

November 3, 2006

Mr. Christopher M. Crane, President  
and Chief Nuclear Officer  
Exelon Generation Company, LLC  
4300 Winfield Road  
Warrenville, IL 60555

SUBJECT: LASALLE COUNTY STATION, UNITS 1 AND 2 - DENIAL OF LICENSE  
AMENDMENT (TAC NOS. MD0336 AND MD0337)

Dear Mr. Crane

By letter to the Nuclear Regulatory Commission (NRC) dated March 13, 2006, as supplemented by letters dated June 15 and July 13, 2006, you submitted a license amendment request (LAR) to revise Technical Specification 3.7.3, "Ultimate Heat Sink [UHS]," for the LaSalle County Station, Units 1 and 2. Specifically, the proposed change would increase the temperature limit of the cooling water supplied to the plant from the core standby cooling system pond (i.e., UHS) from  $\leq 100$  °F to  $\leq 101.5$  °F. After careful review, the NRC staff has concluded that your request cannot be approved. The basis for this finding is documented in the enclosed Safety Evaluation.

A copy of the Notice of Denial of Amendment is enclosed and will be forwarded to the Office of the *Federal Register* for publication.

Sincerely,

*/RA/*

Catherine Haney, Director  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. 50-373 and 50-374

Enclosures:

1. Notice of Denial
2. Safety Evaluation

cc w/encls: See next page

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**OFFICIAL RECORD COPY**

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UNITED STATES NUCLEAR REGULATORY COMMISSIONEXELON GENERATION COMPANY, LLCDOCKET NOS. 50-373 AND 50-374NOTICE OF DENIAL OF AMENDMENT TO FACILITY OPERATING LICENSEAND OPPORTUNITY FOR HEARING

The U.S. Nuclear Regulatory Commission (NRC or the Commission) has denied a request by Exelon Generation Company, LLC (the licensee) for an amendment to Facility Operating Licenses NPF-11 and NPF-12, issued to the licensee for operation of the LaSalle County Station, Unit Nos. 1 and 2, located in LaSalle County, Illinois.

Notice of Consideration of Issuance of this amendment was published in the *Federal Register* on March 28, 2006 (71 FR 15483).

The purpose of the licensee's amendment request was to revise the technical specifications (TS) to change Surveillance Requirement (SR) 3.7.3.1 which verifies the cooling water temperature supplied to the plant from the core standby cooling system (CSCS) pond (i.e., ultimate heat sink (UHS)) is  $\leq 100$  °F. Currently, if the temperature of the cooling water supplied to the plant from the CSCS pond is  $> 100$  °F, the UHS must be declared inoperable in accordance with TS 3.7.3. The license amendment request proposed to increase the temperature limit of the cooling water supplied to the plant from the CSCS pond to  $\leq 101.5$  °F by reducing the temperature measurement uncertainty by replacing the existing thermocouples with higher precision temperature measuring equipment. Should the UHS indicated temperature exceed 101.5 °F, Required Action B.1 would be entered and both units would be placed in Mode 3 within 12 hours and Mode 4 within 36 hours.

The NRC staff has concluded that the licensee's request cannot be granted. The licensee was notified of the Commission's denial of the proposed change by telephone on November 2, 2006.

By 30 days from the date of publication of this notice in the *Federal Register*, the licensee may demand a hearing with respect to the denial described above. Any person whose interest may be affected by this proceeding may file a written petition for leave to intervene pursuant to the requirements of 10 CFR 2.309.

A request for a hearing or a petition for leave to intervene must be filed by: 1) first class mail addressed to the Office of the Secretary of the Commission, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, Attention: Rulemaking and Adjudications Staff; 2) courier, express mail, and expedited delivery services: Office of the Secretary, Sixteenth Floor, One White Flint North, 11555 Rockville Pike, Rockville, MD 20852, Attention: Rulemaking and Adjudications Staff; 3) E-mail addressed to the Office of the Secretary, U.S. Nuclear Regulatory Commission, [HEARINGDOCKET@NRC.GOV](mailto:HEARINGDOCKET@NRC.GOV); or 4) facsimile transmission addressed to the Office of the Secretary, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, Attention: Rulemakings and Adjudications Staff at (301) 415-1101, verification number is (301) 415-1966. A copy of the request for hearing and petition for leave to intervene should also be sent to the Office of the General Counsel, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, and it is requested that copies be transmitted either by means of facsimile transmission to (301) 415-3725 or by email to [OGCMailCenter@nrc.gov](mailto:OGCMailCenter@nrc.gov). A copy of the request for hearing and petition for leave to intervene should also be sent to Mr. Bradley J. Fewell, Assistant General Counsel, Exelon Generation Company, LLC, 200 Exelon Way, Kennett Square, PA 19348, attorney for the licensee. For further details with respect to this action, see (1) the application for amendment dated

March 13, 2006, as supplemented by letters dated July 13 and August 4, 2006, and (2) the Commission's letter to the licensee dated November 3, 2006.

Documents may be examined, and/or copied for a fee, at the NRC's Public Document Room (PDR), located at One White Flint North, Public File Area O1 F21, 11555 Rockville Pike (first floor), Rockville, Maryland, and will be accessible electronically through the Agencywide Documents Access and Management System's (ADAMS) Public Electronic Reading Room link at the NRC Web site <http://www.nrc.gov/reading-rm/adams.html>. Persons who do not have access to ADAMS or who encounter problems in accessing documents located in ADAMS should contact the NRC PDR Reference staff by telephone at 1-800-397-4209, (301) 415-4737, or by e-mail to [pdr@nrc.gov](mailto:pdr@nrc.gov).

Dated at Rockville, Maryland, this 3rd day of November 2006.

FOR THE NUCLEAR REGULATORY COMMISSION

*/RA/*

Catherine Haney, Director  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO FACILITY OPERATING LICENSE NO. NPF-11

AND TO FACILITY OPERATING LICENSE NO. NPF-18

EXELON GENERATION COMPANY, LLC

LASALLE COUNTY STATION, UNITS 1 AND 2

DOCKET NOS. 50-373 AND 50-374

1.0 INTRODUCTION

By letter dated March 13, 2006 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML060720507), Exelon Generation Company, LLC (Exelon, the licensee) submitted a request for a modification to the technical specification (TS) limits concerning the ultimate heat sink (UHS) temperature for LaSalle County Station, Units 1 and 2 (LaSalle). Exelon submitted supplemental material, in response to requests for additional information, by letters dated July 13, 2006 (ADAMS Accession No. ML061950096) and August 4, 2006 (ADAMS Accession No. ML062160395).

The requested modification would increase the TS limit on the UHS temperature from the present value of 100 °F to a proposed value of 101.5 °F. The licensee indicates that the plant safety analyses and other considerations establish a limit of 102 °F for the UHS temperature, and that the requested increase constitutes a reduction in margin justified on the basis of the accuracy of the temperature measurement. Exelon has proposed that the temperature measurement accuracy is improved by the use of upgraded instrumentation, and also by the application of a measurement practice that Exelon believes to further reduce measurement uncertainty.

The NRC staff has completed its review and finds that:

- (1) the degree of measurement accuracy that would be required to support the requested modification is not adequately demonstrated in Exelon's analysis, and
- (2) the TS modification itself does not adequately address single-unit operation (if only one unit is operating, the lack of flow to the other unit could cause the temperature measurements associated with that unit to become non-representative of the UHS temperature.)

Therefore, the NRC staff finds that the requested modification is unacceptable.



## 2.0 REGULATORY EVALUATION

The NRC staff's evaluation of the proposed changes is based upon the following:

- Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.36(c), "Technical specifications";
- 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 5, "Sharing of structures systems and components";
- 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants"; and
- Regulatory Guide (RG) 1.105, "Setpoints for Safety-Related Instrumentation," Revision 3

Section 50.36(c)(2)(ii)(B) of 10 CFR Part 50 specifies that a TS limiting condition for operation (LCO) must be established for, among other things, each operating restriction that is an initial condition of a design-basis accident or transient analysis that either assumes failure of or presents a challenge to the integrity of a fission product barrier.

Section 50.36(c)(3) of 10 CFR Part 50 specifies that "Surveillance requirements are requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained..."

Together, these two provisions of 10 CFR 50.36 require that the surveillance practice and the associated LCO result in adequate assurance that, if the temperature limit in the surveillance requirement is met, the actual value of the UHS temperature will not exceed the limit assumed in the associated safety analyses, despite the presence of unavoidable measurement error.

GDC 5 requires, in part, that "Structures, systems, and components important to safety shall not be shared among nuclear power units unless it can be shown that such sharing will not significantly impair their ability to perform their safety functions..."

The proposed modification involves the sharing of instruments between the two units at this site. The licensee has not addressed the sharing of instruments in the analyses submitted in support of the requested change.

Part III, "Design Control" of Appendix B to 10 CFR Part 50 states, in part, that "[m]easures 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." The TS and the associated instructions must, therefore, accurately reflect the requirements of the design bases. For the UHS temperature measurement and the associated TS limit in particular, then, the established limit must provide adequate assurance that appropriate corrective measures are initiated if the actual temperature of the UHS exceeds the design-basis assumptions of the supported systems. Because it is recognized that the measured value of this temperature will differ from the actual value by some

amount of measurement error, which is unknown but can be statistically bounded, and action must be initiated on the basis of the measured value, the measured value at which action is initiated must include margin to accommodate that unknown error.

RG 1.105 provides guidance on instrument setpoint methodology. It also establishes that instrument settings should provide a 95 percent probability that limits will not be exceeded in 95 percent of the cases in which they are challenged (this is commonly referred to as 95/95 confidence). This in turn implies that measurement uncertainties should be established as  $\pm 1.96$  standard deviations for a normal probability distribution, which in general practice is often rounded to two standard deviations (commonly referred to as 2-sigma, or  $2\sigma$ ). When errors to one side of the limiting setpoint are conservative, and so non-conservative operation occurs only on the other side of the limiting setpoint, the 95-percent probability band can be taken to be asymmetrical rather than centered on the limiting setpoint. In such a case, when adequately justified, the uncertainty can be established at 1.645 standard deviations. It is noted that Exelon has not addressed this practice, and it is mentioned here only for reference as a matter of completeness.

In summary:

- The UHS temperature limit in the TS must provide adequate assurance that the actual UHS temperature is in accordance with the associated safety analyses when the measured UHS temperature is within the TS limits.
- Adequate assurance in regard to instrument uncertainty is established in RG 1.105 as 95/95 confidence. General statistical principals establish that the uncertainty allowance for 95/95 confidence must be  $\pm 1.96$  standard deviations for a normal probability distribution with two-sided uncertainty, or 1.645 standard deviations for one-sided uncertainty. General practice often establishes uncertainty as two standard deviations.
- The analysis that establishes the uncertainty allowance must be executed, checked, and controlled in accordance with generally-accepted mathematical and statistical principles for this type of analysis.
- Sharing between units of equipment important to safety is acceptable only if it is shown that there is no adverse safety impact.

### 3.0 TECHNICAL EVALUATION

Exelon requests the UHS temperature limit adjustment on the basis of:

- (1) the accuracy of the instrumentation used to monitor the UHS temperature, and
- (2) improved accuracy due to the statistical handling of the UHS temperature measurements.

Exelon states that the accident analyses assume a UHS temperature of not more than 104 °F, and that an allowance of 2 °F is appropriate to allow for transient heat-up. The limiting temperature is thus 102 °F. Exelon states that the present TS limit of 100 °F on the measured

temperature is based upon the 102 °F limit with an additional 2 °F allowance for measurement error. Exelon further claims that the uncertainty in the measurement is less than 0.5 °F, and that the 102 °F limit would, therefore, be adequately protected with a TS limit of 101.5 °F (measured temperature). Exelon claims that the reduction in uncertainty is the result of the application of new instrumentation installed under the provisions of 10 CFR 50.59, "Changes, tests and experiments," and partly due to the manual averaging of at least two of the four measurements.

In its August 4, 2006, letter, Exelon provided an uncertainty analysis that concludes that the total single-channel uncertainty is not more than 0.454 °F, and that the uncertainty is not more than 0.326 °F for a two-channel average. The analysis also computes uncertainties for three-channel and four-channel averages, but those are not utilized in the requested TS modification and therefore, are not addressed herein.

The following sections present the results of the NRC staff's review of Exelon's analysis of channel accuracy and the statistical considerations regarding measurement averaging. A discussion of the NRC staff's concerns regarding the details of the requested TS change is also presented.

### 3.1 NRC Staff Review of the Instrument Channel Uncertainty Analysis

The NRC staff has reviewed Exelon's uncertainty analysis for the instrumentation associated with the requested TS modification. As a result of this review, the NRC staff has identified several findings that support the overall conclusion that the analysis is significantly non-conservative and that the claimed channel accuracy is therefore not supported. A selection of the more significant findings is presented below.

#### 3.1.1 One-Sigma Uncertainty

There are several places in Exelon's analysis where the uncertainty values are divided by two or three. These are often associated with assertions to the effect that the basic data represent 2-sigma or 3-sigma uncertainties (two or three standard deviations of the error distributions), and therefore appear to indicate an intent to adjust the uncertainties to represent only one standard deviation. No other explanation for these factors is provided. Regardless of the intent of this practice, the result is that several of the uncertainty data are reduced to one-half or one-third of the values that were originally quoted.

An uncertainty specification of  $\pm 1$  standard deviation will capture only about 68 percent of a population (versus slightly more than 95 percent for  $\pm 2$  standard deviations). This provides significantly less than the 95/95 confidence level indicated in RG 1.105. Therefore, the NRC staff concludes that an uncertainty allowance based upon  $\pm 1$  standard deviation does not provide an acceptable level of confidence that the actual UHS temperature is in accordance with the associated safety analyses.

#### 3.1.2 Measuring and Test Equipment (M&TE) Uncertainty

Exelon's analysis assumes that the M&TE uncertainty is independent among channels. While it may be appropriate to assume that M&TE uncertainties are independent of other uncertainties within a channel, it is not clear that they can be considered independent among channels.

Exelon indicates that two independent meters are available, but there are four channels to be calibrated. It is plausible that the two channels selected (or simply available) for averaging could have been calibrated using the same device, and so the associated M&TE errors would be common rather than independent. This could be mitigated by a requirement that ensures that the averaged measurements come from channels that are calibrated by independent devices, but no such requirement is included in Exelon's request.

In addition, the calculation assumes that the calibration standard used to calibrate the meters is sufficiently accurate as to be ignored, but it also indicates that the uncertainty of the calibration standard may be as high as 25 percent of the uncertainty of the meters themselves. This seems too high to be dismissed without analysis. Furthermore, the uncertainty of this calibration reference would be common to both meters and therefore to all four temperature measurements.

The NRC staff considers this treatment of M&TE-related uncertainty to be nonconservative, and therefore, unacceptable.

### 3.1.3 Treatment of Drift

Exelon's analysis cites a specification for drift over a certain time period, and then uses a "Square-Root-of-the-Sum-of-the-Squares" (SRSS) methodology to combine drift over as many of those time periods as necessary to cover the time period addressed. For example, if drift were specified as one unit per 6 months, the 1-year drift would be computed to be 1.414 units. No justification is provided for this approach.

The NRC staff concludes that this approach would be justified only if the time period in the drift specification had some inherent physical basis and if the drift over each individual time period were independent of the drift over all other time periods. The time periods identified in instrument drift specifications are typically arbitrary, from a physical standpoint, with the associated data normalized to suit the selected time period. The underlying physical cause of drift is not typically random but rather tends to show a consistent trend due to subtle and complex time-related phenomena. Furthermore, it can be shown that the drift projected for any given time period can be made arbitrarily small by dividing the period into sufficiently small sub-periods, normalizing the drift specification to those shorter periods, and using SRSS to project the total drift. In summary, the NRC staff finds Exelon's approach to drift computations to be unsupported, arbitrary, and non-conservative, and therefore, unacceptable.

Exelon's analysis indicates that the resistance temperature detectors (RTDs) themselves are never calibrated, although they are subject to cross-checking to detect "significant drift" in any one device. Cross-checking would not detect common drift among all of the devices, and the accuracy of cross-checking even in the absence of biased drift is imperfect. No consideration is given to the uncertainties involved in cross-checking. The manufacturer's drift specification of  $\pm 0.1$  °F/year is expanded only to 5 years, even though the devices are not calibrated at the end of that period, and so drift would be permitted to continue unabated except for the "cross-calibrations."

Exelon's analysis cites an Electric Power Research Institute (EPRI) Topical Report (TR-103099, "Effects of Resistance Temperature Detector Aging on Cross-Calibration"), in connection with

the overall drift period, but the reference is not specific and it is not clear that the NRC has reviewed and accepted this report as an acceptable basis for analysis.

The RTD drift specification is also subjected to both the single-standard-deviation practice and the SRSS practice addressed above.

The NRC staff finds the treatment of drift in Exelon's analysis to be non-conservative, and therefore, unacceptable.

### 3.2 Staff Review of Uncertainty Reduction through Multi-Channel Averaging

Exelon's uncertainty analysis separates the random and systematic components of each uncertainty for each device in the analysis. It then reduces the magnitude of the composite random component by a factor of 1/(the square root of the number of measurements), and adds the composite systematic component to find the uncertainty in the average of multiple measurements. The NRC staff finds this practice to be in accordance with standard statistical practice for normal probability distributions, and therefore, to be acceptable. The NRC staff finds, however, that some of the uncertainties considered "random" in the analysis should actually be considered "systematic" (for example, uncertainties associated with test and calibration equipment, as discussed earlier in this evaluation), and therefore finds the result of this particular computation to be non-conservative and unacceptable.

### 3.3 Cross-Unit Sharing

The requested modification does not alter the sharing of the UHS itself, but it does address the sharing of the UHS temperature measurements among units. Exelon indicates that this practice is already in-place although not presently addressed in the TS. Exelon requested to modify the TS to take advantage of this sharing.

The UHS temperature sensors are located at the inlets to each of the two condenser banks at each of the two units at this site. The measurements are, therefore, representative of the actual UHS temperature only when the associated circulating water pumps and valves are operating and open. If a unit is not in operation, the associated UHS temperature measurements may appear to be valid, but will in fact represent only the temperature of the stagnant water at the measurement location and will no longer be representative of the UHS temperature.

The operational status of non-safety-related equipment at one unit can therefore directly affect the performance of instrumentation utilized by the other unit. The proposed TS modification does not include any provision for limiting such cross-unit influence, nor does it include consideration of the possibility that the measurement from an otherwise functional instrument channel might not be representative of the UHS temperature.

Therefore, the NRC staff finds that the requirements of 10 CFR 50.36(c)(2) are not satisfied in the proposed modification.

### 3.4 Other Considerations

Exelon indicates that the proposed TS modification is justified in part by the reduction in uncertainty that results from the averaging of independent measurements. However, the proposed TS modification does not include any restriction to that effect, nor any instruction as to what should be done if the necessary number of independent measurements is not available.

For example:

- A single measurement from a single channel would have greater uncertainty than a value determined as the average of multiple channels; therefore, it would provide less assurance that the actual UHS temperature is within the value assumed in the safety analyses.
- A value determined as the average of two channels that have been calibrated by means of the same test equipment would have common M&TE uncertainty, and so the reduction in uncertainty due to averaging would be less than expected.
- Data from a measurement not subject to flow would not be representative of the UHS temperature.

### 4.0 CONCLUSION

On the basis of the above evaluation, the NRC staff has concluded that the requested modifications are not supported by the analysis provided by Exelon.

Exelon has not shown that the instrumentation is sufficiently accurate to justify the requested reduction in margin. Exelon has not provided adequate assurance that anticipated measurement errors would not exceed the margin between the proposed TS limit and the temperature assumed in the plant safety analyses. Such errors could result in a measured temperature that is below the proposed TS limit even though the actual temperature exceeds the value assumed in the safety analyses. The requested modification could, therefore, result in operation outside the conditions assumed in the plant safety analyses.

Therefore, the NRC staff finds that the requested TS modifications are not acceptable.

Principal Contributor: P. Rebstock

Date: November 3, 2006