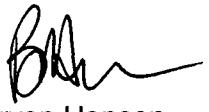
This letter revises a corrective action and provides the current status for the corrective actions and regulatory commitments in Attachment 1, "Reply to Notice of Violation," and Attachment 2, "Regulatory Commitments," of referenced letter (2). The corrective action item was changed based on comments during the procedure review process.

Change bars are provided in the right-hand margin of the attachments to this letter to denote the revised portions of this reply.

IE01
NRR

If you have any questions concerning this letter, please contact Mr. Mark Friedmann, Regulatory Assurance Manager, at (217) 937-4833.

Respectfully,



Bryan Hanson
Site Vice President
Clinton Power Station

RSF/blf

Attachments: 1. Revised Reply to Notice of Violation: EA-06-291
2. Revised Regulatory Commitments

cc: NRC Regional Administrator, Region III
NRC Senior Resident Inspector, Clinton Power Station

Attachment 1
U-603827
Revised Reply to Notice of Violation: EA-06-291

NOTICE OF VIOLATION EA-06-291:

> "Title 10 Part 50, Appendix B, Criteria III states, in part, that measures shall be established to assure that applicable regulatory requirements and the design basis, as defined in § 50.2 and as specified in the license application, for those structures, systems, and components to which this appendix applies are correctly translated into specifications, drawings, procedures, and instructions.
>
> It further states that design control measures shall provide for verifying or checking the adequacy of design, such as by the performance of design reviews, by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program.
>
> Title 10, Part 50.2 states, in part, that "design bases" means that information which identifies the specific functions to be performed by a structure, system, or component of a facility, and the specific values or ranges of values chosen for controlling parameters as reference bounds for design. These values may be (1) restraints derived from generally accepted "state of the art" practices for achieving functional goals, or (2) requirements derived from analysis (based on calculation and/or experiments) of the effects of a postulated accident for which a structure, system, or component must meet its functional goals.
>
> Contrary to the above, prior to August 12, 2006, the licensee had not ensured the adequacy of design of the high pressure core spray (HPCS) system by performance of design reviews or by use of alternate or simplified calculational methods. Specifically, the initiation of suction swap-over from the reactor core isolation cooling tank to the suppression pool, a controlling parameter to ensure continued function of the HPCS pump, was required to occur at 740.19 feet as derived by calculation IP-M-384, Revisions 0, 1, and 1B. However, this calculated value did not prevent significant air entrainment in the suction of the HPCS pump and subsequent loss of function of the HPCS pump.

This violation is associated with a White SDP finding."

RESPONSE

Background

During an NRC Safety System Design and Performance Capability (SSD&PC) inspection conducted in November 2005, the NRC inspectors reviewed calculation IP-M-0384, "Evaluation of Vortex in the RCIC [Water] Storage Tank", Revision 0 (performed in 1994) and Revision 1 (performed in 1998). The original purpose of calculation IP-M-0384 was to determine the analytical level (i.e., elevation of water) where vortexing would occur above the HPCS and Reactor Core Isolation Cooling (RCIC) pumps suction lines. The analytical level was then used as a design input to calculate the automatic RCIC water storage tank to suppression pool low level suction transfer setpoint for the HPCS and RCIC pumps. The inspectors noted that the methodology used in Calculation IP-M-0384, Revisions 0 and 1, was not appropriate and challenged the validity of the linear relationship developed for the Froude number vs. air entrainment. The inspectors concluded the calculations did not

adequately account for the actual fluid configuration where air ingestion into the HPCS and RCIC suction lines would potentially occur.

CPS personnel were unable to provide adequate technical justification for the historical methodology used in 1994 and 1998 and informed the NRC SSD&PC inspection team that a revision to the IP-M-0384 calculation would be completed to consider other industry accepted methodologies. Issue Report 429583 was initiated to investigate and validate the methodologies used in the calculation, including performance of an operability evaluation. After acknowledging the low margin and associated uncertainties with the calculation, CPS shifted the HPCS and RCIC suction sources from the RCIC storage tank to the suppression pool on December 1, 2005, as allowed by the plant Technical Specifications to ensure operability of the RCIC and HPCS systems.

Later in December 2005, CPS issued Revision 1B to calculation IP-M-0384 to demonstrate past operability, using a methodology that had been accepted at another utility to address vortexing concerns. This methodology contained a correlation that was not used in the previous calculations and determined that vortexing would occur at a lower level. With the current suction transfer setpoint, it was determined that air entrainment was possible as the HPCS pump drew water from the RCIC storage tank. As a result, an analysis was completed to evaluate the potential introduction and transport of air in the HPCS suction piping. In parallel, while maintaining RCIC and HPCS aligned to the suppression pool to ensure operability, an Engineering Change was prepared and on August 12, 2006, the HPCS and RCIC suction piping in the RCIC water storage tank was modified by installing downward-turned elbows to increase submergence height to avoid vortexing.

Since the NRC had concerns with the methodologies used in the determination of vortex formation and air entrainment, the NRC concluded that CPS had not adequately demonstrated that the HPCS system would be capable of performing its safety function during the suction swap over from the RCIC water storage tank to the suppression pool. These concerns were documented in NRC Inspection Report 05000461/2006011 (DRS), EA-06-291, dated November 29, 2006, along with preliminary greater than green finding notification. On December 19, 2006, a Regulatory Conference was held to further discuss the significance of the NRC's findings.

On February 7, 2007, the NRC issued Inspection Report 05000461/2007006, "Final Significance Determination for a White Finding and Notice of Violation," related to the failure to select an appropriate method for calculating the minimum elevation (i.e., the analytical level) of water above the HPCS system pump suction line to preclude vortex formation and subsequent air entrainment in the pump's suction. The NRC's conclusion was the analytical level would result in significant air entrainment potentially causing the HPCS system to be incapable of completing its safety function.

1. The reason for the violation.

An investigation was performed to determine the root cause(s) of why CPS did not use an appropriate method for calculating the minimum elevation (i.e., the analytical level) of water above the HPCS system suction line to preclude vortex formation and air entrainment in the pump suction. The investigation by the Root Cause Team determined that the root cause is a process issue whereby CPS engineering failed to evaluate the uncertainties associated with the analytical margin of the affected calculation. It was determined that the related processes (e.g., calculation process, prejob briefing process, management review and

reviewer guidance) used to develop and evaluate the RCIC tank water level setpoint repeatedly failed to adequately evaluate margins with respect to uncertainties associated with methodologies used to determine vortex formation and air entrainment.

2. The corrective steps that have been taken and results achieved.

As stated in the background above, on December 1, 2005, the HPCS system was realigned from the RCIC water storage tank to the suppression pool. This decision was based on ensuring the operability of the HPCS system due to the uncertainties associated with the calculations. Subsequent to the NRC inspection, Engineering Change (EC) 359252 was prepared and on August 12, 2006, the HPCS system suction piping in the RCIC water storage tank was modified by installing downward-turned elbows to increase submergence height to avoid vortexing.

The result of the investigation for this violation has identified the following corrective actions (CA's) to address this violation.

- Update design basis documents for the HPCS system to include the need to analyze vortexing for the tank low-level setpoint (CA-1);
- Revise calculation IP-M-0761 (associated with EC 359252) to supplement the calculation to quantify and document the uncertainty with respect to margin in the analysis with regards to vortexing and air entrainment (CA-2);
- Perform a sampling of design basis calculations for CPS for extent of condition (CA-3);
- Review, evaluate, and revise, as necessary, other safety-related tank vortex calculations (CA-4);

3. The corrective steps that will be taken to avoid further violation.

The corrective action to prevent recurrence (CAPR) is to revise Configuration Change (CC) procedures (CC-AA-309, "Control of Design Analyses" and CC-AA-309-101, "Engineering Standard Use and Adherence") to ensure that the calculated available margin is adequate to bound the combination of uncertainties associated with both the analysis methodology and the actual calculation. (CAPR 1). This action is complete, and the procedures have been implemented at the Clinton Power Station.

4. The date when full compliance will be achieved.

Compliance (i.e., operability of the HPCS system) was achieved by the installation of the modification of the HPCS system suction piping at the RCIC water storage tank on August 12, 2006 to increase submergence height to avoid vortexing. The corrective action to prevent recurrence (CAPR-1) is complete and the procedures have been implemented. Corrective Actions, CA-1, CA-2, and CA-4, associated with this root cause are complete.

Corrective Action CA-3 will be completed by August 17, 2007.

Attachment 2
U-603827
Revised Regulatory Commitments

The following table identifies commitments made in this document. Any other actions discussed in this submittal represent intended or planned actions. They are described to the NRC for the NRC's information and are not regulatory commitments.

Commitment	Committed Date	Commitment Type
Update design basis documents for the HPCS system to include the need to analyze vortexing for the tank low-level setpoint (CA-1);	Complete	One time
Revise calculation IP-M-0761 (associated with Engineering Change 359252) to supplement the calculation to quantify and document the uncertainty with respect to margin in the analysis with regards to vortexing and air entrainment (CA-2);	Complete	One time
Perform a sampling of design basis calculations for CPS for extent of condition (CA-3);	August 17, 2007	One time
Review, evaluate, and revise, as necessary, other safety-related tank vortex calculations (CA-4);	Complete	One time
Revise Configuration Change (CC) procedures (CC-AA-309 and CC-AA-309-101) to ensure that the calculated available margin is adequate to bound the combination of uncertainties associated with both the analysis methodology and the actual calculation. (CAPR 1).	Complete	Continuing