Exelon Generation
4300 Winfield Road
Warrenville, IL 60555

www.exeloncorp.com

Exelon Nuclear

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

LaSalle County Station, Units 1 and 2
Facility Operating License Nos. NPF-11 and NPF-18
NRC Docket Nos. 50-373 and 50-374

Subject: Additional Information Supporting the License Amendment Request to Technical Specification 3.7.3, "Ultimate Heat Sink"

References:

1. Letter from K. R. Jury (Exelon Generation Company, LLC) to U.S. NRC, "Request for a License Amendment to Technical Specification 3.7.3, Ultimate Heat Sink," dated March 13, 2006

2. U.S. NRC to C. M. Crane (Exelon Generation Company, LLC), "LaSalle County Power Station, Units 1 and 2 – Request for Additional Information Related to Ultimate Heat Sink License Amendment Request," dated June 15, 2006

In Reference 1, Exelon Generation Company, LLC, (EGC), requested an amendment to Appendix A, Technical Specifications (TS), of Facility Operating License Nos. NPF-11 and NPF-18 for LaSalle County Station (LSCS) Units 1 and 2 respectively. Specifically, the proposed change increases the temperature limit of the cooling water supplied to the plant from the Core Standby Cooling System (CSCS) pond (i.e., the Ultimate Heat Sink (UHS)) from 100°F to ≤ 101.5°F. This increase is achieved by reducing the temperature measurement uncertainty by replacing the existing thermocouples with higher precision temperature measuring equipment.

In Reference 2, the NRC requested additional information to complete the review of the proposed license amendment.

Attachment 1 of this letter provides the requested information.

EGC has reviewed the information supporting a finding of no significant hazards consideration that was previously provided to the NRC in Attachment 1 of Reference 1. The supplemental information provided in this submittal does not affect the bases for concluding that the proposed license amendment does not involve a significant hazards consideration.

Should you have any questions concerning this letter, please contact Ms. Alison Mackellar at (630) 657-2817.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 13th day of July 2006.

Respectfully,

Joseph A. Bauer

Joseph A. Bauer
Manager – Licensing

Attachment 1: Response to Request for Additional Information

ATTACHMENT 1
Response to Request for Additional Information

Question No. 1

"Show that the temperatures in the two circulating water intake canals are sufficiently representative of each other and of the UHS temperature as assumed in the safety analysis to support the use of the averaged temperature at both units. Show how these relationships remain valid when one unit is out of service, or explain how this will be accommodated in the technical specification (TS) for the other unit." (Category 2.a)

Response

There is only one Ultimate Heat Sink (UHS) at LaSalle County Station (LSCS) supporting both Units 1 and 2. The Circulating Water (CW) suction is drawn from a single intake canal and piped underground to the respective unit's main condensers. The intake canal is relatively narrow with a high flow rate ensuring that there is thorough mixing of the water prior to being drawn into the suction of the six (i.e., three per unit) circulating water pumps. The difference in piping configurations between the two units' underground supplies is minor. The temperature measurements recorded from the installed resistance temperature detectors (RTDs) show extremely close correlation between both units and between individual RTDs. Thus it is considered that the CW temperature for any of the installed RTDs on either unit is representative of the UHS temperature.

If a unit does not have any CW pumps in operation (i.e., the unit is shutdown), surveillance procedure, LOS-AA-S101(201), "Unit 1(2) Shiftly Surveillance," directs the CW temperature to be recorded from the unit that does have a CW pump in operation to determine the TS value for UHS temperature.

A simple schematic of the CW system for LSCS is included in Attachment C.

Question No. 2

"Describe any thermowell modifications or adaptors required for the installation of the resistance temperature detectors (RTDs). Confirm that the RTD insertion length is compatible with the thermowells. Identify any seismic requirements applicable to this installation; for example, if safety-related cooling water is extracted from these canals, there may be seismic II/I considerations." (Category 2.a)

Response

No thermowell modifications or adaptors were required for the installation of the new RTDs. The RTD assemblies were specifically procured and manufactured by the vendor (i.e., Minco) to be installed into the existing thermowells and have been successfully installed on both units. The CW temperature instrumentation is non-safety-related and is not required to be seismically qualified; therefore, there are no safety-related or seismic issues associated with these instruments. There are no safety-related components in the heater bay where these components are installed and; therefore, there are no seismic II/I issues to consider.

Question No. 3

"The request indicates that the existing thermocouple wires will be used for the RTDs, and that temperature compensator modules will be used to correct any signal effects. Where will these

temperature compensator modules be located? What is the specific compensation provided, and how does this account for: (Category 2.a)

a. thermocouple wire resistance, especially considering that the RTDs are using a 2-wire, rather than 3- or 4-wire configuration, and

b. dissimilar metallic junction at both ends of the thermocouple cables. Please explain how these effects are addressed in the uncertainty evaluation."

Response

The temperature compensation modules for the CW instrumentation are located outside of the heater bay in the turbine building. They are housed in a separate enclosure with a dedicated power feed.

The temperature compensator module is manufactured by ifm efector, incorporated. The ifm efector model TR2432 temperature compensator is a temperature transmitter/control monitor that accepts a 2-, 3-, or 4-wire Platinum RTD input and provides a 4-20 milliamp (mA) analog output corresponding to the calibrated temperature range (30°F to 120°F as installed at LSCS). The module automatically compensates for the length of the thermocouple wires and amplifies the signal (i.e., boosts the signal) to compensate for the resistance in the 4-20 mA loop between the heater bay and the LSCS Main Control Room.

The TR2432 is able to accept input from the 4-wire 100 ohm platinum RTD. Since the TR2432 was placed outside the heater bay at LSCS, 4-conductor cable was pulled from the RTD to the TR2432 over a distance of approximately 200 feet. The thermocouple wire is used in a 4-20 mA loop and therefore is not part of the temperature measuring circuit. The thermocouple wire is only used for the output current signal loop to the Plant Process Computer (PPC). This application was verified with the vendor (i.e., ifm efector) as technically acceptable and within the automatic compensation capabilities of the TR2432. Therefore, there is no impact on the uncertainty calculation from the thermocouple wire resistance as it is already included in the manufacturers tolerance of the TR2432.

To ensure confidence prior to installation, the setup was tested pre-modification in a laboratory utilizing 1000 feet of thermocouple wire with the RTD and compensator connected, as they would be in the field installation. The test data showed that the configuration as tested performed better than manufacturer tolerance for the compensator and the RTD configuration.

The impact of dissimilar metal junctions at the I/O termination point of the PPC on the uncertainty evaluation is considered to be negligible since the loop is calibrated/checked by simulating an input to the temperature compensator and verifying the temperature indicated by the PPC. Any emf induced by the dissimilar metal junctions is compensated for when the loop is calibrated. The dissimilar metal junctions are located in a controlled temperature environment (i.e., the Main Control Room computer room). However, to verify that there is no impact, a test was performed that varied the temperature conditions at the dissimilar metal junction. This test concluded that there was a negligible change in CW inlet temperature computer points with varying temperatures at the dissimilar metal junction. Therefore, there is no impact on the uncertainty evaluation.

Question No. 4

"Provide the detailed uncertainty evaluation, showing the source of all input information and the full derivation of all results and conclusions." (Category 2.a)

Response

See Attachment A

Question No. 5

"Describe the configuration (in regard to the acquisition and exchange of these temperature measurement data) of the Data Acquisition System, Plant Process Computer for each unit, and the data communications in each unit and between units as they presently exist and as they would exist following the implementation of the requested change." (Category 2.a)

Response

Data Acquisition System:

Standard RTP Corp I/O cards are used in the LSCS Plant Process Computer (PPC). Each temperature input goes to a separate input channel on an I/O card. The thermocouple wires are connected to the I/O card at the receiving end of a 4-20 mA loop. Since the existing computer points were connected to Analog Input (AI) Cards that are specifically designed to accept thermocouple input, these signals were relocated to existing spare AI cards with an 8-ohm resistor to convert the signal to a range of 32 mV dc to 160 mV dc. The calibrated span of the new RTD card will be 32 mV dc to 160 mV dc corresponding to a temperature span of 30°F to 120°F.

Plant Process Computer for each unit:

Scientech dual, redundant process computers are installed on both LSCS units. Each unit receives the data from its respective input source through the RTP I/O cards. The data is processed independently by each computer (i.e., two per unit) and is available for display to the operator at a workstation. Each temperature point is available as a single point and averaged on the same unit. The PPC displays "bad" points in cyan to indicate if the data is suspect or not available. Each of the four condenser CW inlet temperature data points is set to alarm at 100°F in the PPC (note that this is not a Main Control Room board annunciator). Following the implementation of the requested change, the CW inlet temperature data points will be set to alarm at 101.5°F in the PPC.

The data communications in each unit and between units as they presently exist and as they would exist following the implementation of the requested change:

Both Units 1 and 2 have been modified for the new RTDs and as such would remain following the implementation of the requested change. Currently all data points, which are set to alarm or alert in the PPC, generate a terminal alarm/alert at the Main Control Room workstation(s). The alarm/alert consists of an audible alarm and an alarm message. Each workstation can be used to view any computer point. The following is a list of current computer points for temperature monitoring on the PPC:

F285 = LINE A COND INLET
F286 = LINE B COND INLET
C361 = AVG CWTR INLET TEMP (C361 = (F285 + F286) / 2)

Refer to Attachment B for a block diagram of the configuration.

Question No. 6

"What method or procedures for determining the UHS temperature reading, used to satisfy the TS requirement, will be used after all four new RTDs are installed? Include details on handling failed inputs (if one RTD fails in one unit, if one RTD fails in each unit, if two fail in one unit, if two fail in one unit and one fails in the other unit)." (Category 2.a)

Response

The method for determining UHS temperature did not change with the installation of the new measuring devices (i.e., RTDs). Operators perform a shiftly surveillance procedure, LOS-AA-S101(201), "Unit 1(2) Shiftly Surveillance," which includes recording the daily CW inlet temperature computer point average value for both units. The CW temperatures for any of the installed RTDs on either unit is representative of the UHS temperature recorded to satisfy the 24-hour SR 3.7.3.1. There is no difference in determining the UHS temperature reading to satisfy TS requirements between the old configuration (i.e., thermocouples) and the new configuration (i.e., RTDs). The operators read the Unit 1 and Unit 2 average temperature (i.e., computer point C361) and perform a simple average by calculating (U1C361+U2C361)/2. If a unit does not have a CW pump in operation (i.e., the unit is shutdown), the operating department surveillance procedure directs the CW temperature to be recorded from the unit that does have a CW pump in operation.

The uncertainty evaluation shows that with only two RTDs functional, the uncertainty value is 0.43°F. It is considered extremely unlikely that three of the four RTDs or associated circuitry would be out of service simultaneously. In the unlikely event this condition was to occur, temporary temperature monitoring devices will be utilized with as good, or better, uncertainty and accuracy than the installed instrumentation. This temporary method of meeting SR 3.7.3.1 would be performed in accordance with the requirements of the 10 CFR 50.59, "Changes, tests, and experiments" and the temporary measuring device will be installed in an acceptable location to remain bounded by the instrument uncertainty analysis assumptions to meet the requirements of SR 3.7.3.1 and determine the LSCS UHS temperature.

Currently, TS does not specify the methodology to obtain lake temperature, only the bounding condition of 100°F indicated UHS temperature is specified. As stated in Reference 1, the UHS post-accident temperature is based on current heat removal calculations that analyze for a maximum allowable inlet cooling water temperature of value of 104°F. To account for the worst-case scenario and to apply conservatism, the Core Standby Cooling System (CSCS) pond cooling water inlet temperature of 104°F consists of the current TS CSCS pond cooling water inlet maximum of 100°F, plus 2°F for transient heat up, plus another 2°F margin to account for additional conservatism.

The conservative margin of 2°F is based on the thermocouple instrument loop uncertainty value of approximately ± 1.8°F, with 0.2°F margin added. The analysis considering the new

measuring devices (i.e., RTDs) will use the same peak temperature value of 104°F; however, the new analysis will assume an instrument measurement uncertainty of 0.31°F (i.e., assumes four instrument loops are operable) and conservatively use a bounding margin of 0.5°F (which bounds two operable loops uncertainty). The current accident analyses results remain unchanged since the maximum UHS temperature realized using this new analysis assumption remains unchanged. Therefore the License Amendment is proposing an increase in the temperature limit of the cooling water supplied to the plant from the CSCS pond to ≤ 101.5°F by reducing the temperature measurement uncertainty by replacing the existing thermocouples with higher precision temperature measuring equipment.

<u>Question No. 7</u>

"How are the temperature values presented to the operators and system engineer including any alarms, warnings, or other identification of status or failures?" (Category 2.a)

<u>Response</u>

Currently all data points which are set to alarm or alert in the PPC generate a terminal alarm/alert at the Main Control Room workstation(s). The alarm/alert consists of an audible alarm and an alarm message. Each workstation can be used to view any computer point. The following is a list of current computer points for temperature monitoring on the PPC.

F285 = LINE A COND INLET
F286 = LINE B COND INLET
C361 = AVG CWTR INLET TEMP [C361 = (F285 + F286) / 2]

If any of the computer points has failed the PPC displays "bad" points in cyan to indicate if the data is suspect or not available.

There were no changes to any PPC, I/O or workstation configuration as a result of this modification; however, the PPC database has been updated to reflect the relocation of the CW inlet temperature loop inputs from the thermocouple cards to the analog input cards. The current alarm setpoint on individual computer points are set at 100°F. Upon approval of the proposed change to increase the temperature limit of the cooling water supplied to the plant from the Core Standby Cooling System (CSCS) pond to ≤ 101.5°F, the individual computer points will be set to the new limit of 101.5°F.

It should be noted that in addition to the Main Control Room workstations, any LSCS System Engineer has similar capability at their individual workstations to view Unit 1 or Unit 2 PPC data points and trend data.

<u>Question No. 8</u>

"Describe the type of RTD to be used, and the calibrated range of the temperature measurement." (Category 2.a)

<u>Response</u>

The RTD assemblies were specifically procured and manufactured by the vendor (i.e., Minco) to be installed into the existing thermowells and have been successfully installed on both units.

The RTD is a high precision, 100 ohms, platinum, class A sensor, 4-wire, single element, model XS853PD157X4. The calibrated temperature measurement range of the instrument loop is 30°F to 120°F.

<u>Question No. 9</u>

"How frequently will the new RTD readings be sampled and how frequently are the associated calculations performed?" (Category 2.a)

<u>Response</u>

As stated in the response to Question 6, operators perform a shiftly surveillance procedure, LOS-AA-S101(201), which includes recording the daily CW inlet temperature computer point average value for both units. Currently, SR 3.7.3.1 verifies the cooling water temperature supplied to the plant from the CSCS pond (i.e., the UHS) is ≤ 100°F every 24 hours. The proposed change is being sought to increase the temperature limit of the cooling water supplied to the plant from the CSCS pond to ≤ 101.5°F. There is no change in the frequency of recording the UHS temperature value with the new instrumentation and none planned as a result of the proposed TS change.

The computer points for CW temperature monitoring on the PPC are on a one (1) second data collection rate. As stated in the response to Question 7, each workstation can be used to view any computer point.

<u>Question No. 10</u>

"The statistical theory upon which the assumed accuracy improvement is partly based requires statistical independence among the measurements. How are the common-mode uncertainty elements, such as environmental effects and common maintenance and test equipment, accounted for in the analysis?" (Category 2.a)

<u>Response</u>

Common-mode uncertainty elements are not accounted for in the analysis, as they do not apply. The RTD is a platinum high precision device. It is designed for the temperature and humidity range that it is expected to be exposed to in the heater bay/condenser pit. The TR2432 compensator is installed outside of the heater bay in the turbine building. The device is fully within its operating range for temperature and humidity in this environment. The PPC and I/O cards are housed in the PPC computer room in the Main Control Room that is a monitored and controlled environment.

Each temperature loop has its own thermowell, RTD, RTD cable, temperature compensator, output signal cable (i.e., thermocouple wire), and I/O input channel. The vendor performance parameters used for uncertainty terms in the accuracy evaluation were all random values and no environmental effects were specified.

All test equipment used in field calibrations at LSCS is periodically calibrated, verified to be within the appropriate certification period, and controlled in accordance with the EGC M&TE program MA-AA-716-040, "Control of Portable Measurement and Test Equipment Program."

Question No. 11

"How were any aging effects on RTD and component accuracy accounted for in the uncertainty calculations?" (Category 2.a)

Response

The vendor specifications for RTD accuracy and drift were used in the uncertainty evaluation. The drift value was stated as ±0.2°F/year. It was confirmed with the vendor that the stated drift value is based on cycling the sensor through the entire temperature range of 50°C to 260°C. Drift for the span used in this particular application will be less than the vendor drift value. Potential drift and stability error is also reduced since the elements are platinum, which is considered to be high purity, and because these elements are installed in thermowells. Based on these attributes, a total drift value of ±0.2°F is considered to be bounding for this application and was used in the evaluation.

Question No. 12

"Describe the calibration and surveillance procedures to be implemented to maintain the accuracy of the individual temperature measurements." (Category 2.a)

Response

A RTD loop and calibration check for the CW instrumentation is performed under the LSCS Surveillance program in accordance with LSCS instrument maintenance procedure LIP-GM-928, "RTD Loop and Calibration Check."

References:

1. Letter from K. R. Jury (Exelon Generation Company, LLC) to U.S. NRC, "Request for a License Amendment to Technical Specification 3.7.3, Ultimate Heat Sink," dated March 13, 2006

2. U.S. NRC to C. M. Crane (Exelon Generation Company, LLC), "LaSalle County Power Station, Units 1 and 2 – Request for Additional Information Related to Ultimate Heat Sink License Amendment Request," dated June 15, 2006

ATTACHMENT A
LSCS Engineering Calculation (EC) 0000359093
Uncertainty Evaluation for CW inlet instrument loops

EC 0000359093
T. Van Wyk/LAS43
January 25, 2006

1. Reason for Evaluation

The purpose of this evaluation is to determine loop uncertainty values for proposed new Circulating Water inlet instrument loops. (EC359060 for Unit 1 and EC359114 for Unit 2 will implement these new loops. Refer to these ECs for details on the new loop components.)

These instrument loops provide Ultimate Heat Sink (UHS) temperature indication through the Plant Process Computer (PPC). This proposed new loop configuration will replace the existing thermocouples 1(2) CW010/011 (the sensing elements for computer points F285/F286) with new RTD temperature sensing elements and new temperature comparators, and will relocate the computer inputs to the appropriate type Input/Output (I/O) analog input cards.

2. Scope

The scope of this EC is to evaluate the loop uncertainty values for new temperature instrument loops based on the proposed new loop configurations. The new instrument loops will consist of the following components: high accuracy RTD temperature elements, temperature comparators (to allow using the existing thermocouple cables), precision input resistors at the field input to the I/O card, and the D/A conversion in the PPC I/O equipment. The loop components evaluated in this document have the following specifications:

- New Minco RTDs in the existing thermowells (replacing the existing thermocouples). The new RTDs have the following performance specifications (Ref. 4):

    - Repeatability: ±0.2°F
    - Drift: ±0.2°F

    [Ref. 4 states this value as ±0.2°F/year. However, this is based on cycling the sensor through the entire range of 50°C to 260°C. Drift for the span used in this application will be less. Drift/stability error is also reduced since these elements are Platinum, which is considered to be high purity, and because these elements are installed in thermowells. Therefore, a total drift value of ±0.2°F is considered to be bounding for this application.]

- New ifm® efector600 TR2432 temperature compensator modules. These new modules have the following performance specification (Ref. 5):

    - Accuracy: ±0.54°F
    - Drift: ±0.1% of measured range/ 10 K (Kelvin).

    [The error term value for the 90°F temperature span is very small compared to other error terms and is considered negligible.]

- PPC I/O input card (including precision input signal resistor). The I/O input cards have the following performance specification (Ref. 6):
  - Accuracy: ±0.025% of full scale (30°F to 120°F)

  [The input resistor is a high precision resistor and the error term value due to this resistor is considered negligible.]

3. Methodology

The technical basis (methodology) for this quantitative engineering evaluation consisted of applying the basic concepts of uncertainty as described in Exelon Engineering Standard NES-EIC-20.04. Since the setpoint methodology described in NES-EIC-20.04 is a setpoint methodology and not explicitly applicable to the instrument application being evaluated, the methodology for this engineering evaluation also relied on the technical knowledge/experience of the preparer and reviewer.

4. Detailed Evaluation

The loop evaluated consists of a high-accuracy platinum RTD (Minco Assembly as detailed in Reference 4.), one signal converter (ifm® TR2432 or similar), the input signal resistor at the input to the I/O card, and the A/D conversion by the PPC I/O.

<u>Component 1: Minco RTDs</u>

Component EIDs: 1TE-CW010, 1TE-CW011,
2TE-CW010, 2TE-CW011

From Section 2:
Repeatability: ±0.2°F
Drift: ±0.2°F

These two error terms will be combined using the Square Root Sum of the Squares (SRSS) to determine the overall uncertainty for the RTD temperature sensors.

$$\pm [(0.2°F)^2 + (0.2)^2]^{½} = \pm 0.28\ °F$$

<u>Component 2: ifm® TR2432</u>

Component EIDs: 1TT-CW010, 1TT-CW011
2TT-CW010, 2TT-CW011

From Section 2:
Accuracy: ±0.54°F
Drift: [Negligible per Section 2]

± 0.54 °F

<u>Component 3: A/D conversion at the RTP I/O card</u>

From Section 2:

Accuracy:	±0.025% of full scale (30°F to 120°F)
Drift:	[Negligible per Section 2]

(0.00025 × 90 °F) = 0.0225°F

± 0.023 °F

Loop accuracy is determined by calculating the SRSS of the individual component accuracy numbers:

$$\pm [(0.28°F)^2 + (0.54)^2 + (0.023)^2]^{½} = \pm 0.61°F$$

± 0.61 °F

5. Conclusion

Replacing the existing thermocouple temperature sensors with high-accuracy RTD sensors and temperature compensators will result in improved accuracy for these sensing loops. For this new loop configuration, the resulting loop accuracy is:

± 0.61°F

To obtain a more accurate value of the UHS temperature using these instruments, the average of the four values can be taken. This assumes that the four readings are sensing the same input temperature and that there is little effect between the input and the measurement point.

$$T_{CWAverage} = \frac{T_{1TE-CW010} + T_{1TE-CW011} + T_{2TE-CW010} + T_{2TE-CW011}}{4}$$

The accuracy of this process is considered the same as the accuracy of summing networks addressed in References 1 and 2, or by the multiple test criterion of Reference 3.

In all of these cases the final uncertainty is the square root sum of the squares of the individual channel uncertainties considering the multiplier for each of the uncertainties is one divided by the number of channels that are being averaged.

$$e_{Average} = \sqrt{\left(\frac{e_1}{n}\right)^2 + \left(\frac{e_2}{n}\right)^2 + \left(\frac{e_3}{n}\right)^2 + \bullet \bullet \bullet \bullet + \left(\frac{e_n}{n}\right)^2}$$

If all of the instrument loops are identical then this equation will reduce to

$$e_{Average} = \frac{e_i}{\sqrt{n}}$$

Thus for the CW temperatures, the accuracy of the average of the readings for two loops will be:

$$e_{Average} = \frac{0.61}{\sqrt{2}} = 0.43 \ \text{°F}$$

The accuracy of the average of the readings for three loops will be:

$$e_{Average} = \frac{0.61}{\sqrt{3}} = 0.35\,\text{°F}$$

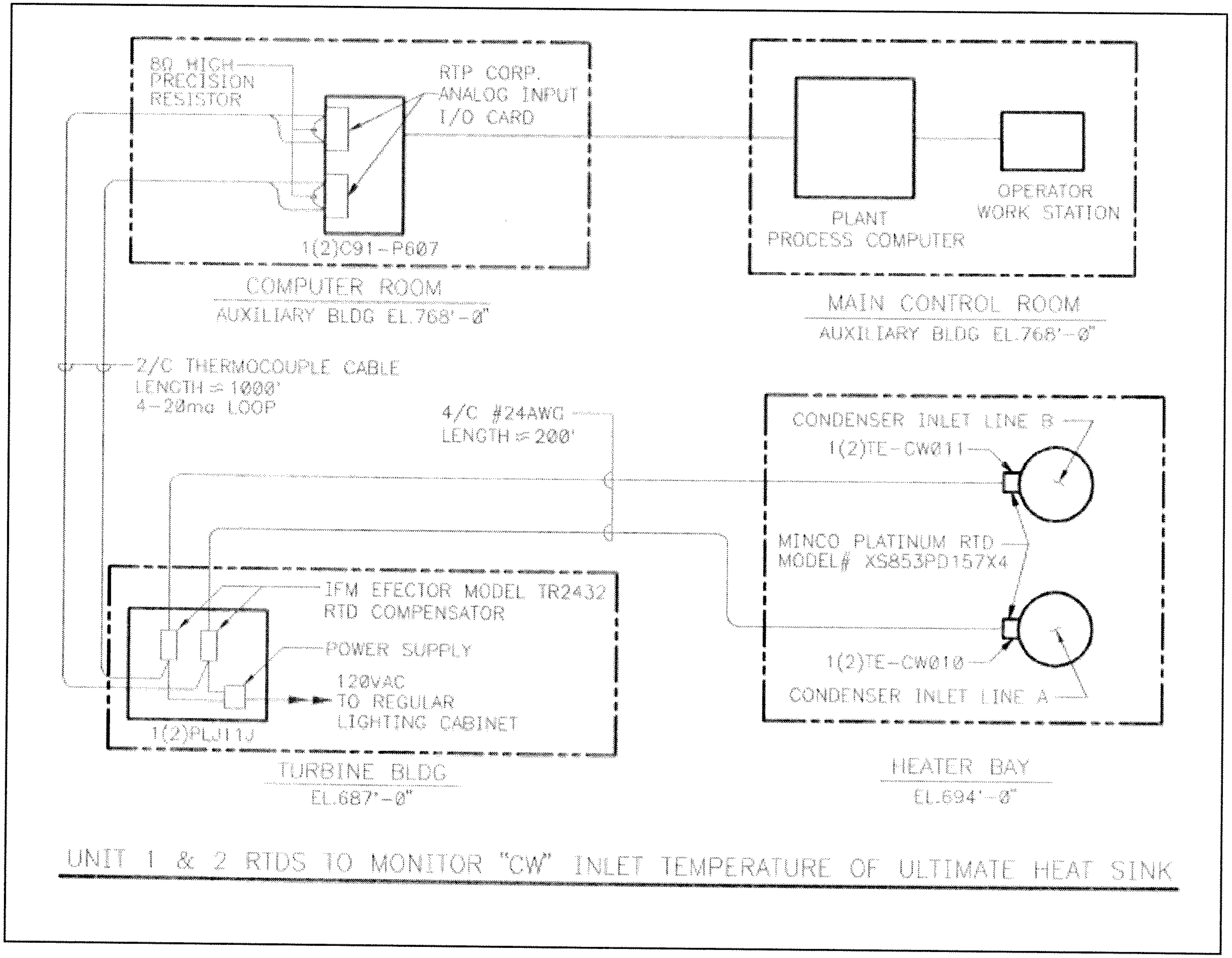
The accuracy of the average of the readings for four loops will be:

$$e_{Average} = \frac{0.61}{\sqrt{4}} = 0.31\,\text{°F}$$

5. References:

1. ISA –RP67.04-1994, Methodologies for the Determination of Setpoints in Nuclear Safety-Related Instrumentation, Section K.2
2. NES-EIC-20.04, Analysis of Instrument Channel Setpoint Error and Instrument Loop Accuracy, Section 3.2
3. ASME PTC 19.1, Measurement Uncertainty, Section 3.2
4. Minco Quotation 160056-2 dated January 26, 2006
5. ifm® efector600 TR2432 operation instructions 701724/00
6. RTP® I/O card specification 981-0021-211A

ATTACHMENT B
RTD Installation Schematic



ATTACHMENT C
Simplified Circulating Water System