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10 CFR 50.90

March 16, 2012

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Subject: Duke Energy Carolinas, LLC
Oconee Nuclear Station, Units 1, 2 and 3
Renewed Facility Operating Licenses Numbers DPR-38, 47 and 55;
Docket Number 50-269, 50-270 and 50-287;
Supplement to License Amendment Request for Measurement Uncertainty Recapture Power Uprate,
License Amendment Request No. 2011-02, Supplement 2

On September 20, 2011, Duke Energy Carolinas, LLC (Duke Energy) submitted a License Amendment Request (LAR) that proposes to amend the Technical Specifications (TS) of Renewed Facility Operating License Nos. DPR-38, 47 and 55 in support of a measurement uncertainty recapture (MUR) power uprate. By letter dated March 12, 2012, the NRC requested Duke Energy submit additional information to enable the NRC Staff to complete their review of the LAR. Enclosure 1 provides responses to the NRC Request for Additional Information (RAI) questions.

Enclosure 2 provides minor corrections and changes to the proposed TS changes associated with the LAR. The changes proposed by this supplement are bounded by the no significant hazards consideration submitted in the September 20, 2011, LAR.

Enclosure 3 provides revisions to the heat balance uncertainty analyses provided in the LAR and includes Cameron International Corporation (Cameron) documents containing information that have been classified as proprietary by Cameron. An affidavit from Cameron for those documents considered proprietary is also included in Enclosure 3. This affidavit sets forth the basis on which the information may be withheld from public disclosure by the NRC pursuant to 10 CFR 2.390. Enclosure 3 also includes a Duke Energy document containing information that has been classified as proprietary by Duke Energy. An affidavit from Duke Energy for the document considered proprietary is also included in Enclosure 3. This affidavit sets forth the basis on which the information may be withheld from public disclosure by the NRC pursuant to 10 CFR 2.390.

There are no Regulatory Commitments made in this submittal. Inquiries on this submittal should be directed to Boyd Shingleton, Oconee Regulatory Compliance Group, at (864) 873-4716.

A001
NRR

I declare under penalty of perjury that the foregoing is true and correct. Executed on March 16, 2012.

Sincerely,

TPGillespie

T. Preston Gillespie, Jr., Vice President,
Oconee Nuclear Station

Enclosures:

Enclosure 1	Response to NRC Request for Additional Information
Enclosure 2	Changes to Proposed Technical Specification Associated With MUR Uprate LAR
Enclosure 3	Heat Balance Uncertainty Analyses

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ENCLOSURE 1

Response to NRC Request for Additional Information

Enclosure 1
Response to NRC Request for Additional Information

RAI-1

In Enclosure 2, Section V.1, "The Main Power System," the licensee stated that the Isolated Phase Bus (IPB) has adequate electrical capacity for the upgrade, but has experienced cooling problems and discussed this cooling problem in LAR Section VI.1.C. In Enclosure 2, Section VI.1.C, "Safety-related Cooling Water System," the licensee stated that, "The IPB ventilation systems for Oconee Units 1, 2, and 3 do not meet the original nameplate design flow which correlates to issues for IPB cooling capacity. During periods with elevated temperatures, the cooling system is not capable of providing the cooling necessary to remove the IPB resistance heating. This condition requires that Duke Energy must either provide supplemental cooling or limit the maximum thermal power. During these conditions, the full potential of the MUR power uprate may not be realized."

a) Provide the current IPB capacity/Ampere rating versus the capacity/Ampere rating required for measurement uncertainty recapture (MUR) power uprate conditions.
b) Provide a discussion on the proposed supplemental/enhanced cooling to the IPB for operation at MUR power uprate conditions.

Duke Energy Response to RAI-1.a

Generator Isolated Phase Bus (IPB):

The Generator IPB is rated at 20kV, 16kA self cooled / 33.119kA forced cooled.
The electrical power output of Units 1 & 2 are calculated to reach 1033 MVA and Unit 3 is calculated to reach 1037 MVA following the MUR uprate. Operating at 95% of the 19kV nominal system voltage (the minimum allowed system voltage during steady state operation), the current from the Main Generator of Units 1 & 2 will reach 33,041.7 Amps. This is within the forced-air-cooled rating of the Generator IPB. Under the same conditions, the current from the Main Generator of Unit 3 would exceed the forced-air-cooled rating of the Generator IPB by 51 Amps. Therefore, the electrical power output of Unit 3 would need to be limited at reduced voltages; however, if the Unit 3 Main Generator is operated at the 19kV nominal system voltage, the output current of 31,511 Amps, would be within the Generator IPB capability.

Unit Auxiliary Transformer Isolated Phase Bus (IPB)

The *Unit Auxiliary Transformer (*UAT) IPB is rated for 20kV, 2kA and is self-cooled. Current from the Generator IPB divides between the Main Step-Up Transformer and the UAT. The maximum load on the UAT IPB is expected to be approximately 1494 Amps, which is well below the self-cooled rating of 2000 Amps. Therefore, the UAT IPB capability and ratings are sufficient and will not be impacted by the MUR uprate.

Duke Energy Response to RAI-1.b

In order to prevent the Unit 1 and 2 Isolated Phase Bus (IPB) from reaching their temperature alarm set points in the summer months, a temporary modification is performed that provides chilled water to a heat exchanger (HX). Once chilled water is established to the heat exchanger, the normal Recirculation Cooling Water (RCW) supply to the IPB forced air cooling (FAC) unit is routed through the HX. The resultant reduction in RCW inlet temperature to the FAC then cools the air circulated by the FAC to maintain IPB temperatures within normal operating parameters.

RAI-2

In Enclosure 2, Section V.1, "The Main Power System," the licensee stated that the Main Power System continues to have adequate capacity and capability for plant operation with an MUR power uprate, and is bounded by the existing analyses and calculations.

Discuss the adequacy of the main power system to support the above statement, providing current capacity/rating versus the capacity/rating required for the MUR power uprate conditions for the generator, main step-up transformer, unit auxiliary transformer, start-up transformer, and also CT-4 transformer as indicated in Section V.I.A of the LAR.

Duke Energy Response to RAI-2

Main Generator

The rating for each unit's main generator is

- Units 1, 2, 3 - 934 MWe, 1037.937 MVA, 452 MVAR, 0.9 pf

Current operating generator output for each unit is:

- Unit 1 - 906.5 MWe, 1023 MVA, 475 MVAR, 0.88 pf
- Unit 2 - 907.3 MWe, 1024 MVA, 475 MVAR, 0.88 pf
- Unit 3 - 914.8 MWe, 1024 MVA, 460 MVAR, 0.89 pf

The change in output for the MUR uprate for each unit is as follows:

- Unit 1 - 924.6 MWe, 1033 MVA, 460 MVAR, 0.89 pf
- Unit 2 - 924.8 MWe, 1033 MVA, 460 MVAR, 0.89 pf
- Unit 3 - 932.5 MWe, 1037 MVA, 455 MVAR, 0.90 pf

The Main Generator rating is adequate for the current unit outputs and will continue to be adequate for the MUR uprated output. The increases in MWe will result in modest reduction in reactive power. The Main Generator rating is adequate for the current unit outputs and will continue to be adequate for the MUR uprated output.

Main Step-Up Transformer (MSU)

Units 1 & 2 MSUs are rated at 1000/1120 MVA at 55°C/65°C, 18.1 / 230kV, 3-phase. The Unit 3 MSU is made up of 3 single-phase transformers; each rated 373.333 MVA at 65°C rise, 18.05 / 525kV.

Each MSU receives power from its associated Main Generator and transmits the power to the switchyard. With the Unit 1 & 2 Main Generators operating at MUR uprate conditions, the associated MSUs will each be loaded to 986.515 MVA. Similarly, with the Unit 3 Main Generator operating at MUR uprate conditions, its MSU will be loaded to 990.335 MVA. In each case, the load is less than the rating of the MSU.

Auxiliary Transformer (1T, 2T, 3T)

All three UATs are 3-phase, 18.1 / 6.9 / 4.16kV transformers.
Units 1 & 2 (1T, 2T) are each rated for 45/60 MVA.
Unit 3 (3T) is rated for 35 / 70 MVA.
Each UAT has two low voltage windings to serve both 4.16kV and 6.9kV buses. The UATs are sized to supply the full load auxiliaries of one unit as well as the Engineered Safeguard equipment of another unit. Analysis with the current Electrical Transient and Analysis Program (ETAP) model is bounding for loading changes required for achievement of MUR uprate condition. Therefore, any increase in current flow through the transformers due to MUR uprated conditions remain within transformer ratings.

CT-1, 2, 3 Start-Up Transformers

Start-up transformers CT-1, CT-2, & CT-3 are three winding 230kV / 6.9 kV / 4.16 kV transformers rated for 33.6 MVA. Current operating conditions analyzed using ETAP are already conservative enough to bound any loading increases that will be seen with MUR conditions; therefore, no additional analysis is required to determine that Start-up Transformer ratings are not impacted by the MUR uprate. Secondary voltages remain within acceptable limits of less than 105% loaded or less than 110% unloaded.

CT-4 Transformer

The CT-4 transformer is a two-winding 13.2/4.16 kV transformer rated for 12/16/20 MVA. The loading for the Oconee Units does not increase at the bus level from the existing analysis for either MUR uprate operation or a LOCA following operation at MUR uprate conditions. CT-4 transformer ratings remain sufficient for operation at MUR uprate conditions.

RAI-3

In Enclosure 2, Section V.I, "AC Distribution", the licensee stated that all alternating current (AC) distribution systems continue to have adequate capacity and capability for plant operation with an MUR power uprate and are bounded by the existing analysis and calculations.

a) Provide a discussion of the AC power distribution system (6.9 kV down to 120 V buses) load changes due to the uprate as listed in the LAR Section V.1, in support of the above statement.

b) Identify the affected loads/motors and provide the increases in the brake horsepower of the motors due to the MUR power uprate and compare with the rated horsepower of the affected motors.
c) If any AC bus is affected, confirm that the affected buses will not result in unacceptable steady-state voltages, overload or exceed the short circuit ratings.
d) Discuss the impact, if any, of the MUR power uprate on the existing protective relay settings.

Duke Energy Response to RAI-3a & c

The 4kV Essential Auxiliary Power (OEM) system powers the loads that will have an increase in required power to achieve the uprate. These changes are duplicated for all three Units. The 6.9kV, 600/208V Safety-Related and Non-Safety-Related, and 120V systems will experience no loading changes and will perform their design functions at MUR uprate conditions.
The following motor loading changes are those required to achieve the MUR uprate:

E Heater Drain Pump

Worst case loading with MUR uprate conditions is 157 kW per pump. All trains of the Heater Drain System (and all pumps) are operated for normal operating condition. Current ETAP loading for normal conditions is 212.5 kW, which is greater than the worst case MUR uprate loading.

D Heater Drain Pump

Worst case loading with MUR uprate conditions is 1080 kW per pump. Current ETAP model loading for normal conditions is 1267.7 kW, which is greater than the worst case MUR uprate loading.

Hotwell Pumps

Worst case loading for each Hotwell Pump (running all three pumps, representative of actual operating conditions) with MUR uprate conditions is 350 kW. Current ETAP model loading for normal conditions is 484.7 kW, greater than the worst case MUR uprate loading.

Condensate Booster Pumps

Worst case loading for each Condensate Booster Pump with MUR uprate conditions is 1384 kW, or 92.8% of nameplate. Current ETAP loading is conservative, at 100% loading, greater than the worst case MUR uprate loading.

The current ETAP calculation is bounding for all pumps. No change is made to the model for representation of MUR uprate conditions. Voltages and currents are still bound by current calculations. No new load flow analysis, motor starting analysis or short circuit analysis was performed to determine acceptability of loading increases to the affected buses because the plant's current ETAP model already includes sufficient conservatism to bound all loading increases required to achieve the MUR uprate. Any 4.16kV buses experiencing load increases due to the uprate will not experience unacceptable steady-state voltages, overload or short circuit currents as they remain within the previously analyzed and acceptable loading conditions.

Duke Energy Response to RAI-3b

Loads that will increase as a result of the MUR uprate are limited to certain motors. The motors that will be required to produce additional mechanical power are those that drive the following pumps: Hotwell Pumps, Condensate Booster Pumps, D Heater Drain Pumps, and E Heater Drain Pumps.

The required power to the hotwell pumps for MUR power uprate conditions was determined in the Performance Evaluation of Power System Efficiencies (PEPSE) heat balance evaluation. The hotwell pumps were modeled within the heat balance using the appropriate pump information, such as head and efficiency curves. The heat balance models two hotwell pumps in operation. Note that normal operation is with three pumps in service, which requires the greatest total motor power. However, the power required per motor is greatest with two pumps in service. Using bounding heat balance conditions, the power required per pump for both pre-MUR and MUR uprate conditions is presented in the table below.

As with the hotwell pumps, the required power to the condensate booster pumps for MUR power uprate conditions was determined in the PEPSE heat balance evaluation. The condensate booster pumps were modeled within the heat balance using the appropriate pump information, such as head and efficiency curves. The heat balance models two condensate booster pumps in operation. Using bounding heat balance conditions, the power required per pump for both pre-MUR and MUR uprate conditions is presented in the table below.

The D heater drain pumps have been de-staged, removing the tenth stage impeller and replacing it with a spacer. Due to this, the existing pump curves do not accurately reflect the pump's head and power performance. Therefore, the required power for these pumps is determined using bounding flows from the heat balance, pressure differentials from the heat balance, and pump efficiency from the existing pump curves. Note that a pump efficiency curve for the de-staged pump does not exist. Pump efficiency is assumed not to significantly change due to the de-staging. Any small change in efficiency is significantly bounded by the conservatism of the bounding flow conditions. The power required per pump for both pre-MUR and MUR uprate conditions is presented in the table below.

The E heater drain pumps were not modeled within the heat balance with pump curves. Due to this, the required power for these pumps is determined using the bounding flows from the heat balance and the pump brake horsepower (BHP) curve. The power required per pump for both pre-MUR and MUR uprate conditions is presented in the table below.

The table below provides the changes in BHP of the above pumps due to the MUR power uprate as well as a comparison to the rated motor horsepower.

Component	Pre-MUR kW	Pre-MUR BHP	MUR kW	MUR BHP	Rated Motor HP
Hotwell Pump (2)	517	693	519	696	1000
Condensate Booster Pump (2)	1371	1839	1384	1856	2000
D Heater Drain Pump (2)	1099	1474	1080	1448	2000
E Heater Drain Pump (2)	149	200	157	210	300

As can be seen in the above table the MUR uprate does not result in any increase in BHP exceeding rated horsepower of the affected motors.

Duke Energy Response to RAI-3d

Protection schemes are determined based upon nameplate data. The existing nameplate ratings of loads supplied by the AC Distribution Systems remain unchanged. Though some motor loads will have increased power requirements (an increase in the percent loading, not an increase in nameplate ratings) due to the MUR uprate, current will remain below the protective device minimum trip currents. Protective device settings are therefore bound by the current analysis based on ETAP model calculations.

RAI-4

In Enclosure 2, Section V.1, "DC [direct current] Distribution," the licensee stated that all DC systems continue to have adequate capacity and capability for plant operation after the MUR power uprate and are bounded by the existing analyses and calculations.

Describe changes in DC power system loading due to the MUR power uprate, if any, and provide a discussion of capacity margins available in the Class 1E batteries.

Duke Energy Response to RAI-4

No DC loads are changed by the MUR power uprate. Since no DC loads are changed by the MUR power uprate, there was no change in the existing capacity margins available in the Class 1E batteries.

RAI-5

In enclosure 2, Section V.1, "Switchyard Systems", the licensee stated that all switchyard systems continue to have adequate capacity and capability for plant operation with an MUR power uprate and are bounded by the existing analyses and calculations.

Provide a summary of the evaluation that supports the above statement, confirming that adequate margin exists between the maximum worst case steady-state load and the switchyard equipment ratings.

Duke Energy Response to RAI-5

Units 1 & 2: 230kV Switchyard Systems

The 230kV switchyard connects the Units 1 & 2 main generators and the Keowee Hydro Station generators to the power grid via eight 230kV transmission lines and the autobank transformer. The 230kV switchyard is the connection point for all offsite power sources for the auxiliary power systems for all three units, and it provides the overhead path from the Keowee Hydro Station generators to the auxiliary power transformers. The switchyard is comprised of two 230kV buses, Red and Yellow, twenty-five power circuit breakers (PCBs) and their associated current transformers (CTs), coupling capacitor voltage transformers (CCVTs), disconnect switches, protective relaying, and auxiliary equipment.

Overhead Lines

Units 1 and 2 generating units are connected via the Main Step-up Transformers (MSU) to the 230kV transmission lines by the Yellow and Red 230kV buses. The worst-case steady-state load is limited by the maximum current that would be transmitted by the MSU transformers. The maximum rating of both units' MSU is 1120 MVA, with a maximum current seen at the 230kV side of the transformer at ~ 2811 Amps per phase.

The MUR power uprate does not impact the MSU rating (see the Response to RAI Question 2); therefore, the maximum current carried by the overhead lines does not change after the MUR uprate, and the current ratings are valid.

Motor Operated Disconnect (MOD) Switches

Motor operated gang switches connect the MSUs and their breakers. Since the MUR power uprate does not impact the transformer rating, the maximum steady state and fault current through the MODs does not change, and the current design remains sufficient.

Unit 3: 525kV Switchyard Systems

The 525kV switchyard transmits power from the Oconee Unit 3 Generator to the power grid and provides multiple connection points for power coming into and leaving a central location. The boundaries for the 525kV switchyard include all power equipment including autobank transformer AT-1 and transformer 5T. It is comprised of two electrical buses (Red and Yellow), eight 525kV circuit breakers that are the connection point to the generators, power circuit breakers (PCBs, and motor operated disconnect switches (MODs).

Overhead Lines

The Unit 3 generating unit is connected via the MSU to the 525kV transmission lines by the Yellow and Red 525kV buses. The worst-case steady-state load is limited by the maximum current that would be transmitted by the MSU transformer. The maximum rating of the three single phase Unit 3 MSU is 373.333 MVA each, with a maximum current seen at the 525kV side of the transformer at ~ 711 Amps per phase.

The MUR power uprate does not impact the MSU rating (see MSU discussion in the RAI Question 2 Response); therefore, the maximum current carried by the overhead lines does not change after the MUR uprate, and the current ratings are still valid.

Motor Operated Disconnect (MOD) Switches

Motor operated disconnect switches are used on either side of all breakers to clear any one of them. This allows the breaker to be cleared without adversely affecting any circuit. A MOD switch is used between the MSU of Unit 3 and its breakers. Since the MUR power uprate does not impact the transformer rating, the maximum steady state and fault current through the MODs does not change, and the current design is still valid.

Power Circuit Breakers (PCBs)

The outputs of Units 1, 2 and 3 generators are connected to the switchyard through PCBs. Either of the two unit breakers is capable of passing the rated output of the MSUs for each unit. Since the MUR power uprate does not impact the MSU rating, the maximum steady state and fault current through the PCBs does not change, and the current design is still valid.

Autobank Transformer AT-1

Ratings: 22.9 – 240.0Y/138.6 – 525.0Y/303.1kV, 150MVA (tertiary) / 1500MVA at 55°F rise, 168MVA (tertiary) / 1680MVA at 65°F rise

Three single-phase transformers are connected together to form (nominally) a three-phase 1500 MVA, 230kV/525kV autotransformer between the 230kV and 525kV switchyards. AT-1 is connected to PCBs 55 and 56 on the high side, 31 and 33 on the low side. The 22kV (nominal) tertiary winding is used to provide power to the 4.16kV auxiliary power system in the plant through the 5T transformer.

The autobank transformer AT-1 is sized to carry the maximum amount of current that the MSU will provide. The MSU rating is not affected by the uprate; therefore, the increase in MVA is still within the AT-1 rating. There will be no impact due to the MUR uprate.

Transformer 5T

Ratings: 21.95-4.16Y/2.4kV, 12/16MVA at 55°F/65°F rise

Unit Auxiliary Transformer 5T steps down 22kV (nominal) power from switchyard autotransformer AT-1 to the 4.16kV auxiliary power system. Auxiliary system loading will not increase beyond currently analyzed conditions. The current loading will remain acceptable and no impact will be experienced due to the MUR uprate.

RAI-6

In enclosure 2, Section V.1.A, "Emergency Diesel Generators," the licensee stated that the equivalent source for emergency system is Keowee Hydro Station and MUR power uprate will not change the loading of the Keowee Hydro units.

Provide a current main single line diagram that identifies and shows the interconnection of the equipment described in this section. Provide a summary of the evaluation that supports your conclusion that plant operation under MUR power uprate conditions are bounded by the loading tables as indicated in Section V.1.A of the LAR.

Duke Energy Response to RAI-6

A simplified overall single line diagram of the ONS electrical distribution system and the current relay and metering drawings illustrating the interconnection of the equipment described in Enclosure 2 Section V.1.A are listed below and are provided in Attachment 2 to this enclosure. Electronic copies of these drawings have also been placed on a Duke Energy Share Point and are available for NRC review.

- K-700, "Keowee Hydro Station One Line Diagram Relays & Meters 13.8-230kV"
- O-800, "Oconee Nuclear Station One Line Diagram Relays & Meters 230 kV Switchyard PCB's 1 - 12"
- O-702-A, "Oconee Nuclear Station Units 1-3 One Line Diagram 6900V & 4160V Auxiliary Sys."
- O-800-D, "Oconee Nuclear Station One Line Diagram, AC Elementary Diagram, 3 Line Connection Diagram, Transformer CT4"

A summary of the evaluation that supports the conclusion that plant operation under MUR power uprate conditions are bounded by the loading tables is provided as follows. The current ETAP model is already conservative enough to exceed loading increases required for achieving the MUR power uprate. For this reason, there is no change to the AC Distribution Systems for the MUR power uprate. Therefore, the rating of the Keowee Hydro Units will not be exceeded.

The AC Distribution System Evaluation shows that the MUR uprate will not increase the electrical loading of any component associated with the Keowee Hydro Station.

RAI-7

In Enclosure 2, Section V.1.B, "Station Blackout [SBO]," the licensee stated that SBO systems continue to have adequate capacity and capability for plant operation for the MUR power uprate and are bounded by the existing analyses and calculations.

Provide a summary of the Class 1E battery sizing calculations that demonstrates sufficient capacity exists for the four-hour SBO coping duration under MUR power uprate conditions.

Duke Energy Response to RAI-7

No DC loads will be changed by the MUR power uprate. Therefore, sufficient capacity will continue to exist for the four-hour SBO coping duration under MUR power uprate conditions.

RAI-8

In Enclosure 2, Section V.1.C, "Environmental Qualification [EQ] of Electrical Equipment," the licensee stated that they have reviewed the Oconee EQ program for the MUR power uprate and determined that no EQ Program changes are required as a result of the MUR power uprate.

Provide a summary of your evaluation that supports the above statement. In your response, provide a discussion/summary of temperature, pressure, and radiation levels/profiles to demonstrate that electrical equipment that is required to be environmentally qualified will continue to remain qualified (including any required margins) under MUR power uprate conditions.

Duke Energy Response to RAI-8

The review of Oconee EQ Program documentation included review of both Duke Energy EQ program-level documents and discrete EQ files/calculations for specific components installed at Oconee. This review was conducted to focus on the EQ parameters of temperature, pressure, and radiation, with respect to any potential parameter changes due to the MUR power uprate.

Temperature and Pressure:

Temperature and pressure were evaluated as part of the engineering evaluations for the MUR power uprate. The potential changes in ambient temperatures, system temperatures, system pressures, and potential accident external pressures (high energy line break) and accident temperatures were considered during the review. Radiation was evaluated in a separate review.

The potential impact of the MUR uprate on ambient plant temperatures was addressed via the HVAC evaluations for the Oconee Reactor Building(s), the Auxiliary Building(s), and the Turbine Building(s).

The evaluation for the Reactor Building HVAC System showed that the MUR uprate would not increase the overall heat load for the Reactor Building, and also showed that the Reactor Building ambient temperature would be unaffected by the slight change (approx. 2°F increase) in Main Feedwater system temperature. Therefore, the temperatures used for EQ analysis of Reactor Building components at Oconee are unchanged.

The evaluation for the Auxiliary Building HVAC System showed that the 2°F increase in Main Feedwater system temperature due to the MUR uprate will not affect the heat loading in the penetration area of the feedwater piping where the HVAC is designed to maintain the overall temperature below 150°F. The evaluation also showed that the MUR uprate will not impact the HVAC in other areas of the Auxiliary Building at all. Note that the Main Steam system temperatures (at the SG outlet and at the Turbine throttle valve inlet) will decrease approximately 0.5°F, which provides a balance to the temperature increase for the Main Feedwater system. Therefore, the temperatures used for EQ analysis of Auxiliary Building components at Oconee are unchanged.

The Turbine Building at Oconee does not contain EQ equipment. Therefore, the MUR uprate has no impact on qualification analysis relative to the Turbine Building.

The potential impact of the MUR uprate on system temperature changes was evaluated as part of the MUR uprate engineering system reviews. The BOP systems review considered the Main Steam System, the Main Feedwater System, and other plant systems (such as Emergency Feedwater, Recirculating Cooling Water, Main Condenser, Auxiliary Service Water, High and Low Pressure Service Water, etc.). The EQ Evaluation considered potential system temperature changes for plant systems with EQ components (Main Steam and Main Feedwater). The other secondary-side systems evaluated do not contain EQ components, and were not further reviewed for EQ impact. The results of these evaluations showed that Main Feedwater process temperatures changed approximately 2°F (an increase at the inlet and outlet of the MFW pumps, and also at FW Heaters A and B), and that Main Steam process temperatures changed approximately 0.5°F (a decrease at the SG outlet and at the Main Steam throttle valve inlet). These slight parameter changes do not affect the qualification of any EQ components at Oconee because the temperatures have already been evaluated as not impacting the ambient temperatures of the Reactor and Auxiliary Buildings.

The NSSS systems review considered Oconee plant systems related to the Nuclear Steam Supply Systems, such as Reactor Building Spray, Component Cooling, Core Flood, High Pressure Injection, Low Pressure Injection, Reactor Coolant, etc. The review also evaluated instrument & control systems at Oconee, such as the Engineered Safety Features Actuation System, the Nuclear Instrumentation & Reactor Protection System, the Integrated Control System, etc. With respect to temperature, the evaluation showed that the RCS hot leg temperature increases approximately 0.4°F due to the MUR uprate. This slight temperature change was evaluated for environmental qualification impact, and was determined to have no impact on the qualification of EQ components. Overall, the evaluation concluded that there is no impact to system functions due to the MUR uprate. The evaluation of the I&C NSSS-related systems concluded that impact from the MUR uprate was negligible, with the exception of minor adjustments needed for Nuclear Instrumentation / Reactor Protection system algorithms, and procedural & administrative updates necessary to account for the increase in core thermal power due to the MUR uprate and also changes necessary to re-calibrate the Integrated Control System (ICS), which is a non-safety system and therefore not subject to EQ requirements. Therefore, the 0.4°F increase in the RCS hot leg temperature has no impact on the EQ Program at Oconee.

The potential impact of the MUR uprate on system pressures was evaluated as part of the BOP and NSSS reviews. The evaluations showed that the Main Steam and Main Feedwater system pressures decrease a slight amount due to the MUR uprate. The Main Steam throttle valve inlet pressure decreases by 0.3 psia and the final feedwater inlet pressure to the steam generators decreases by 8.3 psia. These changes were evaluated to have no impact on environmental qualification.

The potential impact of the MUR uprate on accident external pressures (high energy line break) and temperatures was addressed as part of the BOP evaluation. Overall, there were no constraints or open items identified as part of the HELB program review for the MUR uprate.

To summarize the evaluation of the temperature and pressure review (due to the MUR uprate), the BOP systems were determined to show some slight parameter changes, but these minor changes were shown to have no impact on the EQ components at Oconee. The evaluation of the NSSS-related systems for temperature and pressure showed that the current design basis analyses (for the pressure and temperature profiles, LOCA and other events) were performed at 102% of core thermal power, which bounds the MUR uprate. The RCS hot leg temperature increases approximately 0.4°F due to the MUR uprate, and RCS pressure is unchanged. There is no EQ impact with respect to temperature or pressure due to the MUR uprate.

Radiation:

The potential impact of the MUR uprate on radiation dose was addressed in the EQ evaluation. The evaluation considered EQ component irradiation test information and Oconee environmental criteria, and compared the postulated radiation levels (normal and accident values) with available test data. The evaluation also considered an additional 20 years of plant operation due to Oconee license renewal.

The radiation evaluation was performed with an assumed 2% dose increase (for both normal operation and accident conditions), considered for the full 60-year plant lifetime, to account for any increases in radiation dose within the plant due to the MUR power uprate. This assumption was determined to be conservative because the MUR uprate core thermal power increase is approximately 1.66%, and because the Oconee radiological analyses assume that 100% of the noble gases are released to the recirculating coolant. So, the comparison between postulated dose (total integrated dose, or TID) and EQ test values (irradiation test levels) was performed with conservative plant TIDs.

Some EQ components that were installed later in plant life were evaluated for their expected installed service lives (not the full 60 year period), because they are not subject to the full postulated 60-year TID. These instances are annotated in the evaluation.

For all the EQ components, either those with a qualified life of 40 years or greater or those that have qualified lives less than 40 years, the radiation evaluation showed the postulated 60-year dose (plus the 2% assumed dose increase to account for the MUR uprate) was enveloped by the irradiation test values, or the justified dose for the component's actual installed lifetime was enveloped by the irradiation test values, or the component itself was determined to be insensitive to radiation (i.e., comprised of an inorganic material). Therefore, the evaluation of EQ components for any radiation impact due to the MUR power uprate determined that qualification was unaffected.

With respect to numerical margin, the increase in TID due to the additional 20 years of plant operation from license renewal greatly exceeds any assumed dose increase due to the MUR. The smallest margin computed for any EQ component (between postulated and tested values), using the 60-year normal radiation dose and the 2% assumed increase due to the MUR, was 5.2% for the BIW cables in containment.

In addition, an evaluation was performed to determine if there were any EQ zones at Oconee that are currently classified as mild environments (with TIDs less than 1000 rads) which may be impacted by the 2% assumed dose increase due to the MUR uprate, and become harsh environments. No EQ zones were identified that will cross this threshold due to the MUR uprate. The EQ mild zones that were reviewed included the Control Room, the Electrical Equipment Room, and the Turbine Building. The Radwaste Building at Oconee was not evaluated because it does not contain any safety-related components and is not subject to EQ review.

Summary:

The EQ evaluation for the Oconee MUR uprate review demonstrated that the qualification of EQ components at Oconee is not affected by the MUR power uprate, and that temperature, pressure, and radiation parameters remain enveloped by the qualification documentation.

RAI-9

Provide a discussion on the auxiliary power requirements for the Cameron Flowmeter, such as DC or AC power requirements, and its loading impact, if any, on the associated safety-related or non-safety-related power systems.

Duke Energy Response to RAI-9

The Cameron Flowmeter power supply requirements are as follows:

Device	Power Requirement
Cameron Transmitter CheckPlus	120 VAC, 1Ø, 60 Hz 0.8 Amp Max
Cameron Computer Processing (CPU) Unit LEFM CheckPlus C	120 VAC, 1Ø, 60 Hz 1.3 Amps
Acopian 24EB10 Power Supply	120 VAC, 1Ø, 60 Hz 0.075 Amp Max

The Feedwater ultrasonic flow instrumentation is powered from two separate non safety-related power sources, one from Power panel 1KE and the other from Power panel 1KM. Identical numbers and types of equipment are on each power source as follows:

- (1) Cameron CPU - 1.3 Amps
- (2) Cameron Transmitters @ 0.8 Amps ea. - 1.6 Amps
- (1) Acopian instrument power supply - 0.075 Amps

Therefore, the total load on each source is 1.3 + 1.6 + 0.075 = 2.975 Amps. The Panelboards are fed from 208V MCC's which are fed from 112.5KVA transformers. The additional approximate 360VA load on each transformer is less than 0.5% of the transformer rating. The loads are being supplied from presently spare circuit breakers in each Panelboard. This small load addition to each Panelboard has negligible impact and is acceptable.

RAI-10

The staff notes that Enclosure 2 to "Summary of RIS 2002-03 Requested Information License Amendment Request No. 2011-02," Section VI.1.G, "Fire Protection Systems," states that

"...No Changes were made to the plant configuration or combustible loading as a result of implementation the MUR uprate that affect the ONC fire protection program. Additional building heat up will be minimal such that currently credited Appendix R manual actions and future NFPA 805 recovery actions will not be prevented from being accomplished within their required time..."

The staff requests the licensee to verify that (1) the measurement uncertainty recapture (MUR) power uprate will not require any change in procedures and resources necessary for systems required to achieve the nuclear safety performance criteria and are adequate for the MUR power uprate, and (2) require any new recovery actions to meet the nuclear safety performance criteria per National Fire Protection Association (NFPA) 805 licensing basis.

Duke Energy Response to RAI-10

1) There are no new procedure requirements as a result of MUR uprate that will change timing or resources necessary for NFPA-805. This is based on a review of vendor documents supporting the MUR uprate and site documents supporting the conversion from Appendix R to NFPA-805. The MUR uprate does not change any area temperatures or create issues for accessibility to components required for NFPA-805 credited safe shutdown. Based on the above there are no changes in procedures and resources necessary for systems required to achieve the nuclear safety performance criteria and are adequate for the MUR power uprate.
2) No new recovery actions are required to meet the nuclear safety performance criteria per National Fire Protection Association (NFPA) 805 licensing basis.

RAI-11

Some plants credit aspects of their fire protection system for other than fire protection activities, e.g., utilizing the fire water pumps and water supply as backup cooling or inventory for nonprimary reactor systems. If ONS Units 1, 2, and 3, credits its fire protection system in this way, the LAR should identify the specific situations and discuss to what extent, if any, the measurement uncertainty recapture uprate affect these "non-fire-protection" aspects of the plant fire protection system. If ONS Units 1, 2, and 3 do not take such credit, the staff requests that the licensee verify this as well. In your response discuss how any non-fire suppression use of fire protection water will impact the ability to meet the fire protection system design demands.

Duke Energy Response to RAI-11

The HPSW system is credited for supplying the fire headers for suppression and fire fighting activities. The required inventory to be supplied by this system has not changed as a result of MUR uprate. The existing flow calculations and design basis cover the maximum design flow required by the plant and is unchanged due to MUR uprate. The system design basis and supporting calculations account for and provide bypass flow data from the fire header to other systems. A site-specific calculation is being prepared to specifically address issues relating to NFPA-805 in regard to the supply of fire protection water from HPSW after the conversion to NFPA-805. The issues from this calculation are unaffected by the MUR uprate. The LPSW system is credited with supplying the fire headers during shutdown. Shutdown requirements are addressed as part of the Non Power Operation analysis. The design requirements for the LPSW system are not affected by and are not dependent on the MUR uprate.

RAI-12

The LAR states that core power level could be determined with a power measurement uncertainty of approximately ± 0.34%. However, the Caldon Ultrasonic Engineering Report ER-824 submitted as Attachment 6.2 of this LAR, shows that the power uncertainty using a LEFM CheckPlus system is ± 0.31%.

Attachment 6.7 of this LAR provides the Oconee's Secondary Power Uncertainty Analysis. In this attachment, Oconee calculated the uncertainty in the secondary side heat balance measurement of thermal power. Appendix G of Attachment 6.7 describes the calculation for the secondary power uncertainty using Cameron's LEFMs and the other new instrumentation strings. Appendix G shows that the secondary power uncertainty using LEFMs is ±0.34%. It is understood that the secondary calorimetric power calculation is used to determine plant power in the event of a loss of LEFM signal. In support of this request, please:

a. Explain why Duke is using the ±0.34% power uncertainty calculated for the secondary power side to determine the core power level, instead of the 0.31% reported in the Caldon Ultrasonic Engineering Report.

b. Appendix G, page 134 states: "This Appendix calculates the secondary power uncertainty using Cameron's LEFMs and the other new instrumentation strings." Please clarify what "the other new instrumentation strings" means. This LAR only considers the modification using the LEFM CheckPlus system.

c. Describe how the uncertainty using Cameron's LEFM CheckPlus was used to determine Oconee's Secondary Power Uncertainty Analysis reported in Attachment 6.7. In particular how the terms were grouped and show that tolerance limits for this calculation have been based on a statistically sufficient quantity of sample data to bound these values and provide a confidence that the interval contains 95 percent of the population.

Duke Energy Response to RAI-12a

The Caldon uncertainty considers only the feedwater temperature and flow rate uncertainties measured by the LEFM CheckPlus system. The secondary power heat balance additionally accounts for all the other uncertainties involved in the determination of reactor power. This includes the uncertainties due to changes in the feedwater pressure and main steam pressure and temperature measurements. The calculated results are higher when the additional instrumentation is included in the uncertainty. Consequently, Duke is using the higher value of ±0.34%.

Duke Energy Response to RAI-12b

Duke is installing new main steam pressure and temperature instrumentation strings. The overall heat balance uncertainty is calculated using these new strings. The new strings are independent of the MUR uprate and are added to provide increased measurement accuracy for those parameters.

Duke Energy Response to RAI-12c

Since the LEFMs are not installed yet, nor are the new instrument strings, there is no data available to provide trending or sampling. The heat balance uncertainty is a calculated value based on the Caldon calculation for the LEFM CheckPlus system and the vendor provided data for the feedwater pressure and main steam pressure and temperature strings. Caldon has provided justification in ER-813, ER-824, and ER-825 (Attachments 6.2, 6.3, and 6.4 of the LAR, respectively) that their calculation provides 95% confidence that the measured power will bound 95% of the measured data.

RAI-13

Section 4 of Enclosure 1 states that Duke Energy had evaluated the potential impact of pending/future LARs on the MUR evaluation (or vice versa), and that they were included in this LAR. The pending/future LARS identified are:

- Change to Reactor Vessel Inspection Plan,
- Tornado/High Energy Line Break
- Main Steam Isolation Valves
- Protected Service Water

The NRC staff plans to evaluate this proposed amendment to the TS to support a MUR. Please clarify what this sentence means.

Duke Energy Response to RAI-13

Duke Energy provided this clarification by letter dated November 21, 2011, in the response to an NRC request dated November 7, 2011. Refer to the explanation provided in Enclosures 1 and 2 of that letter.

RAI-14

Enclosure 2, Item I.1, requires the licensee to provide a description of the plant-specific implementation of the feedwater flow measurement technique. The information provided in the LAR does not describe the arrangement, the instrumentation in the complete system that would acquire the flow data and calculate the power level, or whether the LEFM would provide data to the plant process computer system for use in the calorimetric power algorithm. Also, describe how the data from the LEFM will be used (or not) if the plant computer fails. Provide a diagram that depicts functionally the instrumentation used to perform the secondary calorimetric; using either the feedwater flow venturi or the LEFM CheckPlus system.

Duke Energy Response to RAI-14

Attachment 1 of this enclosure provides two sketches outlining the Oconee approach for integrating the LEFM CheckPlus into the Core Thermal Power (CTP) measurement and control. Sketch 1 shows the conceptual interface between the Integrated Control System (ICS), LEFM CheckPlus, and Operator Aid Computer (OAC), and the generalized method for calibration of ICS related signals from LEFM signals within the OAC software. This sketch includes two "CORRECTION" blocks that are expanded in Sketch 2. For simplicity, these sketches are overviews of the general approach. Actual correction for FDW Flow is applied to six individual flow indications, three on each loop. Correction of FDW Temperature is applied to the average of three redundant sensors.

Not shown are corrections to FDW pressure which are applied in a manner similar to FDW Temperature. FDW pressure error has a very small effect on CTP and the correction scheme is excluded from the diagram for simplicity.

The ICS is shown only to indicate the particular inputs of Feedwater Flow and Temperature, and feedback of CTP from the OAC, out of several hundred ICS related data points fed to the OAC. The LEFM CheckPlus does not feed any signals directly to the ICS. The ICS response to LEFM CheckPlus failures occurs only as response to CTP information from the OAC.

The ICS produces its own calculation for CTP using signals that are selected from redundant sensors. Signal selection is done to prevent upsets due to instrument failure. Because of the use of selected signals (and because some small but important thermal influences are unknown to the ICS), the ICS calculation for CTP has higher uncertainty than the ASME calculation done in the OAC. Therefore, CTP data from the OAC is periodically transmitted to the ICS and is used to "calibrate" the ICS CTP signal. Because of the calibration the ICS will control thermal power precisely and accurately to the operator established CTP demand.

The ICS validates the CTP information from the OAC against its own internal CTP calculation. The two signals must agree within +/- 2% tolerance, and also the OAC signal must be received by the ICS in a timely manner, within 2 minutes of the previous update. If either criterion is not met, the ICS will reject the OAC CTP calculation and rely solely on its internal CTP calculation. It is recognized that the ICS, when relying on its internal CTP calculation, has the potential to operate over power due to greater uncertainty in its measurement. To prevent this, the ICS CTP value is deliberately adjusted to indicate 0.5% to 1.0% higher than the OAC at 100% power. Therefore, on rejection of the OAC reading, the ICS will see a higher power CTP, and the ICS will reduce actual power as a result. The conservatism and stability of the ICS CTP calculation is assured by weekly monitoring of the signals by Oconee personnel. The 2% tolerance for comparison was established as a reasonable means to detect catastrophic failure of the OAC internal calculations.

The interaction between the ICS and OAC for thermal power measurement and control is well established and proven technology that has been in service since 1997.

The interactions between signals provided by the ICS and LEFM are done within the OAC. The OAC uses the ICS signals primarily for internal calculations, but uses the LEFM to correct the ICS provided readings for accuracy. The ICS data is used as the primary input to CTP calculations because its update period is one second, whereas the LEFM update is every 5 seconds. The ICS data is therefore timelier for analysis.

CORRECTION METHODOLOGY

The correction of ICS signals is done using a first order lag function with time constant tentatively set to 15 minutes. The lag function is an ordinary first order linear low-pass filter. Both the flow signal and temperature signals are corrected the same way. Since the signals are corrected the same way, only the flow signal correction is described below.

The flow filter input is the difference of the LEFM CheckPlus flow signal and corresponding Venturi flow signal. The filtered difference is then added to the Venturi flow signal; this provides the continuous calibration against the LEFM CheckPlus signal.

There are three logical states for the correction algorithm. State 1 is normal operation as described above. State 2 is freeze. When this state is invoked, the correction lag output is input to itself, which freezes the signal to its last value. State 3 is zero, which applies a 0.0 value to the correction lag input, which smoothly removes the LEFM CheckPlus calibration correction from the Venturi flow signal. The "freeze" state will over-ride the normal correction and the "zero" state will over-ride both "freeze" and normal correction.

Because the correction is done using a lag function, the correction is always smoothly applied into and out of service. The time constant for the correction is set based on engineering judgment. The analysis balances competing optimization rules: the faster the time constant, the faster the response to stochastic errors in the venturi flow, but the greater the potential upset from large data failure. The slower the time constant, the greater is the long term precision, but slower the response to transient events affecting the venturi flow measurement. The period of 15 minutes was chosen by engineering judgment as a compromise between these two competing rules that assures that there will be negligible influence on the flow correction from a detection of gross error in the LEFM CheckPlus, prior to the LEFM CheckPlus being declared out-of-service, and there will be timely correction of flow errors for transient measurement events. This period is also supported by the demonstrated stability of the venturi flow signals.

OPERATION OF CTP INPUT SIGNALS WITHIN THE OAC

The Oconee approach to using the LEFM CheckPlus will use the existing CTP calculation methodology. The only revisions to the methodology are to employ more accurate measurement for determining Main Steam enthalpy, and to use LEFM CheckPlus to obtain greater accuracy in the existing Feedwater Flow and temperature measurements. The final thermal power measurement will be scaled to a new value of 2610 MWt representing 100% CTP. After scaling, the previous 100% thermal power of 2568 MWt is nominally represented as 98.39% RTP. The actual MWt value is always available to the operator.

The OAC calculates CTP using primary side and secondary side measurement signals. The secondary measurement signals are used solely above 50% RTP; therefore justification of operation at 100% RTP involves only secondary CTP measurement; only signals pertaining to the secondary side CTP measurement are shown on the block diagram (Sketch 1 and 2). Since Oconee produces superheated steam, Main Steam temperature and pressure are used to determine final steam enthalpy. Feedwater temperature and pressure are used to determine

Feedwater enthalpy. Total Secondary Thermal Power is the steam enthalpy minus Feedwater enthalpy, times the Feedwater mass flow rate. CTP is derived by subtracting the RC Pump thermal power from the total measured power, and adding in Let-Down thermal power and Heat Loss terms. The Make-Up thermal power is embedded in the Heat Loss term and is not explicitly calculated.

LEFM CheckPlus flow is used to correct the venturi flow signal over the full operating range. LEFM CheckPlus temperature is used to correct the FDW RTD signal above 350°F, which is achieved at powers greater than approximately 30% RTP.

When LEFM CheckPlus is declared Out-of-Service (OOS) for any reason, the LEFM CheckPlus correction signals are blocked. When operating greater than 2568 MWt, the correction signals will be in freeze for any LEFM CheckPlus OOS condition; simultaneously the flow signal will be multiplied by a scaling factor of 1.0004. Since Feedwater flow multiplies directly to thermal power, CTP indication will increase by 0.04%. When operating at or below 2568 MWt, the LEFM CheckPlus correction signals will be set to zero for any LEFM CheckPlus OOS condition. This action will cause the CTP calculation to revert to pre-uprate condition of no correction to Feedwater venturi flow and temperature.

RAI-15

Enclosure 2, Item I.1.D, Criterion 3 from ER-80P requires the licensee to confirm that the methodology used to calculate the uncertainty of the LEFM in comparison to the current feedwater instrumentation is based on accepted plant setpoint methodology. It is not clear if the response provided address the request of criterion 3. To support the NRC staff review, please clarify the following:

a. Confirm that the LEFM uncertainty calculation referenced in Oconee's response is the calculation provided in the Caldon Ultrasonic Engineering Report, Attachment 6.2 of this LAR.

b. Identify the calculation that Oconee uses to estimate the overall heat balance uncertainty using the LEFM CheckPlus system.

Duke Energy Response to RAI-15a

Attachment 6.2 of the MUR LAR is Caldon Report ER-813, Rev. 1, "Bounding Uncertainty Analysis for Thermal Power Determination at Oconee Unit 1 Using the LEFM CheckPlus System," October 2010. The uncertainty in thermal power calculated therein, ± 0.31% RTP, bounds the uncertainty calculated for Oconee Units 2 and 3 (Attachments 6.3 and 6.4 of the MUR LAR, respectively). The ± 0.31 %RTP LEFM uncertainty is indeed used in the calculation of the overall heat balance uncertainty. Due to a recent revision to this calculation (Caldon Report ER-813, Rev. 2, February 2012), the bounding uncertainty changed slightly to ± 0.30% RTP. Revision 2 of ER-813 and Revision 2 to ER-824 and ER-825 for Unit 2 and 3 respectively, are provided in Enclosure 3 of this response.

Duke Energy Response to RAI-15b

The overall heat balance uncertainty using the LEFM CheckPlus system is documented in Appendix G of OSC-3737 (Attachment 6.7 of the MUR LAR). OSC-3737 calculates uncertainty using the methodology documented in EDM-102 (Reference II.35 of the MUR LAR), which itself is based on ISA RP 67.04 (Reference I.19 of the MUR LAR). As documented in the response to Criterion 3 in the MUR LAR, Reference I.19 is the basis used in the calculation of the LEFM CheckPlus uncertainty. Therefore, both the LEFM uncertainty and the overall heat balance uncertainty, which uses the LEFM uncertainty as input, are calculated based on the same method. OSC-3737 has been revised as a result of changes to the Caldon reports. Revision 10 to OSC-3737 is provided in Enclosure 3.

RAI-16

Enclosure 2, Item I.1.D, Criterion 1 from ER-157P requires the licensee to justify continued operation at the pre-failure power level for a pre-determined time and the decrease in power that must occur following that time. The response provided in the LAR states that an engineering evaluation was performed to justify an allowed outage time upon loss of the LEFM signal.

Also, the response provided for this criterion states that the analysis performed established a bounding uncertainty of 0.037% RTP, rounded to 0.04% RTP, over a 7-day period for Oconee Unit 3 at operating levels above 90% RTP. This result would allow Oconee to maintain the new power level for up to 7 days. Please note that the NRC staff position in approved MUR has been to allow licensees to maintain the new power level for up to 72 hours when the LEFM failed. Thus, provide a justification for determining the allowed outage time (AOT) of the LEFM to be for a 7-day period. In particular, how Duke Energy determined that using the last acceptable LEFM calorimetric power calculation with the additional bias is acceptable to maintain the new power level for up to 7 days.

Duke Energy Response to RAI-16

The Oconee ICS is designed to precisely control Core Thermal Power against an operator selected CTP Setpoint. The control action of the ICS is such that stability and accuracy of actual CTP is predicated on stability and accuracy of the CTP measurement. Continuous calibration of the venturi flow and temperature measurements against the LEFM elevates the accuracy of these measurements to that of the LEFM. Because a lag function is employed in each correction factor, the factors are the result of data averaging; therefore the factors represent a statistically valid correction for signals that may include some inherent noise and exhibit normal distribution. The question of 7-day accuracy of the CTP measurement then becomes a question of the stability of the venturi measurement and temperature signals when the correction factors are frozen. The Duke Energy approach to this problem is to discover the actual bounding drift that may occur in the venturi flow in a 10-day period ascertained from empirical data, and use that data as a basis to assert a 7-day allowance period, with a bias correction accounting for the additional uncertainty due to potential drift. Three units' data were available; the bounding drift is asserted as the worst case for all units. For further details please see the response to question 16g, below.

RAI-16a

Also, in support of this request, please provide information on the following:

a. Please provide a description of what level of Cameron LEFM CheckPlus degradation or system alert would render the Cameron LEFM CheckPlus to be declared non-operational at Oconee. Describe how will the degraded status of the LEFM CheckPlus will be determined.

Duke Energy Response to RAI-16a

Oconee's approach is to make no distinction between "failed" and "degraded" conditions of LEFM, for purposes of continued operation. Therefore, the entry into SLC will be made for any condition of LEFM where it is NOT "normal". For this reason Duke has established and justified a reasonable Completion Time to restore the LEFM to allow thorough analysis of any problem, followed by comprehensive repair.

The determination of degraded status is from information provided by the LEFM CheckPlus system.

The OAC will also perform additional monitoring routines that will validate the LEFM CheckPlus signals. These include (but are not limited to): data update rates, data quality checks, and redundant data comparisons (between LEFM CheckPlus processors A and B).

RAI-16b

b. If the power level is below the Current Licensed Thermal Power at the time the Cameron LEFM CheckPlus is declared non-operational or if the power level drops below the Current Licensed Thermal Power during the AOT, describe what administrative control will be used to assure that power won't be raised above the Current Licensed Thermal Power prior to the Cameron LEFM CheckPlus becoming operational.

Duke Energy Response to RAI-16b

All power demand manipulations are controlled by the Control Room Operator by procedure.

Operations procedures currently address the issue of inadvertent power overshoot during power escalation by stopping power escalation below 100% setting and allowing sufficient settling time for dynamic control errors prior to increasing to 100%.

Escalation of power to 100% will not be allowed if the LEFM is not in service. This restriction will be controlled by SLC and procedure.

While in the SLC Condition B for a non-functional LEFM, no power maneuvering will be allowed that would return the unit to 100% power from a power decrease. Any power decrease that occurs while in the SLC Condition will not be recovered to 100%. This restriction will be controlled by SLC which will require suspending operations involving increasing thermal power above 2568 MWt when the LEFM is not functional.

RAI-16c

c. Please clarify the use of the bounding uncertainty of 0.04% RTP when the LEFM failed. Is this a bias or a correction factor for the venturi flowmeter?

Duke Energy Response to RAI-16c

The 0.04% RTP uncertainty is added to the feedwater flow signal as a scaling factor bias that will cause the flow to read high. The factor is added to a scaling term such that, during 7-day Completion Time for a nonfunctional LEFM, the resulting FDW flow indication will be 1.0004 times the previous (normal corrected) reading. This flow signal will result in an increase in CTP indication of 0.04%. This increased CTP data is fed from the OAC to the ICS in the normal manner, which due to control action of the ICS will cause actual plant power to decrease by that same factor. Use of this bias term accounts for all of the increased uncertainty that exists in the FDW Venturi flow measurement for the AOT period, such that operation at or below RTP is assured over that period.

RAI-16d

d. Please identify the engineering evaluation performed and provide a copy of this evaluation, as well as a summary of the data collected with its references (e.g., fouling, drift, etc.) to determine the bounding uncertainty of 0.04% RTP.

Duke Energy Response to RAI-16d

The methodology and goals of the FDW flow drift evaluation are documented in the ER-932 report. Basically, comparison was made between CTP Secondary and a "truth" variable based on Turbine First Stage Pressure. This particular variable was chosen for comparison because it is simple, it is inherently linear with steam flow and therefore power, and it is independent of all other CTP measurements. Any drift associated with First Stage Pressure is indistinguishable from drift in CTP itself; therefore, drift calculations based on this term are bounding for drift in Secondary CTP.

The drift calculations were made for deviation between Secondary CTP and the "truth" value existing at the start of any particular test run, and compared to subsequent deviations at 3-day, 7-day, and 10-day intervals. Data were evaluated for ten-day period to bound the 7-day Completion Time. Data were evaluated only during steady state operation above 90% RTP. The evaluation period employed data covering one year of recent operation for all three Oconee units.

Results from the data evaluation demonstrate that for any arbitrary ten-day period, total CTP drift did not exceed +/-0.037% beyond any 3-day drift. Also demonstrated was that for any arbitrary ten-day period, the overall drift was random. The unit exhibiting the largest drift was Unit 3. The Unit 3 drift data were used to establish a conservative drift uncertainty of Secondary CTP of 0.04% for seven days.

RAI-16.e

e. This section states that if the LEFM cannot be restored within 7 days and the power level, overpower trip setpoint and flux/flow trip setpoint cannot be reduced within 6 hours, then the unit shall be placed in Mode 3. Provide a justification for placing the unit in Mode 3 when the conditions described before are presented.

Duke Energy Response to RAI-16e

The analytical limit in the safety analyses accounts for two different uncertainty terms. One is the core thermal power measurement uncertainty in which Feedwater flow measurement is the most significant contributor. The other uncertainty term is associated with the Power Range Nuclear Instrumentation (NI). Guidance exists in plant operating procedures that does not allow NI indications to be greater than 2% non-conservative during unit operation. Both the NI uncertainty and heat balance uncertainty are accounted for in the analytical limit in the safety analyses. When the LEFM is functional the Feedwater flow measurement uncertainty is 0.34%, which is what the current analytical limits are based on, and when the LEFM is nonfunctional this uncertainty eventually increases back towards 2%. This increase in Feedwater flow measurement uncertainty, when the LEFM is nonfunctional, is not bounded by the analytical limit in the safety analyses. Therefore the high flux trip and the flux/flow/imbalance trip setpoints have to be reduced to maintain the analytical limit.

The SLC will require all 4 channels of these Functions to be declared inoperable since the required allowable value has not been adjusted as required by proposed Note f of TS Table 3.3.1-1. The mode of applicability for these functions is Mode 1 and 2 (when not in shutdown bypass operation) so entry into TS 3.3.1 Condition B will be required. TS 3.3.1 Required Action B.1 directs entry into Condition C. Required Action C.1 and C.2 requires the affected Unit be placed in Mode 3 within 12 hours and the CRD Trip Breakers to be opened within 12 hours.

RAI-16f

f. Please provide mark up of the TS pages where the requirements for the operators to perform the following activities will be located:

   i. Calorimetric calculations when the LEFM CheckPlus system failed,

   ii. After LEFM signal is not available after 7 days, then within 6 hours the unit will be reduced to no more than 2568 MWt (the previously licensed rated thermal power), the overpower trip setpoint will be reduced, and the flux/flow trip setpoints will be adjusted as specified in the Core Operating Limits Report, and

   iii. If the power level, overpower trip setpoint and flux/flow trip setpoint cannot be reduced within six hours, then the unit shall be placed in Mode 3 within the next 6 hours.

Duke Energy Response to RAI-16f

(i.)
For the ONS application, the LEFM CheckPlus system does not directly affect the calorimetric calculations so there is no requirement to re-perform. LEFM CheckPlus flow is used to correct the venturi flow signal over the full operating range. LEFM CheckPlus temperature is used to

correct the FDW RTD signal above 350°F, which is achieved at powers greater than approximately 30% RTP.

When LEFM CheckPlus is declared Out-of-Service (OOS) for any reason, the LEFM CheckPlus correction signals are blocked. When operating greater than 2568 MWt, the correction signals will be in freeze for any LEFM CheckPlus OOS condition; simultaneously the flow signal will be multiplied by a scaling factor of 1.0004. Since Feedwater flow multiplies directly to thermal power, CTP indication will increase by 0.04%. When operating at or below 2568 MWt, the LEFM CheckPlus correction signals will be set to zero for any LEFM CheckPlus OOS condition. This action will cause the CTP calculation to revert to pre-uprate condition of no correction to Feedwater venturi flow and temperature.

(ii., iii.)
These requirements will be addressed by a Selected License Commitment (SLC) as stated in the LAR. A copy of the draft SLC is provided in Attachment 3 to this enclosure for information only. This SLC is being developed and processed in accordance with Duke Energy procedures for SLC manual changes. Duke Energy has decided to require that the setpoints be changed or the power be reduced to no more than 2568 MWt within 7 days rather than allowing an additional 6 hours after the 7 day Completion Time allowed to restore the LEFM. If not met, the SLC will direct the operator to declare all 4 channels of the Nuclear Overpower Trip and Nuclear Overpower Flux/Flow Imbalance Trip Functions inoperable and take the appropriate action of TS 3.3.1 for that function. TS 3.3.1 Condition B is applicable and must be entered since two or more channels are inoperable. TS 3.3.1 Required Action B.1 requires that the Condition referenced from TS Table 3.3.1-1 for that function to be entered. Condition C is applicable to the Nuclear Overpower Trip and Nuclear Overpower Flux/Flow Imbalance Trip Functions. Required Action C.1 requires the affected Unit be placed in MODE 3 in 12 hours and all CRD Trip Breakers to be opened within 12 hours. This is slightly more restrictive in that the Nuclear Overpower Trip and Nuclear Overpower Flux/Flow Imbalance Trip setpoints must be reduced 6 hours earlier than previously proposed. However the 12 hour time period to place the affected Unit in MODE 3 is the same (i.e., the six hours previously proposed to reduce the setpoint plus the six hours previously proposed to place the Unit in MODE 3).

RAI-16g

g. The LAR states: "This (bounding) uncertainty has a 95% statistical probability at a 95% confidence level. The analysis demonstrates that the drift is random and not uni-directional." Provide data to show that tolerance limits for this calculation have been based on a statistically sufficient quantity of sample data to bound these values and provide a confidence that the interval contains 95% of the population.

Duke Energy Response to RAI-16g

The drift limit is based on the worst-case analysis of drift from data evaluated for each Oconee unit. Data from Unit 3 demonstrated the largest drift, which was obtained using a validated data set population of 4,561 data points. The confidence level of this data set is 98.5%. The bounding probability of 95% is obtained by evaluating 2 times the standard deviation of the drift data. The drift data distributions are normal as demonstrated in Appendix 1A, 2A, and 3A of the ER-932 report. This report has been placed on a Duke Energy Share Point site and is available for NRC review.

In the determination of the 7 day Completion Time for a nonfunctional LEFM, the objective is to maintain reactor power above the previously licensed 100% RTP. Towards that end, unless there were intentional reactor power changes, and then only rapid changes, the data included all power levels above 90% power. This inclusion of data above 90% ensures that the point of interest above the existing 100% power level, or 98% considering the existing 2% power measurement uncertainty, is included in the evaluation. Validation of the test data set includes determination that the Turbine First Stage Pressure ("truth") was not significantly influenced by variations in Auxiliary Steam flow which siphons steam away from the turbine and is an upset to the First Stage Pressure signal.

As described in the report, the 7-day drift allowance is based on the worst-case increase in drift probability of 10-day drift data compared to 3-day drift data. This worst-case increase is in the order of 0.04%.

The data distributions are based on evaluation of the instant 15-minute values of the data set. The thermal power measurements are based on precisely archived 10-minute averages of data and exhibit small variance in the order of 0.05%. The typical 1-hour control capability of the ICS is in the order of 0.01%. The typical shift average (12-hour) control capability is in the order of 0.001%. These small numbers are achieved because the ICS mathematically integrates the CTP error.

The uncertainty distribution in the comparison data is most certainly due to variation in the Turbine First Stage Pressure ("truth") signal which is not time averaged, but is based on archived data compressed from "instant" values. The data are exact values for the archived time stamp, but the data compression algorithm introduces additional uncertainty in the intermediate values. This additional uncertainty is conservative for purposes of determining maximum 10-day drift because the compression algorithm tends to capture peak values and therefore give additional weight to error terms based on the interpolated calculated values.

Since inherent drift in the "truth" variable is indistinguishable from drift in Secondary CTP, drift calculations based on this variable are conservative.

Additional validation of the conservatism of the drift results is confirmed by the magnitude of the mean of the 10-day drift data, which in all cases is less than 0.04%.

RAI-17a

Enclosure 2, Item II.1D, describes the calculation of the Reactor Protection System Trip Function Allowable Values (AVs) for the high flux trip setpoint following the power uprate. To support the NRC staff review, please provide the following information:

a. This section states that the current safety analysis setpoint method is described in Chapter 4 of DPC-NE-3005-PA, Revision 3b, "Oconee Nuclear Station UFSAR Chapter 15 Transient Analysis Methodology." Please provide a copy of the method used to determine the high flux trip setpoint AV.

Duke Energy Response to RAI-17a

A copy of Chapter 4 of DPC-NE-3005-PA is provided via a Duke Energy Share Point and is available for NRC review. To summarize Chapter 4 of DPC-NE-3005-PA, the safety analyses assume the RPS trip setpoints are the Technical Specification allowable values given in Technical Specification Table 3.3.1-1. The safety analyses then error adjust the signal being compared to the setpoint such that conservatism is introduced in the parameter(s) actuating reactor trip.

RAI-17b

b. The high flux trip setpoint AV is currently 105.5% of 2568 MWt (2709.2 MWt). The high flux trip setpoint assumed in the safety analyses was increased to 107.5% of 2568 (2760.6 MWt).

   Following the uprate, the 105.5% setpoint will be retained such that the new Technical Specification AV will be 105.5% of 2610 (2753.6 MWt). Following NRC approval of the MUR, Duke Energy intends to use the proposed trip setpoint (2753.6 MWt) whenever a particular analysis is revised. Please clarify if Duke Energy intends to use the proposed trip setpoint of 2753.6 MWt for revising safety analysis. If this is the case, how Duke Energy justify using this value, which does not leave any extra margin for reactor trip on high flux.

Duke Energy Response to RAI-17b

The safety analyses documented in Chapter 15 of the UFSAR all assume the initial reactor power was 102% of 2568 MWt and the high flux trip setpoint was increased by the same magnitude, from 105.5% of 2568 MWt to 107.5% of 2568 MWt. This was done because the exact magnitude of the uprate was unknown when the analyses were performed. The actual magnitude of the uprate is 1.66% and consequently, the magnitude of the high flux trip setpoint currently credited in the UFSAR analyses is higher than what it will be following the uprate. Duke intends to capture that margin in any analysis that is redone by reducing the magnitude of the high flux trip setpoint to that allowed by the Technical Specifications. Margin is incorporated as described in Chapter 4 of DPC-NE-3005-PA.

RAI-17c

c. This section describes the proposed setpoint for the new high flux trip AV for 3 Reactor Coolant Pumps (RCPs). This description states that the proposed setpoint maintains the 4 RCP difference between rated thermal power and the high flux trip setpoint, i.e., 5.5% RTP. The proposed setpoint was determined to be 79.3% of 2610 MWt, or 2069.7 To calculate this value, Oconee used the MWt for the current operation with 3 RCPs – the current nominal power level is 75% of 2568 MWt, which will become 73.8% of 2610 MWt, or 1926 MWt. Then adding 5.5% to 73.8% yields the proposed setpoint of 79.3%. It is not clear why 5.5% RTP is added to the setpoint for the high flux trip AV for 3 RCPs. Further, Enclosure 2 Item II.1D, item 6a, "Loss of coolant flow – flow coastdown," states: "the maximum allowed operating power for 3RCPs (Technical Specification 3.4.4) will remain at 1926 MWt (now 73.8% RTP if 2610 MWt)." Please explain why Oconee is adding 5.5% to determine the new setpoint for the high flux trip AV for 3 RCPs.

Duke Energy Response to RAI-17c

The difference between 100 % RTP and the high flux trip setpoint allowable value when operating with 4 RCPs is 5.5%. For simplicity, the same 5.5% difference is applied when operating with 3 RCPs. The proposed maximum allowed power level for 3 RCP operation is 73.8% of 2610 MWt per Technical Specification 3.4.4. Thus, the proposed high flux trip setpoint allowable value for when 3 RCPs are operating is set 5.5% higher than 73.8%, or at 79.3 %RTP.

RAI-17d

d. This section states that if the LEFM is out of service for longer than 7 days, the high flux trip setpoint is returned to the pre-MUR uprate value of 2709.2 MWt (103.8% of 2610 MWt). According to the response provided in Enclosure 2, Item I.1.D, Criterion 1 from ER-157P, if the LEFM is out of service the unit will decrease power to the pre-MUR licensed thermal power level of 2568 MWt, so Oconee should not reference the MUR uprate value when the LEFM is out of service for longer than the Selected Licensee Commitment (SLC) allowance.

Duke Energy Response to RAI-17d
When the LEFM is operating normally at 100 %RTP, the high flux trip setpoint allowable value is set at 105.5 % RTP. If the LEFM is out of service for longer than the allowed time (proposed 7 days), then both reactor power and the high flux trip setpoint are reduced by the magnitude of the MUR uprate, or 1.7%. This preserves the initial margin to the high flux trip and also maintains the fidelity of the safety analyses (i.e., does not invalidate the safety analyses).

RAI-17e

e. Please clarify how Duke Energy calculated the setpoint for 3 RCPs in operation when the LEFM is out of service for longer than the SLC allowance. Technical Specification 3.4.4 states that power should be reduced to 75% RTP when 3 RCPs are in operation.

Duke Energy Response to RAI-17e

Similar to the high flux trip setpoint allowable value for 4 RCP operation, the 3 RCP trip setpoint allowable value will be reduced by the magnitude of the MUR uprate, or 1.7%, when the LEFM is out of service longer than the allowed time. The proposed allowable value when the LEFM is in service is 79.3 %RTP. The proposed allowable value when the LEFM is out of service is 1.7% less than that, or 77.6 %RTP.

RAI-18

Enclosure 2 Item VIII.1.B states that the Flux-Flow Imbalance setpoints were reviewed based on the increased power level, and it was determined that the Flux-Flow Imbalance envelope could remain unchanged. Section 3 of Enclosure describes proposed changes to accommodate the

MUR. This section does not describe the review performed by Oconee to determine that the Flux-Flow Imbalance envelope could remain unchanged. Please describe how these setpoints were reviewed, and how it was determined that its envelope can remain unchanged.

Duke Energy Response to RAI-18

When the UFSAR Chapter 15 safety analyses were performed for the MUR uprate, the flux-flow-imbalance envelope was not adjusted for the increase in power. They are the same setpoints as are currently installed in the RPS. Since acceptable results are obtained and the setpoints were not changed, the review described in Enclosure 2, Item VIII.1.B simply concluded they were acceptable at the current values. However, since the setpoints are documented in the COLR, they can change on a cycle specific basis.

RAI-19

The measurement uncertainty recapture (MUR) uprate can have an adverse affect on steam generator (SG) tube vibration and wear rates due to the changes in temperature, pressure and flow associated with the uprate. In section IV.1.F of the letter dated September 20, 2011, the licensee stated that the effects of the MUR on the axial flow induced vibration, and subsequently on tube wear rate, tube plugging and life expectancy, will be insignificant based on the results of an experimental program.

Please provide a description and the results of the experimental program that was used to determine that the effects of the MUR on axial flow induced vibration would be insignificant.

Response to RAI-19

An experimental program was undertaken to investigate axial flow induced vibration for Oconee replacement once through steam generators (ROTSGs) using a multi span test rig having the same tube support configuration as the Oconee ROTSGs with a single tube subject to axial flow (in pressurized air). The test results allowed the relationship between axial flow velocity and tube vibration response to be determined for various axial flow rates. The MUR uprate results in an increased axial velocity and is bounded by a 2.75% increase beyond the 12 meters per second, which is hydraulically equivalent to current 100% rated thermal power. This 2.75% increase in axial velocity would result in a 0.43% increase in the maximum tube vibration response. This increase is considered to be statistically insignificant and within the accuracy of the test results. It was concluded that the MUR uprate will have an insignificant effect on axial flow induced vibration and consequently will have an insignificant effect on ROTSG tube wear rate, tube plugging and life expectancy.

RAI-20

Specify which adjusted reference temperature (ART) values and materials were limiting pre-uprate for the purposes of heatup and cooldown pressure-temperature limit curves; and how these ART values would be impacted by the uprate.

Duke Energy Response to RAI-20

For each of the three Oconee Units, the materials with associated ART values for pre-uprate and uprate conditions that were considered limiting for heatup and cooldown limit curves are provided in the table below. The same materials are limiting for both the pre-uprate and the uprate conditions. As reflected in the table, the ART values of the limiting materials were in general always lower for the uprate condition compared to the pre-uprate condition. The only exception is the ART value for Oconee Unit 3 at the 3/4 T location for AWS 192. At this location, the ART value was 0.1°F greater for the post-uprate condition than for the pre-uprate condition. It was determined that the 0.1°F increase on this material and location did not affect the previously calculated pre-uprate P-T limit curves as discussed in ONS MUR LAR section IV.I.C.iii.

RAI-21

Specify whether different ART values and materials would be limiting for the purposes of heatup and cooldown press-temperature limit curves post-uprate; and how these ART values would change due to the uprate.

Duke Energy Response to RAI-21

As shown in the table below, the same materials, pre- and post-uprate, are limiting with respect to 1/4 T and 3/4 T ART values and are used for the calculations of the P-T curves for the three Oconee Units. For detailed discussions with regard to ART values for pre and post uprate conditions, refer to response to RAI 20 above. Therefore, based on the above, the pre-uprate P-T limit curves remain valid for post-uprate conditions.

RAI-22

Report the limiting ART values for the purposes of heatup and cooldown pressure-temperature limit curves taking into consideration the 48 EFPY fluence projections for the end of the license renewal period with MUR conditions; and report whether this would impact the current heatup and cooldown press-temperature limit curves.

Duke Energy Response to RAI-22

The current heatup and cooldown pressure-temperature limit curves are valid only through 33 EFPY. As discussed in responses to questions 20 and 21, these P-T limit curves are demonstrated to remain valid through 33 EFPY post-uprate conditions. The pressure-temperature limit curves for the end of the license renewal period with MUR conditions are currently under development for the three Oconee Units and will be implemented prior to expiration of 33 EFPY pressure-temperature limit curves.

Table for RAI 20 & 21 Responses
Pre-MUR and Post-MUR ART Values
for Limiting Materials for 33 EFPY P-T Limit Curves

Oconee Unit 1				
Vessel Component	Wall Location	Limiting Material	Pre-MUR ART (°F)	Post-MUR ART (°F)
Beltline	¼t	SA-1073	191.3	188.9
Axial Weld	¾t	SA-1073	148.5	146.5
Beltline	¼t	SA-1229	203.1	200.5
Circ. Weld	¾t	WF-25	188.0	182.3
Nozzle Belt	¼t	AHR 54	108.1	106.8
Base Metal	¾t	AHR 54	86.8	86.0
Oconee Unit 2				
Vessel Component	Wall Location	Limiting Material	Pre-MUR ART (°F)	Post-MUR ART (°F)
Beltline	¼t	AAW 163	63.5	63.1
Base Metal	¾t	AAW 163	49.8	49.5
Beltline	¼t	WF-25	248.4	243.4
Circ. Weld	¾t	WF-25	189.6	185.7
Nozzle Belt	¼t	AMX 77	151.2	149.8
Base Metal	¾t	AMX 77	126.4	125.2
Oconee Unit 3				
Vessel Component	Wall Location	Limiting Material	Pre-MUR ART (°F)	Post-MUR ART (°F)
Beltline	¼t	AAW 192	113.5	103.6
Base Metal	¾t	AAW 192	94.0	94.1
Beltline	¼t	WF-67	211.7	209.3
Circ. Weld	¾t	WF-67	164.5	162.4
Nozzle Belt	¼t	4680	151.1	149.8
Base Metal	¾t	4680	126.1	125.0

RAI-23

Confirm that under MUR conditions the assumptions within BAW-2275, "Low Upper-Shelf Toughness Fracture Mechanics Analysis of B&W Designed Reactor Vessels for 48 EFPY," are still bounding for Oconee units and consistent with the NRC SE for BAW-2275 found in Appendix B of BAW-2251. Confirmation is expected to include the quotation of relevant passages from BAW-2275 and BAW-2251, the property ranges covered in those documents that would be influenced by the uprate, and the minimum acceptable Oconee USE values defined in those documents for each unit.

Duke Energy Response to RAI-23

The fluence values for all the welds at the 1/4T projected locations for 48EFPY with MUR Power Uprate is found to be lower or the same than the fluence values at the 1/4T without MUR PU. The only exception is the SA-1585 weld of ONS-1, for which the fluence increased slightly from 0.722 x 10^{-19} n/cm^2 to 0.725 x 10^{-19} n/cm^2. This weld was evaluated and it was confirmed that this marginal increase in fluence does not change the calculated J_1 and thus the margin of 3.85 (=$J_{0.1}/J_1$) as previously calculated remains the same. Thus, the calculated $J_{0.1}/J_1$ margins or equivalent margins of the welds; SA-1229, SA-1585, SA-1430 in ONS-1 and WF-25 in ONS-2 and WF-67 in ONS-3 remain bounding after MUR Power Uprate. Hence, the equivalent margins previously calculated remain bounding even after the MUR Power Uprate of ONS Units 1, 2 and 3. The current License Renewal Application (LRA) of ONS Units 1, 2, and 3 are based on the Topical Report BAW-2275A found in BAW-2251A.

Note that, per the Safety Evaluation Report (SER) of BAW-2275A, the NRC reviewed the best-estimate chemistry reported in BAW-2251A and stated the following "The Staff has examined the recent best-estimate chemistry based on total population and coil-to-coil classification by Framatome, and determined that the maximum increase in best-estimate copper due to this revision is 0.01% for B&W fabricated welds. According to the chemistry table of Regulatory Guide (RG) 1.99 Revision 2, this small increase in best-estimate copper would only slightly reduce the fracture toughness."

In BAW-2251A, the NRC also observed the following about the B&WOG's J_d model "The staff performed an extensive study, as documented in Reference B.3, and concluded that when the 1/4T fluence exceeds 10^{19} n/cm^2 (E>1 MeV), the B&WOG's J_d model is less conservative than the Eason model. After examining the 1/4T fluence data for all Linde 80 welds from the five RPVs in the current topical report, the staff found that the fluence for the most limiting weld, SA-1526 at 48 EFPY is 0.655 x 10^{19} n/cm^2. At this fluence value, the staff has determined, based on the conclusions documented in Reference B.3, the B&WOG's J_d model is either equivalent or more conservative than the Eason model. Hence, using the B&WOG's J_d model in this application is appropriate." As mentioned earlier, the fluence value for 48 EFPY with MUR PU is either nearly the same or lower, hence the above observation remains valid. Also note the limiting weld (SA-1526) among the welds analyzed in BAW-2251A is not a RV weld of any of the Oconee Units The Cu content of the limiting ONS unit weld (SA-1430) is only 0.21% compared to the 0.35% Cu content of SA-1526 (limiting weld analyzed in BAW-2251A). Also the 60 year fluence value of SA-1430 (0.614 x 10^{-19} n/cm^2) with MUR is less than that of SA-1526 (0.655 x 10^{-19} n/cm^2) analyzed in BAW-2251. As discussed above, the equivalent margins analysis for the B&WOG Linde 80 welds are based on the BWOG-J_d model that was developed based on all the Linde 80 welds of the B&W fabricated plants, and as such, are not based on minimum acceptable USE values.

RAI-24

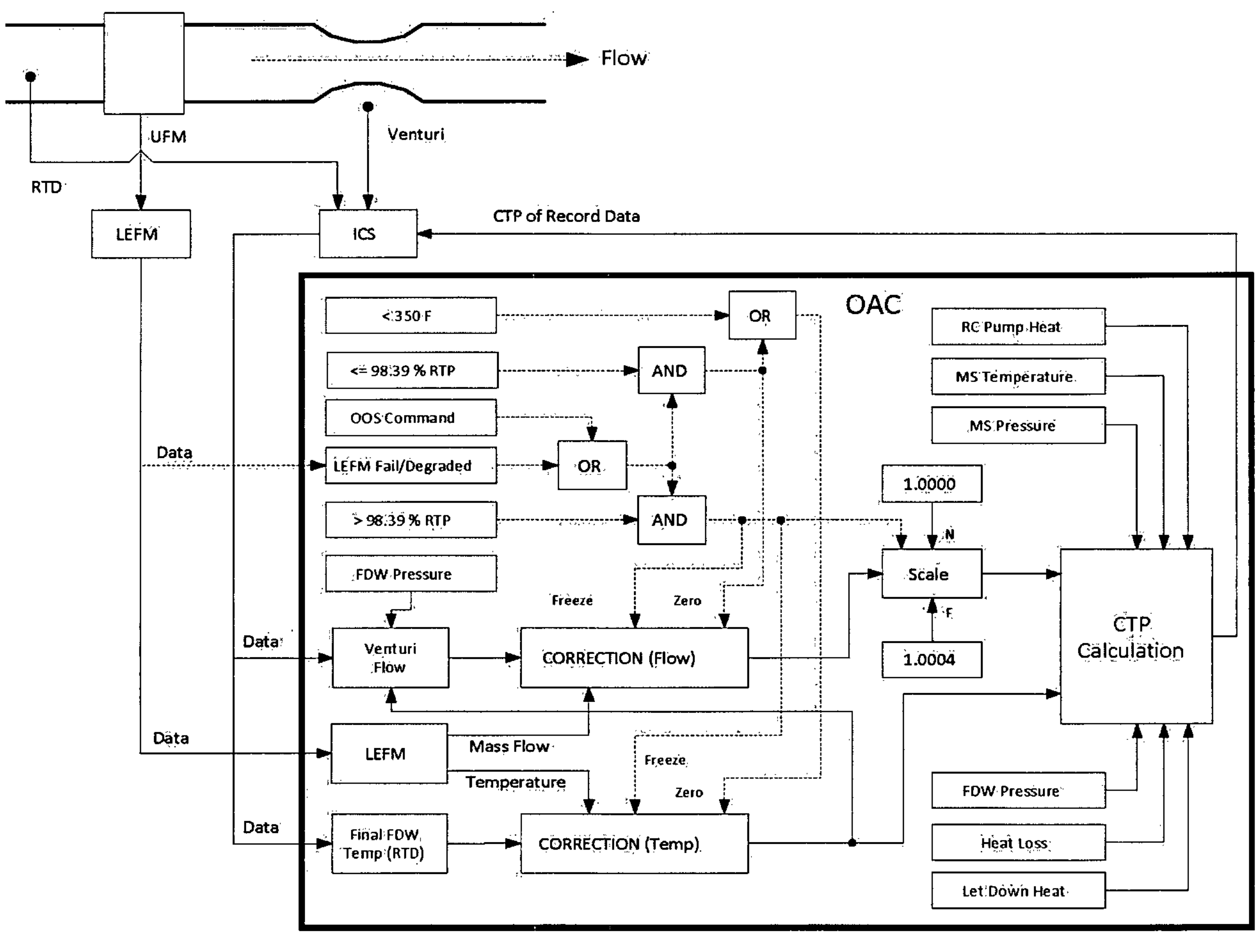
In Section VII.I of the LAR, credit is taken for "approved plant procedures" and processes such as the "modification process". Please summarize or provide copies of the procedures and processes that are used to develop or change human factors interfaces, such as procedures, training, or physical changes to the control/display interfaces, and procedures that address verification and validation of operator actions and interfaces. Include specific references by Procedure Number and Title.

Duke Energy Response to RAI-24

Engineering Directive Manual (EDM) 601, Engineering Change Manual, Step 601.5.2.4.2 requires the design engineer to perform a review of the modification against the criteria in Appendix K, Engineering Review Screen for Design Changes. The appendix requires the design engineer to review the modification for human factors issues in subsection 5.4 of the appendix. When the review determines that human factors are impacted, the engineer is then required to process the modification per the requirements contained in Engineering Manual (EM) 4.17, Human Factors Engineering Procedure. EM 4.17 requires design analysis, operating experience review, functional requirements analysis, task analysis, and failure modes and effects analysis. Once these activities are completed, EM 4.17 then requires that the task analyses be used to develop the human-system interface (HSI) design, determine the effect on procedures, and the effects on Operations training and licensing. After completion of the HSI, EM 4.17 then requires verification of the HSI. Once verification is complete, EM 4.17 in conjunction with Nuclear System Directive (NSD) 408, Testing, then requires a final validation of the HSI. This validation is conducted with the operating procedures identified and prepared for the modification per the requirements of NSD 301, Engineering Change Program.

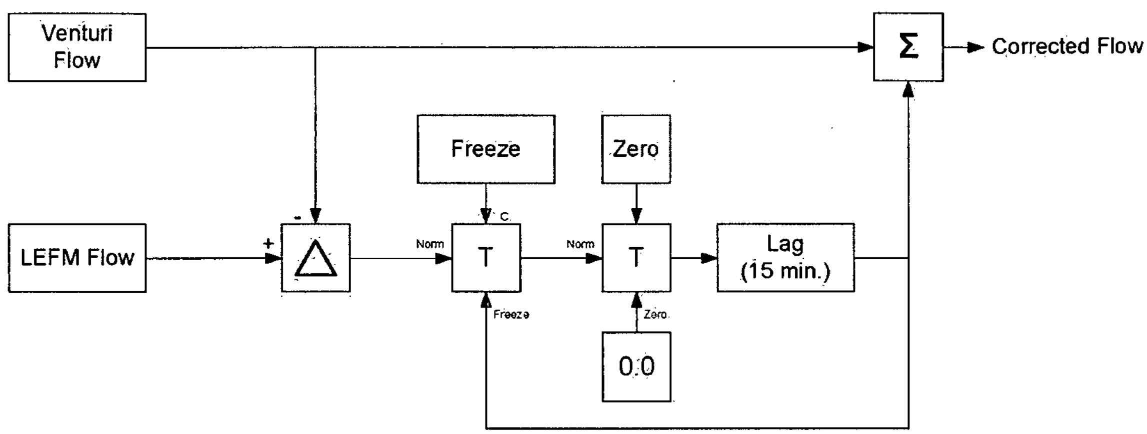
Attachment 1
Sketch 1

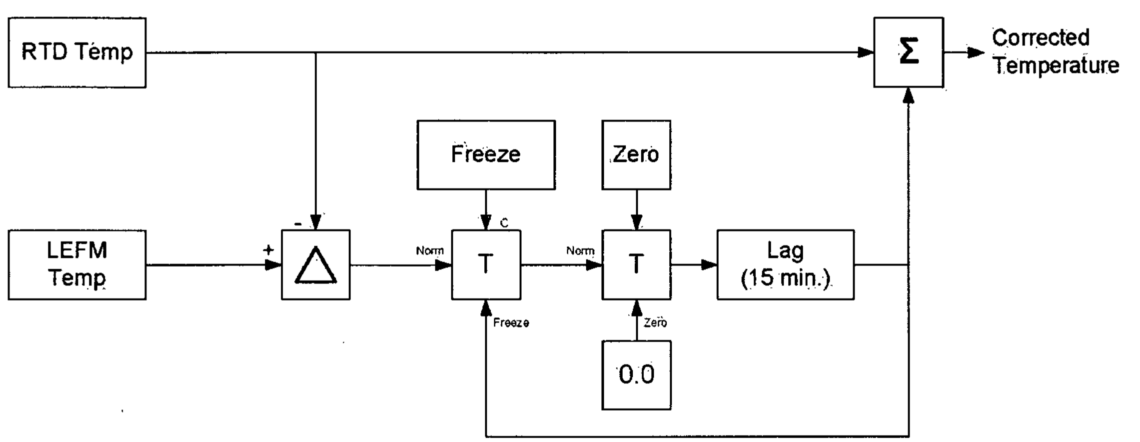
OAC Sketch



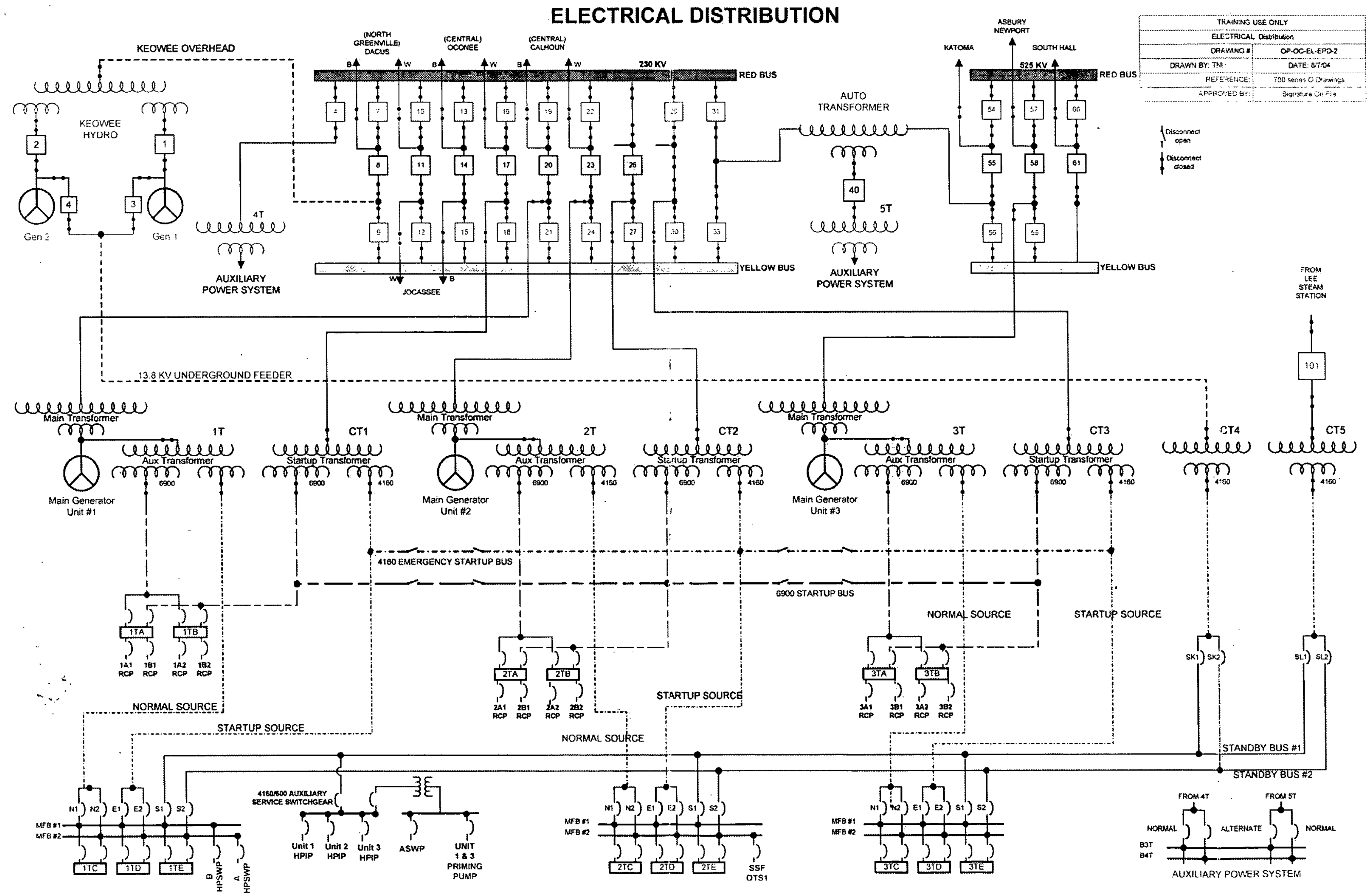
Attachment 1
Sketch 2

Correction Block Sketch



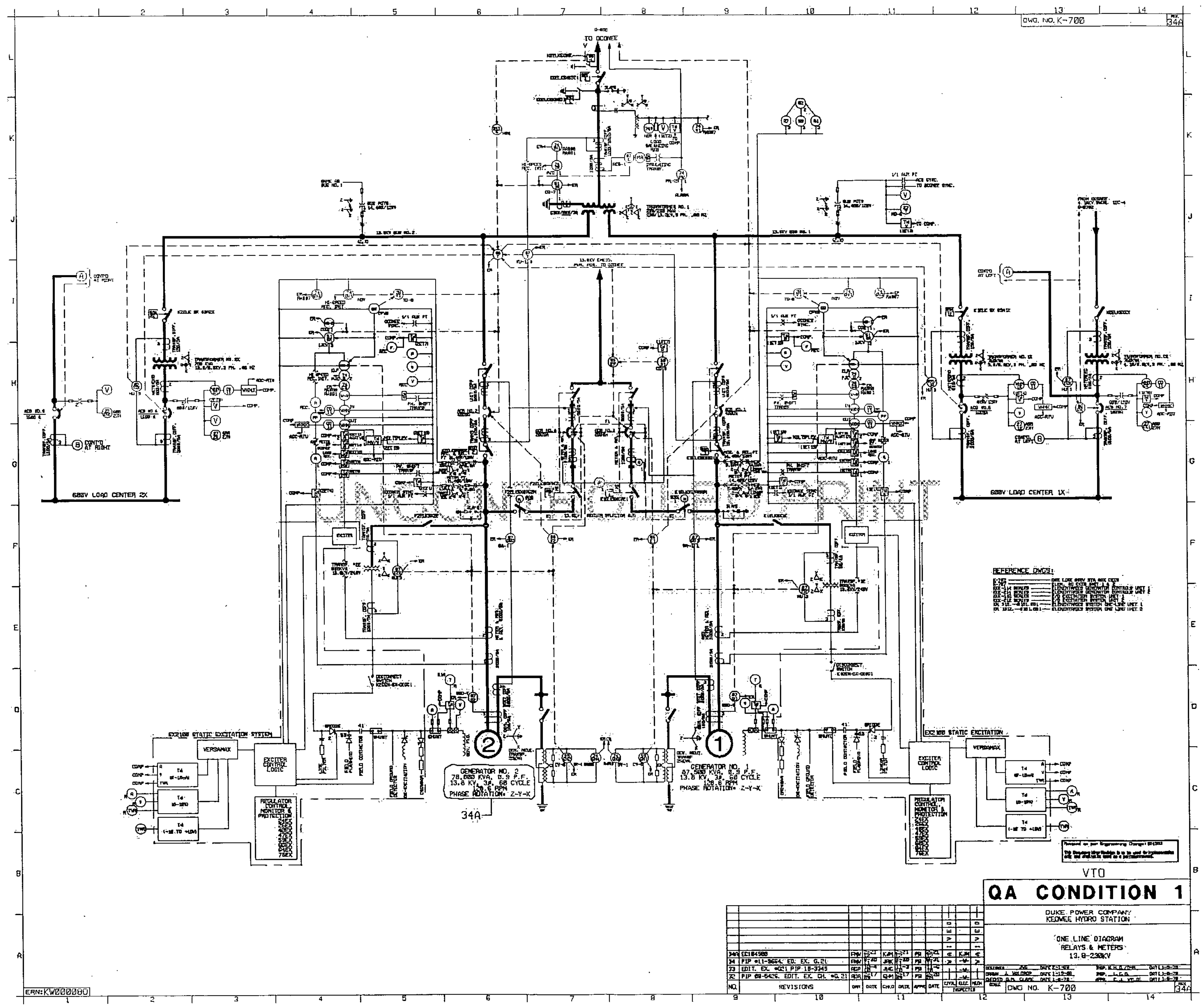


Attachment 2
Oconee Nuclear Station



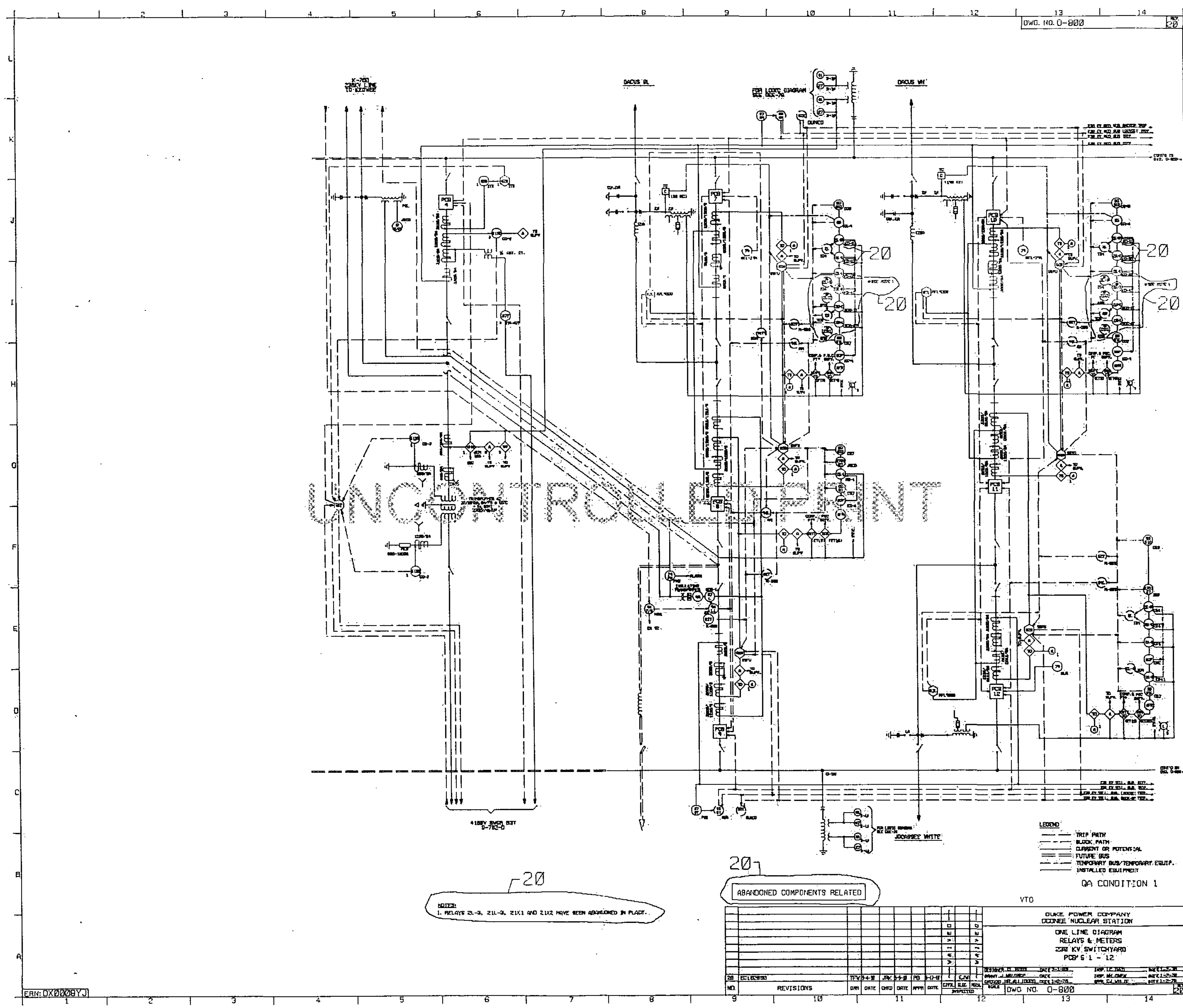
Attachment 2

K-700, Keowee Hydro Station One Line Diagram Relays & Meters 13.8-230kV



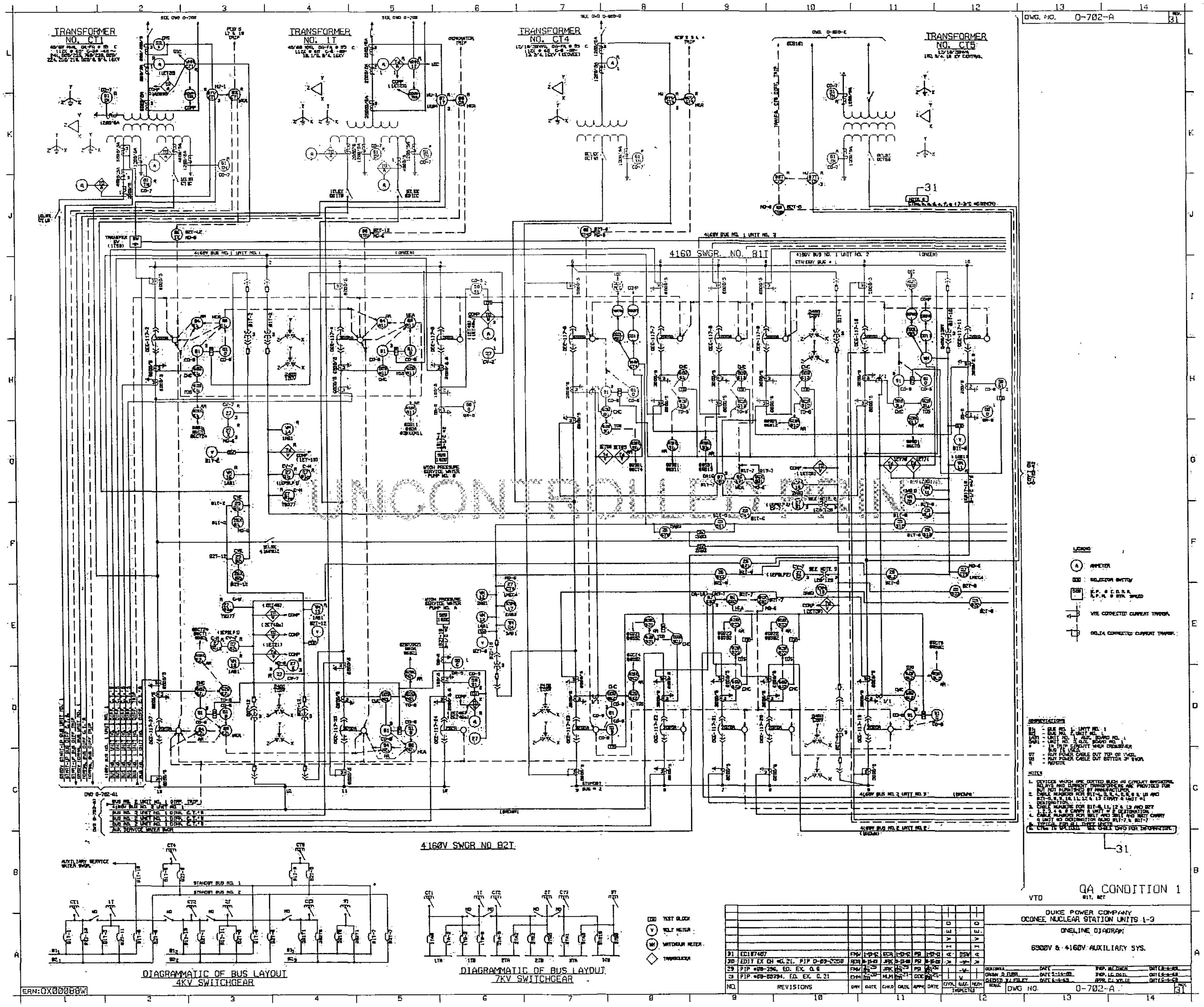
Attachment 2

O-800, Oconee Nuclear Station One Line Diagram Relays & Meters 230 kV Switchyard PCB's 1 - 12



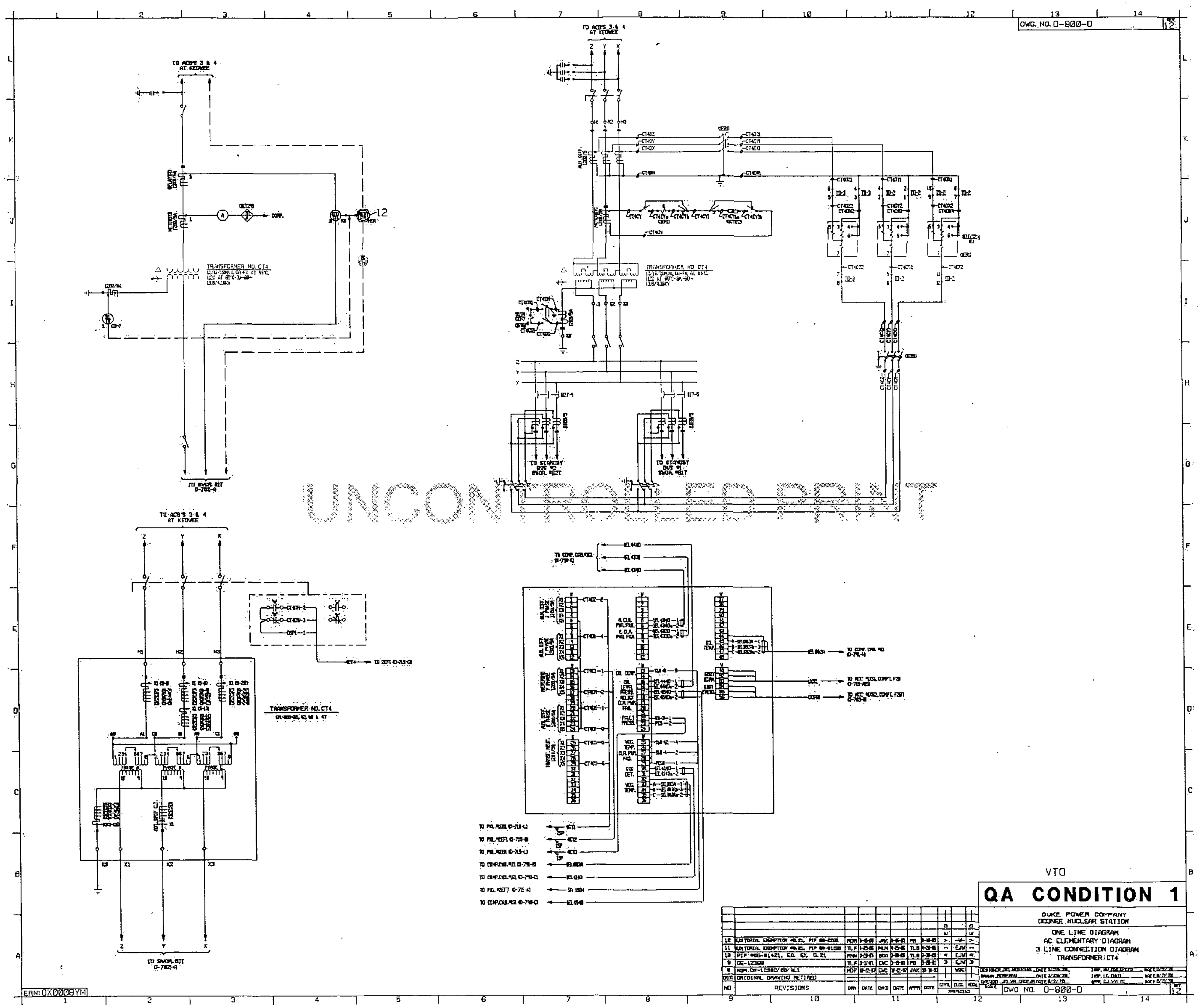
Attachment 2

O-702A, Oconee Nuclear Station Units 1-3 One Line Diagram 6900V & 4160V Auxiliary Sys



Attachment 2

O-800-D, Oconee Nuclear Station One Line Diagram, AC Elementary Diagram, 3 Line Connection Diagram, Transformer CT4



Attachment 3

Draft SLC 16.7.16

16.7 INSTRUMENTATION

16.7.16 Leading Edge Flow Meter (LEFM)

COMMITMENT The LEFM system consisting of two ultrasonic flow measuring planes in each feedwater loop shall be functional.

APPLICABILITY: MODE 1

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. LEFM system not functional when thermal power is less than or equal to 2568 MWt	A.1.1 Reduce the Nuclear Overpower High Setpoint to [Allowable Value ≤ 77.6 %RTP] with 3 RCPs operating	24 hours AND 7 days from failure to meet the commitment
	OR	
	A.1.2 Reduce the Nuclear Overpower High Setpoint to [Allowable Value ≤ 103.8% RTP] with 4 RCPs operating	24 hours AND 7 days from failure to meet the commitment
	AND	
	A.2 Reduce the flux/flow/imbalance envelope as provided in the COLR	24 hours AND 7 days from failure to meet the commitment

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. LEFM system not functional when power level is greater than 2568 MWt.	B.1 Suspend operations involving increasing thermal power above 2568 MWt (98.39% RTP).	Immediately
	AND	
	B.2.1 Restore LEFM to functional status.	7 days
	OR	
	B.2.2.1 Reduce thermal power to ≤ 2568 MWt (98.39% RTP)	7 days
	AND	
	B.2.2.2 Reduce the Nuclear Overpower High Setpoint to [Allowable Value ≤ 103.8% RTP] with 4 RCPs operating	7 days
	AND	
	B.2.2.3 Reduce the flux/flow/imbalance envelope as provided in the COLR	7 days
C. Required Action and association Completion Times of Condition A or B not met	-----NOTE----- When initiated, the Required Action must be completed. -----	
	C.1 Declare all four channels of the Nuclear Overpower and Nuclear Overpower Flux/Flow Imbalance Functions inoperable and enter the applicable Conditions of TS 3.3.1.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 16.7.16.1	Verify LEFM System is functional a. LEFM System status is Normal b. LEFM is not out of service	12 hours
SR 16.7.16.2	Perform a CHANNEL CALIBRATION on the LEFM system.	24 months

ENCLOSURE 2

License Amendment Request No. 2011-02, Supplement 2

Minor Changes to Proposed Technical Specification Associated With MUR Uprate LAR

Changes to Proposed Technical Specification Associated With MUR Uprate LAR

Duke proposes to make some minor changes to the Technical Specification changes originally proposed by the MUR Uprate LAR.

1. In the Technical Specification Table 3.3.1-1, footnotes (d) & (e) were inadvertently tied to SR 3.3.1.2 for Functions 1.a and 1.b. They should have been associated with SR 3.3.1.4. The table has been revised to annotate SR 3.3.1.4 with these footnotes for these specific functions.

   Attachment 1 & 2 provides revised pages for the TS markup and TS retype pages originally submitted.

2. Change TS Table 3.3.1-1 footnote (e) to refer to a nominal trip setpoint. The limiting trip setpoint being referred to in the note is 104.75%RTP, which is actually the same as the nominal trip setpoint for ONS. Duke Energy proposes to remove the requirements associated with the limiting trip setpoint since those values will be documented in the ONS uncertainty calculations and referenced by the associated calibration procedures. The proposed change is consistent with TSTF-493, which allows the plant to use either the Limiting Trip Setpoint or the Nominal Trip Setpoint. The following re-worded footnote e is proposed in its place:

   e) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the nominal Trip Setpoint or a value that is more conservative than the nominal Trip Setpoint; otherwise the channel shall be declared inoperable. The nominal Trip Setpoint and the methodology used to determine the predefined as-found setpoint tolerance band and the as-left setpoint tolerance band are specified in the Selected Licensee Commitments.

   Attachment 1 & 2 provides revised pages for the TS markup and TS retype pages originally submitted.

3. Change the TS 3.4.4 Required Action A.1 Completion Time from 6 hours to 12 hours. As currently proposed, TS 3.4.4, Action A would require the high flux trip setpoint to be reduced to the 3 RCP high flux trip setpoint within 6 hours of going to 3 RCP operation. Duke Energy has determined that the short Completion Time unnecessarily hurries the setpoint change and proposes to increase the Completion Time to 12 hours to allow a more orderly reduction in the high flux trip setpoint. The 12 hour Completion Time is justified based on the low probability of an event occurring in that 12 hour time frame between when an affected Unit enters 3 RCP operation and when the high flux trip setpoint is reset.

   Attachment 1 & 2 provides revised pages for the TS markup and TS retype pages originally submitted.

ATTACHMENT 1
TECHNICAL SPECIFICATION MARKUPS

Table 3.3.1-1 (page 1 of 2)
Reactor Protective System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	CONDITIONS REFERENCED FROM REQUIRED ACTION B.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. Nuclear Overpower				
a. High Setpoint – 4 reactor coolant pumps running	1,2[(a)]	C	SR 3.3.1.1 SR 3.3.1.2 SR 3.3.1.4[(d)(e)] SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.7	≤ 105.5% RTP[(f)]
b. High Setpoint – 3 reactor coolant pumps running	1,2[(a)]	C	SR 3.3.1.1 SR 3.3.1.2 SR 3.3.1.4[(d)(e)] SR 3.3.1.5	≤ 79.3% RTP[(f)]
~~b~~c. Low Setpoint	2[(b)],3[(b)] 4[(b)],5[(b)]	D	SR 3.3.1.1 SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.7	≤ 5% RTP
2. RCS High Outlet Temperature	1,2	C	SR 3.3.1.1 SR 3.3.1.4 SR 3.3.1.5	≤ 618°F
			SR 3.3.1.6 SR 3.3.1.7	
4. RCS Low Pressure	1,2[(a)]	C	SR 3.3.1.1 SR 3.3.1.4 SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.7	≥ 1800 psig
5. RCS Variable Low Pressure	1,2[(a)]	C	SR 3.3.1.1 SR 3.3.1.4 SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.7	As specified in the COLR

Table 3.3.1-1 (page 2 of 2)
Reactor Protective System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	CONDITIONS REFERENCED FROM REQUIRED ACTION B.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
6. Reactor Building High Pressure	1,2,3(c)	C	SR 3.3.1.1 SR 3.3.1.4 SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.7	≤ 4 psig
7. Reactor Coolant Pump to Power	1,2(a)	C	SR 3.3.1.1 SR 3.3.1.4 SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.7	>2% RTP with ≤ 2 pumps operating
8. Nuclear Overpower Flux/Flow Imbalance	1,2(a)	C	SR 3.3.1.1 SR 3.3.1.3 SR 3.3.1.4 SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.7	As specified in the COLR
9. Main Turbine Trip (Hydraulic Fluid Pressure)	≥ 30% RTP	E	SR 3.3.1.4 SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.7	≥ 800 psig
10. Loss of Main Feedwater Pumps (Hydraulic Oil Pressure)	≥ 2% RTP	F	SR 3.3.1.4 SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.7	≥ 75 psig
11. Shutdown Bypass RCS High Pressure	2(b),3(b) 4(b),5(b)	D	SR 3.3.1.1 SR 3.3.1.4 SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.7	≤ 1720 psig

(a) When not in shutdown bypass operation.

(b)

(c)

(d) If the as-found channel setpoint is conservative with respect to the Allowable Value but outside its predefined as-found acceptance criteria band, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.

(e) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the nominal Trip Setpoint or a value that is more conservative than the nominal Trip Setpoint; otherwise the channel shall be declared inoperable. The nominal Trip Setpoint and the methodology used to determine the predefined as-found setpoint tolerance band and the as-left setpoint tolerance band are specified in the Selected Licensee Commitments.

(f) If the high accuracy indication (including the Leading Edge Flow Meter) is unavailable, reduce the overpower trip setpoint as specified in the Selected Licensee Commitments.

XXX, YYY, ZZZ

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.4 RCS Loops – MODES 1 and 2

1.

73.8

LCO 3.4.4 Two RCS Loops shall be in operation, with:

a. Four reactor coolant pumps (RCPs) operating;
b. Three RCPs operating and:
THERMAL POWER restricted to ≤ ~~75~~% RTP.

2. LCO 3.3.1, "Reactor Protection System (RPS) Instrumentation," Function 1.b (Nuclear Overpower – High Setpoint for 3 RCP Operation), Allowable Value of Table 3.3.1-1 is reset for 3 RCPs operating; and
3. LCO 3.3.1, "Reactor Protection System (RPS) Instrumentation," Function 8 (Nuclear Overpower Flux/Flow/Imbalance), Allowable Value specified in the COLR is reset for 3 RCPs operating.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. ~~A.~~ Required Action and associated Completion Time of Condition A not met.	B. ~~A.~~1 Be in MODE 3.	12 hours

OR

Requirements of LCO not met for reasons other than Condition A.

A. Requirements of LCO 3.4.4.b.2 not met	A.1 Reset the RPS to satisfy the requirements of LCO 3.4.4.b.2.	12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.4.1	Verify required RCS loops are in operation.	12 hours

XXX, YYY, ZZZ

ATTACHMENT 2

RETYPED TECHNICAL SPECIFICATIONS

Table 3.3.1-1 (page 1 of 2)
Reactor Protective System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	CONDITIONS REFERENCED FROM REQUIRED ACTION B.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. Nuclear Overpower				
a. High Setpoint– 4 reactor coolant pumps running	1,2[(a)]	C	SR 3.3.1.1 SR 3.3.1.2 SR 3.3.1.4[(d)(e)] SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.7	≤ 105.5% RTP[(f)]
b. High Setpoint – 3 reactor coolant pumps running	1,2[(a)]	C	SR 3.3.1.1 SR 3.3.1.2 SR 3.3.1.4[(d)(e)] SR 3.3.1.5	≤ 79.3% RTP[(f)]
c. Low Setpoint	2[(b)],3[(b)] 4[(b)],5[(b)]	D	SR 3.3.1.1 SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.7	≤ 5% RTP
2. RCS High Outlet Temperature	1,2	C	SR 3.3.1.1 SR 3.3.1.4 SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.7	≤ 618°F
3. RCS High Pressure	1,2[(a)]	C	SR 3.3.1.1 SR 3.3.1.4 SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.7	≤ 2355 psig
4. RCS Low Pressure	1,2[(a)]	C	SR 3.3.1.1 SR 3.3.1.4 SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.7	≥ 1800 psig
5. RCS Variable Low Pressure	1,2[(a)]	C	SR 3.3.1.1 SR 3.3.1.4 SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.7	As specified in the COLR
6. Reactor Building High Pressure	1,2,3[(c)]	C	SR 3.3.1.1 SR 3.3.1.4 SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.7	≤ 4 psig

Table 3.3.1-1 (page 2 of 2)
Reactor Protective System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	CONDITIONS REFERENCED FROM REQUIRED ACTION B.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
7. Reactor Coolant Pump to Power	1,2[(a)]	C	SR 3.3.1.1 SR 3.3.1.4 SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.7	>2% RTP with ≤ 2 pumps operating
8. Nuclear Overpower Flux/Flow Imbalance	1,2[(a)]	C	SR 3.3.1.1 SR 3.3.1.3 SR 3.3.1.4 SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.7	As specified in the COLR
9. Main Turbine Trip (Hydraulic Fluid Pressure)	≥ 30% RTP	E	SR 3.3.1.4 SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.7	≥ 800 psig
10. Loss of Main Feedwater Pumps (Hydraulic Oil Pressure)	≥ 2% RTP	F	SR 3.3.1.4 SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.7	≥ 75 psig
11. Shutdown Bypass RCS High Pressure	2[(b)],3[(b)] 4[(b)],5[(b)]	D	SR 3.3.1.1 SR 3.3.1.4 SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.7	≤ 1720 psig

(a) When not in shutdown bypass operation.

(b) During shutdown bypass operation with any CRD trip breakers in the closed position and the CRD System capable of rod withdrawal.

(c) With any CRD trip breaker in the closed position and the CRD System capable of rod withdrawal.

(d) If the as-found channel setpoint is conservative with respect to the Allowable Value but outside its predefined as-found acceptance criteria band, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.

(e) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the nominal Trip Setpoint or a value that is more conservative than the nominal Trip Setpoint; otherwise, the channel shall be declared inoperable. The nominal Trip Setpoint and the methodology used to determine the predefined as-found setpoint tolerance band and the as-left setpoint tolerance band are specified in the Selected Licensee Commitments.

(f) If the high accuracy indication (including the Leading Edge Flow Meter) is unavailable, reduce the overpower trip setpoint as specified in the Selected Licensee Commitments.

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.4 RCS Loops – MODES 1 and 2

LCO 3.4.4 Two RCS Loops shall be in operation, with:

a. Four reactor coolant pumps (RCPs) operating; or
b. Three RCPs operating and:
   1. THERMAL POWER restricted to ≤73.8% RTP.
   2. LCO 3.3.1, "Reactor Protection System (RPS) Instrumentation," Function 1.b (Nuclear Overpower – High Setpoint for 3 RCP Operation), Allowable Value of Table 3.3.1-1 is reset for 3 RCPs operating; and
   3. LCO 3.3.1, "Reactor Protection System (RPS) Instrumentation," Function 8 (Nuclear Overpower Flux/Flow/Imbalance), Allowable Value specified in the COLR is reset for 3 RCPs operating.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Requirements of LCO 3.4.4.b.2 not met	A.1 Reset the RPS to satisfy the requirements of LCO 3.4.4.b.2	12 hours
B. Required Action and associated Completion Time of Condition A not met. <u>OR</u> Requirements of LCO not met for reasons other than Condition A.	B.1 Be in MODE 3.	12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.4.1	Verify required RCS loops are in operation.	12 hours