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February 11, 2011

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

Subject: Duke Energy Carolinas, LLC
Oconee Nuclear Station, Units 1, 2 and 3
Renewed Facility Operating Licenses Numbers DPR-38, -47, -55;
Docket Number 50-269, 50-270 and 50-287;
Response to Request for Additional Information Regarding License Amendment Request to Change Technical Specification Surveillance Requirement Frequencies to Support 24-Month Fuel Cycles
License Amendment Request No. 2010-001, Supplement 1

On May 6, 2010, Duke Energy Carolinas, LLC (Duke Energy) submitted a LAR requesting Nuclear Regulatory Commission (NRC) approval for certain Oconee Nuclear Station (ONS) TS Surveillance Requirement frequencies that are specified as "18 months" by revising them to "24 months" in accordance with the guidance of Generic Letter 91-04, "Changes in Technical Specification Surveillance Intervals to Accommodate a 24-Month Fuel Cycle." The NRC electronically transmitted a Request for Additional Information (RAI) to Duke Energy on November 26, 2010. The Enclosure provides Duke Energy's response to the RAI and revises information submitted in the initial LAR as indicated in the enclosure.

If there are any questions regarding this submittal, please contact Boyd Shingleton of the Oconee Regulatory Compliance Group at (864) 873-4716.

I declare under penalty of perjury that the foregoing is true and correct. Executed on February 11, 2011.

Sincerely,

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

Enclosure:
Duke Energy Response to NRC Request for Additional Information

A001
NRR

cc w/Enclosure:

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ENCLOSURE

Duke Energy Response to NRC Request for Additional Information

Enclosure

Duke Energy Response to NRC Request for Additional Information (RAI)

RAI 1

The licensee stated "Any necessary revisions to setpoint calculations and calibration procedures to incorporate results of the statistical analysis of the historical As Found/ As Left (AFAL) data will be completed prior to implementation" for the following SR in Attachment 6 and the first Commitment in Attachment 5 of the LAR:

SR 3.3.1.7 page 21
SR 3.3.5.4 page 25
SR 3.3.8.3 page 27
SR 3.3.10.2 page 32
SR 3.3.11.3 page 34
SR 3.3.28.2 page 38

To ensure compliance with TSTF-493, Revision 4, or RIS 2006-17, provide the necessary calculations, affected calibration settings and calibration procedures for all instrumentation where projected drift values are outside the existing design allowances.

Duke Energy Response to RAI 1

An instrument drift analysis was performed for the applicable functions of the six noted surveillances per the methodology included in Attachment 7 of the LAR. The results of these analyses determined drift for a bounding interval of 30 months which is represented as the extended cycle analyzed drift (AD_E). The analyzed drift values were then compared to the 30-month acceptable limit as determined from the setpoint uncertainty calculation for each function. For all occurrences where AD_E exceeded the 30-month acceptable limit (i.e., projected drift exceeded design allowances), revisions to the applicable setpoint uncertainty calculation were performed to determine impacts to the total loop uncertainty and any related setpoints or decision points. In addition, a review of existing as-found calibration tolerances, channel functional tests (if applicable) and channel check limits (if applicable) were performed to identify any changes needed as a result of the increased drift. The attached evaluation flow chart (Attachment 1) illustrates this process.

The attached table (Attachment 2) provides a comparison of AD_E versus the 30-month acceptable limit for all the surveillance functions in question. For those functions where AD_E > 30-month acceptable limit (AL_{30}); the referenced drift analysis, setpoint uncertainty calculation and calibration procedure are provided as requested. For the Reactor Protective System (RPS) and Engineered Safeguards Protective System (ESPS) functions, the calibration procedure for one channel is provided and is typical for all channels.

The following input is applicable to the table information and compliance with TSTF-493, Revision 4 or Regulatory Information Summary (RIS) 2006-17:

- There are some functions for which a drift analysis was not applicable. Justifications for these functions are provided in the referenced section of calculation OSC-9852 as noted in the AFAL Analysis column.

- The scope of TSTF-493, Revision 4 or RIS 2006-17 is limited to the RPS and ESPS functions included in SR 3.3.1.7 and SR 3.3.5.4. For these functions, the current Allowable Values (AV) specified in Technical Specifications (TSs) are based on the channel functional tests performed on a 45 day staggered basis for RPS and every 92 days for ESPS. The channel functional tests only include the cabinet hardware. As such, instrument drift associated with these tests are unaffected by transition to 24 month cycles. The AD_E specified for the RPS and ESPS functions is applicable to the process sensors calibrated on a 18 month frequency and does impact the total loop uncertainty for each function. For the RPS and ESPS functions where AD_E exceeded the AL_{30}, revision of the associated setpoint uncertainty calculation has been completed and no instances were found requiring changes to the current nominal plant setpoint or associated AV. Refer to the response to RAI 2 for additional information.

- The notice of availability for TSTF-493, Revision 4 occurred after the Oconee Nuclear Station (ONS) submittal of the LAR for 24 month cycles. Given this and the fact that no AVs specified in the TSs require change as a result of transitioning to 24 month cycles, ONS has not adopted the TSTF.

- The uncertainty calculation revisions for PAM SR 3.3.8.3 functions 4, 12 and 14 have not been approved as of this date but will be completed prior to implementation as stated in the LAR.

RAI 2

If the projected drift values are within the existing design allowances in question 1, provide a comparison table and/or a sample diagram to illustrate the setpoint calculation values of current and 24-month fuel cycles. The information to be provided should include but not be limited to the instrument function name, TS allowable value (AV), Limiting Trip Setpoint (LTSP), Nominal trip setpoint (NSTP), total loop uncertainties, margin, As-Found tolerance (AFT), and As-Left tolerance (ALT).

Duke Energy Response to RAI 2

The attached table (Attachment 3) includes the requested information for those functions in the six noted surveillances where the analyzed drift for 30 months was bounded by existing design allowances or $AD_E < AL_{30}$ as specified in Attachment 2. All the values were obtained from the noted references or as specified in the table notes.

The following input is applicable to the table information:

- Only SR 3.3.1.7 (RPS) and SR 3.3.5.4 (ESPS) have AVs specified in the TSs and these AVs are based on the channel functional tests as noted in the response to RAI 1.

- The ONS setpoint methodology does not require the calculation of a LTSP, therefore only the NTSP employed in the plant equipment, the allowable value as specified in TSs and the calibration as-found setting tolerance are provided.

- For the RPS and ESPS functions, the margin identified is that between the AV and the as-found calibration setting tolerance. For increasing setpoints, margin between the

nominal trip setpoint (NTSP) and the analytical limit (AL) can be determined by adding the total loop uncertainty to the NTSP (or subtracting for decreasing setpoints) and comparing that value to the AL.

- For the non RPS and ESPS surveillances, no AVs are specified in the TSs and no ALs are applicable. Therefore, applicable process limits and setpoints (decision points) are provided. Note that some functions have multiple decision points only one of which is provided for clarity.

- At ONS, as-found calibration tolerances are conservatively set equal to as-left calibration tolerances. Therefore the setting tolerances specified are for both as-found and as-left conditions.

- By procedure, any instrumentation found out of the specified setting tolerance (OOT) is re-calibrated within the required tolerance prior to return to service.

- Engineering evaluations are required for all OOT conditions exceeding notification limits. Notification limits are specified in each calibration procedure. The default notification limit is two times the specified procedure setting tolerance or as specified in the calibration procedure for other reasons (TSs, setpoint uncertainty calculation, site directives).

RAI 3

SR 3.3.1.7 – The licensee stated "the instrumentation had six failures of the TS functions that would have been detected solely by the periodic performance of the SR" in the fourth paragraph of page 20 to Attachment 6 of the LAR. The licensee also indicated those failures were repetitive, but stated, at the end of page 22, "Considering the total number of Rosemount transmitters in the various systems in all three units, the total number of failures identified is small." What's the total number of Rosemount 1154GP transmitters in all three Units and justify why extension of surveillance frequency to 24-months is valid.

Duke Energy Response to RAI 3

The total number of Rosemount 1154GP transmitters installed in all three units is 64. Of these 64 applications, 52 support an 18 month TS surveillance included in the LAR for extension to 24 months and for which a surveillance history review was performed to identify failures. The six failures identified for SR 3.3.1.7 on pages 21 and 22 of Attachment 6 of the LAR were the only failures associated with the 52 applications. As noted on page 2 of Attachment 6 of the LAR, the surveillance history review included a minimum of five 18 month cycles or approximately 65,000 transmitter operating hours per application. Therefore, the number of failures identified is considered small.

Also, there are 95 additional Rosemount 1154 series transmitters installed in all three units (Models 1154DP, 1154HP, 1154HH and 1154SH) and 60 additional Rosemount 1153 series transmitters installed in all three units. The Rosemount model 1153 and 1154 transmitters are all Class 1E nuclear service qualified devices with the same operating principle and similar construction. ONS has not identified any failure trends of these devices due to time-based

degradation that would impact extension of the surveillance interval to 24 months.

RAI 4

SR 3.3.8.3 – The licensee indicated in pages 29 and 30 of Attachment 6 of the LAR that only one good drift data was obtained for the RVLIS Head Level instrument loop.

Provide a justification regarding how the drift for this instrument loop is established with high degree of confidence.

Duke Energy Response to RAI 4

The statement in question from Page 30 of Attachment 6 of the LAR is "The data shows continued improvement with each procedural change and the final calibration, which is the only one with both procedural changes, shows the RVLIS Head Level instrument loops performing well within expected calibration limits". As the two procedural changes noted had a significant effect on calibration results, performance of an AFAL drift analysis with like data (i.e., calibrations performed with both procedure changes implemented) was not possible due to an inadequate sample size.

Based on the above, the drift of the RVLIS Head Level instrumentation for a worst case calibration frequency of 30 months was established based on the AFAL drift analysis results obtained for the RVLIS Hot Leg Level instrumentation. The RVLIS Hot Leg Indication extended cycle Analyzed Drift is a reasonable estimate of the RVLIS Vessel Head Level Indication extended cycle Analyzed Drift because both loops share the same equipment, location and function. The only difference between the loops is instrument span. The RVLIS Hot Leg Level AFAL drift error determined for the maximum 30-month calibration frequency is ± 3.92% of span. This value has been incorporated in the RVLIS instrument uncertainty calculation for both the Hot Leg and Head level instrumentation. Previously, the RVLIS instrument uncertainty calculation included an equivalent drift allowance of +/- 2.46% of span for a nominal 18 month calibration frequency. Therefore the drift allowance included in the uncertainty analysis increased by 1.61 times the 18 month drift allowance. This increase exceeds the typical Square Root Sum of the Squares (SRSS) extrapolation of drift of 1.29 times or $(30/18)^{1/2}$ for moderate time dependency and provides a high degree of confidence that the drift established in the uncertainty analysis is both reasonable and bounding.

RAI 5

SR 3.3.16 – The licensee stated, in the last paragraph of page 35 to Attachment 6 of the LAR, "This instrument loop is calibrated every 12 months online," and "There are no uncertainty calculations for the Reactor Building Purge – High Radiation instrument loops." Since this online calibration is a TS surveillance requirement, describe this online calibration and the setpoint calculation in more detail.

Duke Energy Response to RAI 5

Background from TS 3.3.16 Bases:

The RB Purge Isolation–High Radiation Function closes the RB purge valves. This action isolates the RB atmosphere from the environment to minimize releases of radioactivity in the event an accident occurs.

The radiation monitoring system measures the activity in a representative sample of air drawn in succession through a particulate sampler, an iodine sampler, and a gas sampler. The TS Limiting Condition for Operation (LCO) addresses only the gas sampler portion of this system (RIA-45).

The trip setpoint is chosen sufficiently below hazardous radiation levels to ensure that the consequences of an accident will be acceptable, provided the unit is operated within the LCO at the onset of an accident or transient and the equipment functions as designed. The mode of applicability for TS 3.3.16 is during movement of recently irradiated fuel assemblies within containment.

Calibration of RIA-45:

Two different calibration procedures are used to meet SR 3.3.16.3. One procedure is used to calibrate the instrumentation necessary to extract the sample from the process duct, route the sample through the detectors, monitor and control the sample flow rate, and return the sample to the process stream. The components consist of pumps, valves, gauges, flow meters, RM-80 processing unit including internal power supplies and tubing. The calibration tolerances employed are based on vendor specifications. The calibration of this instrumentation includes the following activities:

- RM-23L Display Test
- Monitor In-Service Test
- Subassembly Test and Power Fail
- Power Fail Trip Setpoint Test and Adjustment
- Purge Test
- Mass Flow Meter Calibration
- Pressure Gauge Check
- Vacuum Gauge and Sample Vacuum Gauge Checks
- Analog Output Test/Adjustment
- Cleaning Sight Glass Rotometers

The other procedure calibrates the radiation monitor detector. The calibration tolerances employed are based on vendor specifications coupled with operating experience. The calibration of the detector includes the following activities:

- A loss of count test is performed.
- A detector RD-59 Temperature Control Test is performed.
- A Calibration Source (Cl-36) is obtained. The pump is turned off. Inlet and outlet valves are closed. The source is installed on a Lucite source positioner and placed in a sample chamber facing the detector face.

- After 30 minutes, the most current 10 minute average for AS FOUND Measured Gross counts per minute is recorded.
- Error between the measured count rate and the expected count rate must be less than 10%.

Alarm/Trip Setpoints for RIA-45:

The alarm/trip setpoints for these instruments are calculated in accordance with NRC approved methods in the Offsite Dose Calculation Manual (ODCM) to assure that the alarm/trip will occur prior to exceeding applicable dose limits in Selected Licensee Commitment (SLC) 16.11.2. As described below, the alarm setpoints are established based on a fraction of the reporting limit per release path and are therefore inherently conservative.

"Alert" alarm setpoints are set to alarm if 3% of reporting limit of 10 CFR 50.73 (a) (2) (viii) (A) (20 times EC limit) for noble gases is exceeded based upon Xe-133 as the major noble gas contributor. The reporting limit is divided as follows: 3% of the limit for each of the three Unit Vents, 0.5% for the Rad Waste Facility Vent (4RIA-45) and 0.5% for the Interim Radwaste Facility Vent (RIA-53). When the alert alarm setpoint is exceeded, a "Process Radiation Monitor High" statalarm and a computer alarm for high radiation is received.

"High" alarm setpoints are set to alarm if 30% of instantaneous dose rate limit of SLC 16.11.2 is exceeded based upon Xe-133 as the major noble gas contributor. The instantaneous dose limit is divided as follows: 30% of the limit for each of the three Unit Vents, 5% for the Rad Waste Facility Vent (4RIA-45) and 5% for the Interim Radwaste Facility Vent (RIA-53). When the high alarm setpoint is exceeded, Reactor Building purge valves close, the Reactor Building purge exhaust trips, and the mini-purge also trips.

RAI 6

SR 3.3.19.1 and SR 3.3.20.1 (both are functional tests) are missing from 2.A "Non-Calibration Changes" of Attachment 6 of LAR. Provide the detailed evaluation results of those two SRs.

Duke Energy Response to RAI 6

NRC initially advised Duke Energy by electronic mail on September 14, 2010 that SR 3.3.19.1 and SR 3.3.20.1 (both channel functional tests) were missing from the 2.A non-calibration changes evaluation in Attachment 6 of the LAR. Duke Energy determined and advised the NRC by electronic mail that these two SRs should have been grouped with the other EPSL SRs (SRs 3.3.17.1, 3.3.18.1, 3.3.21.1, and 3.3.23.1) and addressed jointly. The NRC requested that Duke Energy provide the missing information associated with these two SRs when responding to other RAI questions that were forthcoming.

The detailed evaluation for these two channel functional tests is provided below:

Detailed GL 91-04 Evaluation Results

<u>TS 3.3.19 Emergency Power Switching Logic (EPSL) 230 KV Switchyard Degraded Grid Voltage Protection (DGVP)</u>

SR 3.3.19.1 Perform CHANNEL FUNCTIONAL TEST.

TS 3.3.20 Emergency Power Switching Logic (EPSL) CT-5 Degraded Grid Voltage Protection (DGVP)

SR 3.3.20.1 Perform CHANNEL FUNCTIONAL TEST.

The surveillance test interval of these SRs is being increased from once every 18 months to once every 24 months, for a maximum interval of 30 months including the 25% grace period. All of the actuation instrumentation and logic, controls, monitoring capabilities, and protection systems, are designed to meet applicable reliability, redundancy, single failure, and qualification standards and regulations as described in the ONS Updated Final Safety Analysis Report (UFSAR). As such, these functions are designed to be highly reliable. This is acknowledged in the August 2, 1993 NRC Safety Evaluation Report relating to extension of the Peach Bottom Atomic Power Station, Unit Numbers 2 and 3 surveillance intervals from 18 to 24 months:

> "Industry reliability studies for boiling water reactors (BWRs), prepared by the BWR Owners Group (NEDC-30936P) show that the overall safety systems' reliabilities are not dominated by the reliabilities of the logic systems, but by that of the mechanical components, (e.g., pumps and valves), which are consequently tested on a more frequent basis. Since the probability of a relay or contact failure is small relative to the probability of mechanical component failure, increasing the Logic System Functional Test interval represents no significant change in the overall safety system unavailability."

A review of the applicable ONS surveillance history demonstrated that the instrumentation for these functions had no failures of the Technical Specification (TS) functions that would have been detected solely by the periodic performance of the above SRs.

As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on the history of system performance, the impact of this change on safety, if any, is small.

Revision to Initial LAR Submittal

During review of the NRC RAI Duke Energy discovered that an instrument drift analysis to support the extension of TS SR 3.3.8.3 Post Accident Monitoring (PAM) function 4 RCS Pressure (Wide Range) from a frequency of 18 months to 24 months had not been completed.

There are two different Reactor Coolant System (RCS) Wide Range (WR) pressure applications. One set of transmitters monitor RCS WR pressure and provide input to the Engineered Safeguards Protective System (ESPS) and another set of transmitters monitor RCS WR Pressure for PAM. Instrument drift calculation OSC-9752 was performed for the ESPS transmitters. The PAM pressure transmitters are calibrated in the RVLIS Instrument Calibration. During performance of the drift calculations to support the LAR, calibration data from historical performances of these procedures was used to perform a drift analysis of the RCS Hot Leg Level and RV Head Level applications, however the calibration data for the PAM pressure transmitters was over looked resulting in no drift analysis being completed for the pressure function. Subsequently, during the LAR development, the drift calculation performed for the

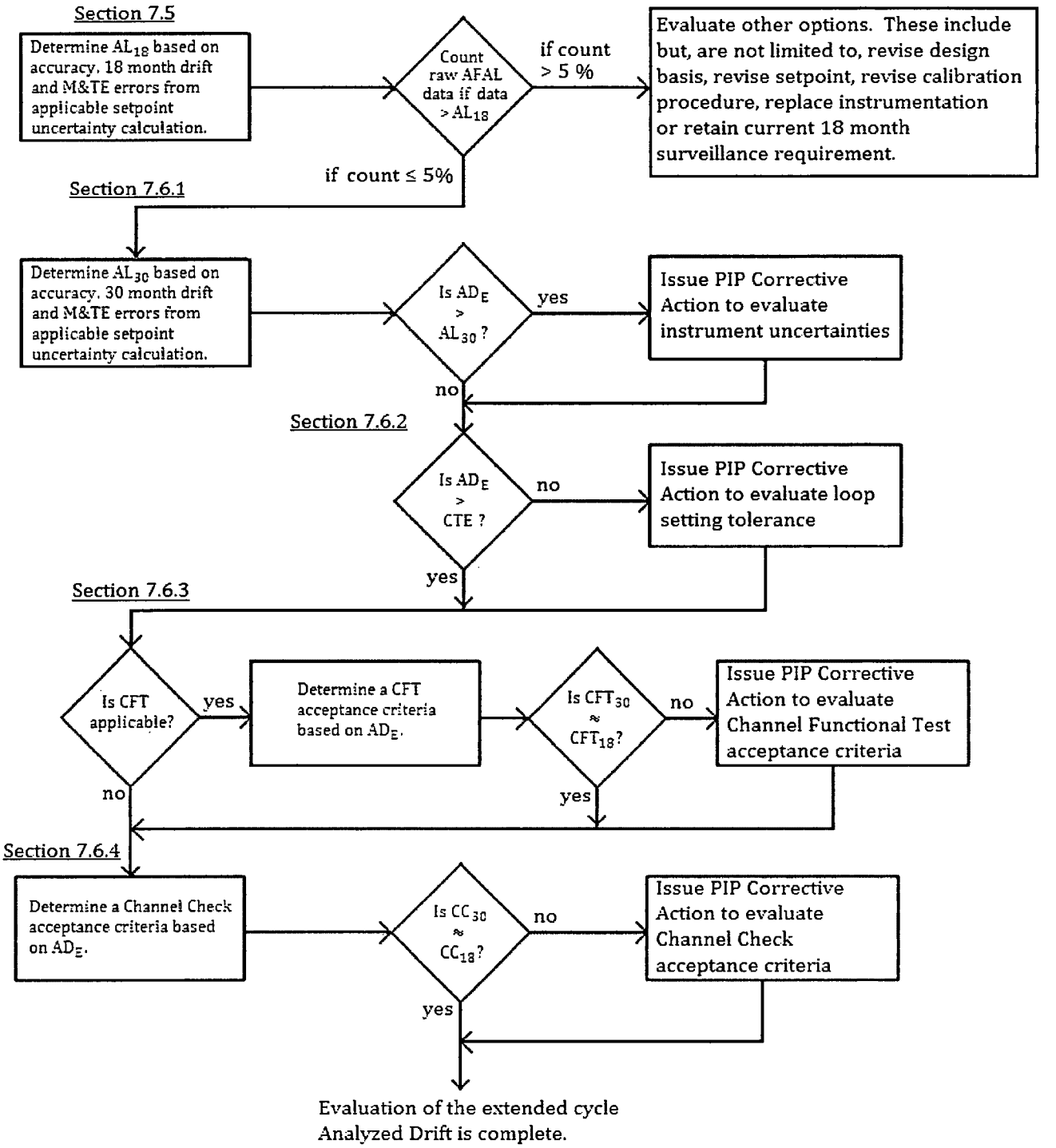
ESPS RCS WR pressure transmitters was inadvertently credited for completion of the RCS WR Pressure PAM function as well.

In addition to TS 3.3.8.3 PAM function 4, the RCS WR Pressure transmitters also provide input to the RVLIS for density compensation of the level signals during certain conditions and the Subcooling Monitor which are functions 3, 5 and 17 of SR 3.3.8.3. Drift analyses were completed for the primary instrumentation inputs to functions 3, 5 and 17; RCS Hot Leg Level, Reactor Vessel Head Level and RCS THOT temperature. However, due to the omission of the drift analysis for the PAM pressure transmitters, potential impacts on these functions due to projected drift of these instrument loops for 24 month cycles were not evaluated. In addition, the PAM pressure transmitters provide an input to the Anticipated Transient Without Scram (ATWS) circuitry; however there are no 18 month TS calibration SRs in the LAR for ATWS.

In addition to evaluating the historical drift associated with current 18-month calibrations, extension of 18 month TS SRs were also supported by completion of a failure history review as noted in the LAR. The failure review was completed as required for the RCS WR Pressure PAM instrumentation.

The drift analysis (OSC 10180) for the PAM WR pressure transmitters has been completed and Attachment 2 of OSC 9719 (Attachment 7 to LAR) has been revised to list the calculation for this function.

AFAL Drift Evaluation Flow Chart



The 18 month Analyzed Drift (or just Analyzed Drift) is determined in Sections 1.0 through 7.3 of the As-Found/As-Left (AFAL) Drift Analyses. The 18 month Analyzed Drift is statistically derived from the AFAL drift data. The extended cycle Analyzed Drift (AD_E) is based on the 18 month Analyzed Drift and the determination of moderate or strong time dependency in Section 7.4 of the AFAL Drift Analyses.

The Analyzed Drift and extended cycle Analyzed Drift are evaluated with respect to current and extended calibration intervals in Section 7.5 and 7.6.

Section 7.5
The 18 month acceptable limit (AL_{18}) is used to compare the instrument uncertainties to As-Found/As-Left (AFAL) data (i.e., loop past performance). If the AFAL data exceeds the acceptable limit at an unacceptable rate for an 18 month calibration interval, the loop cannot be expected to meet its performance requirements for extended fuel cycles. To be considered for calibration interval extension, 95% of all AFAL data (except that which represents failed instruments) should be less than or equal to the 18 month acceptable limit. The 18 month acceptable limit contains those uncertainty terms that are present in the AFAL Drift data. Typically, this includes accuracy, drift and Measurement and Test Equipment (M&TE) uncertainties.

Section 7.5 is intended to cover Issue 1 of Enclosure 2 to NRC Generic Letter 91-04.

Section 7.6.1
The 30-month acceptable limit (AL_{30}) is the same as the 18 month acceptable limit except that it is based on the 30-month drift specification. If the extended cycle Analyzed Drift (AD_E) is less than or equal to the 30-month acceptable limit, then the uncertainty calculation is conservative for use with extended fuel cycles. This is because the instrument uncertainties resulted in a more conservative error term than one based on the extended cycle Analyzed Drift. If the extended cycle Analyzed Drift (AD_E) is greater than the 30-month acceptable limit, then the uncertainty calculation may not be conservative for use with extended fuel cycles. This is because the instrument uncertainties resulted in a less conservative error term than one based on the extended cycle Analyzed Drift. Section 7.6.1 is intended to cover Issues 4 and 5 of Enclosure 2 to NRC Generic Letter 91-04.

Section 7.6.2

If the Analyzed Drift (AD_E) is greater than or equal to the instrument loop setting tolerance (CTE), then the extended cycle Analyzed Drift cannot be exceeded without the loop setting tolerance being exceeded and the loop recalibrated. This eliminates the possibility of the loop drifting outside the extended cycle Analyzed Drift without identification or correction. If the extended cycle Analyzed Drift (AD_E) is less than the instrument loop setting tolerance (CTE), then the instrument loop could drift outside the extended cycle Analyzed Drift without the loop being recalibrated. To reduce the likelihood of this possibility, the loop setting tolerance should be evaluated and reduced if necessary.

Section 7.6.2 is intended to support Issue 6 of Enclosure 2 to NRC Generic Letter 91-04.

Section 7.6.3

Where applicable, a Channel Functional Test (CFT) acceptance criteria based on the extended cycle Analyzed Drift (AD_E) is determined and compared to the current CFT acceptance criteria. If the extended cycle CFT acceptance criteria are significantly larger than the current CFT acceptance criteria, the current criteria may be too restrictive. If the extended cycle CFT acceptance criteria are significantly smaller than the current CFT acceptance criteria, the current criteria may be too permissive. The determination of the appropriate extended cycle CFT acceptance criteria will be made by the engineer responsible for that instrument loop.

Section 7.6.3 is intended to support Issue 6 of Enclosure 2 to NRC Generic Letter 91-04.

Section 7.6.4

Where applicable, a Channel Check acceptance criteria based on the extended cycle Analyzed Drift (AD_E) is determined and compared to the current Channel Check acceptance criteria. If the extended cycle Channel Check acceptance criteria are significantly larger than the current Channel Check acceptance criteria, the current criteria may be too restrictive for extended fuel cycles. If the extended cycle Channel Check acceptance criteria are significantly smaller than the current Channel Check acceptance criteria, the current criteria may be too permissive. The determination of the appropriate Channel Check acceptance criteria will be made by the engineer responsible for that instrument loop.

Section 7.6.3 is intended to support Issue 6 of Enclosure 2 to NRC Generic Letter 91-04.

SR 3.3.1.7

Table 3.3.1-1 Reactor Protective System Instrumentation	AFAL Analysis	AL_{30}	AD_E	Uncertainty Calc	Cal Procedures
1) a. Nuclear Overpower - High Setpoint	OSC-9852, Section 6.1	not applicable			
b. Nuclear Overpower - Low Setpoint	OSC-9852, Section 6.2	not applicable			
2) RCS High Outlet Temperature	OSC-9852, Section 6.3	not applicable			
3) RCS High Pressure	OSC-9771	± 9.6 psi	± 11.1 psi random; ± 2.6 psi bias	OSC-4048	IP/0/A/0305/001 M, N, O , P
4) RCS Low Pressure	OSC-9771	± 9.6 psi	± 11.1 psi random; ± 2.6 psi bias	OSC-4048	IP/0/A/0305/001 M, N, O , P
5) RCS Variable Low Pressure	OSC-9771	± 9.6 psi	± 11.1 psi random; ± 2.6 psi bias	OSC-4048	IP/0/A/0305/001 M, N, O , P
6) Reactor Building High Pressure	OSC-9819	± 0.24 psi	± 0.27 psi	OSC-3446	IP/0/A/0305/005 A, B, C, D
7) Reactor Coolant Pump to Power	OSC-9852, Section 6.4	not applicable			
8) Nuclear Overpower Flux/Flow Imbalance	OSC-9793	± 0.93% span	± 0.89% span random; - 0.07% span bias	OSC-3416, OSC-8857	IP/1,2,3/A/0305/001 I, J, K, L
9) Main Turbine Trip (Hydraulic Fluid Pressure)	OSC-9792	± 17.0 psi	± 27.5 psi	OSC-3395	IP/0/A/0305/009, 010, 011, 012
10) Loss of Main Feedwater Pumps (Hydraulic Oil Pressure)	OSC-9792	± 1.7 psi	± 6.5 psi	OSC-3395	IP/0/A/0305/009, 010, 011, 012
11) Shutdown Bypass RCS High Pressure	OSC-9771	± 9.6 psi	± 11.1 psi random; ± 2.6 psi bias	OSC-4048	IP/0/A/0305/001 M, N, O , P

SR 3.3.5.4

Table 3.3.5-1 Engineered Safeguards Protective System Analog Instrumentation					
1) Reactor Coolant System Pressure - Low	OSC-9752	± 0.87% span	± 0.54% span		
2) Reactor Coolant System Pressure - Low Low	OSC-9752	± 0.87% span	± 0.54% span		
3) Reactor Building (RB) Pressure - High	OSC-9720	± 1.74% span	± 0.54% span		
4) Reactor Building Pressure - High High	OSC-9809	± 0.267 psi	± 0.291 psi random; ± 0.027 psi bias	OSC-3446	IP/0/A/0310/003D, 4D, 5D

SR 3.3.8.3 Table 3.3.8-1 Post Accident Monitoring Instrumentation	AFAL Analysis	AL_{30}	AD_E	Uncertainty Calc	Cal Procedures
1) Wide Range Neutron Flux	OSC-9852, Section 6.5	not applicable			
2) RCS Hot Leg Temperature	OSC-9791	± 1.01% span	± 0.49% span		
3) RCS Hot Leg Level	OSC-9825	± 2.74% span	± 3.92% span	OSC-4310	IP/1,2,3/A/0200/042
4) RCS Pressure (Wide Range)	OSC-10180	± 47.1 psi	± 51.2 psi	OSC-3862*, OSC-5123*	IP/1,2,3/A/0200/042
5) Reactor Vessel Head Level	OSC-9852, Section 6.6, OSC-9825	± 2.74% span	± 3.92% span	OSC-4310	IP/1,2,3/A/0200/042
6) Containment Sump Water Level (Wide Range)	OSC-9852, Section 6.7	not applicable			
7) Containment Pressure (Wide Range)	NA (12 Month SR Frequency)	not applicable			
8) Containment Isolation Valve Position	OSC-9852, Section 6.8	not applicable			
9) Containment Area Radiation (High Range)	OSC-9804	± 24.3 % of reading	± 15.03% of reading		
10) Not Used	Not Used	Not Used			
11) Pressurizer Level	OSC-9776	± 8.2 inches	± 8.3 inches (The System Engineer considered this difference negligible.)		
12) Steam Generator Water Level	OSC-9781	± 4.4 inches	± 6.9 inches	OSC-4478*	IP/0/A/0275/019 A, B
13) Steam Generator Pressure	OSC-9777	± 15.7 psig	± 9.0 psig		
14) Borated Water Storage Tank Level	OSC-9754	± 13.6 inches	± 18.1 inches	OSC-3189*	IP/0/A/0203/001 A
15) Upper Surge Tank Level	OSC-9741	± 1.98% span	± 2.23% span	OSC-2248	IP/0/A/0275/010 L
16) Core Exit Temperature	OSC-9746	± 0.33% span	± 0.26% span random; ± 0.03% span bias		
17) Subcooling Monitor (degrees subcooled)	See Items 2 & 4.				
18) a. HPI System Flow - HPI Flow	OSC-9732	± 1.77% span**	± 1.74% span (at 187.5 gpm)		
b. HPI System Flow - HPI Crossover Flow	OSC-9733	± 1.28% span**	± 1.59% span (at 187.5 gpm)	OSC-2533	IP/0/A/0202/001 D
19) LPI System Flow	OSC-9841	+ 3.31%/-3.50% span**	± 4.05% span (at 400 gpm)	OSC-3566	IP/0/A/0203/001 C
20) Not used	Not Used	Not Used			
21) Emergency Feedwater Flow	OSC-9786	± 3.01% span**	± 2.70% span (at 400 gpm)		
22) Low Pressure Service Water Flow to LPI Coolers	NA (12 Month SR Frequency)	not applicable			

* Revision of these calculations have not been approved but will be completed prior to implementation as is stated in the LAR.
** The 30 Month Drift Acceptable Limit (AL) and extended cycle Analyzed Drift (AD_E) shown are from the most conservative flow calibration point.

		AFAL Analysis	AL_{30}	AD_E	Uncertainty Calc	Cal Procedures
SR 3.3.10.2	**Wide Range Neutron Flux**	OSC-9852, Section 6.5	not applicable			
SR 3.3.11.3	**Automatic Feedwater Isolation System (AFIS) Instrumentation**	OSC-9777	± 11.2 psig	± 11.1 psig		
SR 3.3.28.2	**Low Pressure Service Water (LPSW) Standby Pump Auto-Start Circuitry**	OSC-9823	± 4.1 psig	± 7.0 psig	OSC-7693	IP/1-2,3/A/0250/001 B

SR 3.3.1.7

Table 3.3.1-1 Reactor Protective System Instrumentation		Analytical Limit[1]	Total Loop Uncertainty[2]	Allowable Value[3]	Margin[4]	Nominal Trip Setpoint[5]	Setting Tolerance[6,7]	References
1)	a. Nuclear Overpower - High Setpoint	= 112% FP	± 5.0% FP	≤ 105.5% RTP[10]	0.1875% RTP	= 104.75% FP	± 0.5625% FP	IP/1,2,3/A/0305/003 A, B, C, D; OSC-7237
	b. Nuclear Overpower - Low Setpoint	T/S AV is the only requirement.	No uncertainties applied.	≤ 5% RTP	0.5% RTP	= 4% FP	± 0.5% FP	IP/1,2,3/A/0305/003 A, B, C, D; OSC-7237
2)	RCS High Outlet Temperature	= 620 °F	± 1.08 °F	≤ 618 °F	0.3 °F	= 617 °F	± 0.7 °F	IP/1,2,3/A/0305/003 A, B, C, D; OSC-4048, OSC-2729
3)	RCS High Pressure	See response to RAI, Question 1.						
4)	RCS Low Pressure	See response to RAI, Question 1.						
5)	RCS Variable Low Pressure	See response to RAI, Question 1.						
6)	Reactor Building High Pressure	See response to RAI, Question 1.						
7)	Reactor Coolant Pump to Power	RCP's either on or off.	± 5.15% FP	> 2% RTP with ≤ 2 pumps operating	0.125% RTP	= 1.5% FP with ≤ 2 pumps operating	± 0.375% FP	IP/A/1,2,3/0305/003 A, B, C, D; OSC-7237
8)	Nuclear Overpower Flux/Flow Imbalance	See response to RAI, Question 1.						
9)	Main Turbine Trip (Hydraulic Fluid Pressure)	See response to RAI, Question 1.						
10)	Loss of Main Feedwater Pumps (Hydraulic Oil Pressure)	See response to RAI, Question 1.						
11)	Shutdown Bypass RCS High Pressure	See response to RAI, Question 1.						

SR 3.3.5.4

Table 3.3.5-1 Engineered Safeguards Protective System Analog Instrumentation		Analytical Limit[1]	Total Loop Uncertainty[2]	Allowable Value[3]	Margin[4]	Nominal Trip Setpoint[5]	Setting Tolerance[6,7]	References
1)	Reactor Coolant System Pressure - Low	= 1400 psig	+ 198.1 psi / - 120.4 psi	≥ 1590 psig	2.5 psi	= 1600 psig	± 7.5 psi	IP/0/A/0310/014A, B, C; OSC-2759
2)	Reactor Coolant System Pressure - Low Low	= 200 psig	+ 206.6 psi / - 120.4 psi	≥ 500 psig	42.5 psi	= 550 psig	± 7.5 psi	IP/0/A/0310/014A, B, C; OSC-2759
3)	Reactor Building (RB) Pressure - High	= 9 psig	± 0.6 psi (Barton); ± 0.4 psi (Rsmt)	≤ 4 psig	0.91 psi	= 3 psig	± 0.09 psi	IP/0/A/0310/014A, B, C; OSC-2495
4)	Reactor Building Pressure - High High	See response to RAI, Question 1.						

SR 3.3.8.3

Table 3.3.8-1 Post Accident Monitoring Instrumentation	Example Process Limit[8]	Total Loop Uncertainty[2]	Example Setpoint/Decision Point[9]			Setting Tolerance[6,7]	References
1) Wide Range Neutron Flux	Reactor is not shutdown when power is between 0.1% and 10% FP.	± 4.97% span (log scale); (i.e., 0.31% FP to 3.25% FP)	1% FP			± 3.0% span	IP/0/A/0301/003 A1, B1, C1, D1; OSC-6733, OSC-2820
2) RCS Hot Leg Temperature	None requiring uncertainties.	± 10.10 °F	None requiring uncertainties.			± 2.0 °F	IP/0/A/0200/041 A & B; OSC-3862, OSC-2820
3) RCS Hot Leg Level	See response to RAI, Question 1.						
4) RCS Pressure (Wide Range)	See response to RAI, Question 1.						
5) Reactor Vessel Head Level	See response to RAI, Question 1.						
6) Containment Sump Water Level (Wide Range)	No longer used in EOP's	+ 8.9 inches / -18.4 inches	NA			± 0.4 ft-H_2O	IP/0/A/0203/001 H; OSC-2578, OSC-2820
7) Containment Pressure (Wide Range)	NA (12 month SR Frequency)						
8) Containment Isolation Valve Position	Open/Closed	NA (limit switches)	Open/Closed			NA	PT/l,2,3/A/0202/012, PT/1,2,3/A/0l60/003
9) Containment Area Radiation (High Range)	Within +100% / -50% of reading.	± 32.8% of reading	None requiring uncertainties			± 18.6% of reading	IP/0/A/0361/004; OSC-2904, OSC-2820
10) Not Used	Not used						
11) Pressurizer Level	400 inches = water solid PZR	± 24 inches	375 inches (indicates water solid PZR during normal conditions)			± 3.0 in-H_2O	IP/0/A/0200/052 A; OSC-4263, OSC-2820
12) Steam Generator Water Level	See response to RAI, Question 1.						
13) Steam Generator Pressure	770 psig (to prevent FDW isolation during normal cooldown)	± 27.3 psi (normal); -2.4 psi ± 102.84 psi (harsh)	700 psig (manually deactive AFIS)			± 9.0 psi	IP/0/A/0270/013; OSC-4295, OSC-2820
14) Borated Water Storage Tank Level	See response to RAI, Question 1.						
15) Upper Surge Tank Level	See response to RAI, Question 1.						
16) Core Exit Thermocouples	maximum CETC TLU = 15 °F	+3.69°F ± 11.26°F (five TC average)	700°F (indicates ICC conditions)			± 4.0 °F	IP/0/A/0200/041 D; OSC-3862, OSC-2820
17) Subcooling Monitor (degrees subcooled)	maintain > 100 °F from NDT curve	WR Pressure & HL RTD uncertainties built into subcooled margin curves.	150°F subcooled (natural circulation cooldown)			NA	IP/1,2,3/A/200/042; OSC-3862, OSC-2820
18) a. HPI System Flow - HPI Flow	525 gpm (conservative HPI pump runout flow)	+ 22.4 gpm / - 22.8 gpm	475 gpm, indicated			± 5.6 gpm at 375 gpm	IP/0/A/0202/001 D; OSC-4083, OSC-2820
b. HPI System Flow - HPI Crossover Flow	See response to RAI, Question 1.						
19) LPI System Flow	See response to RAI, Question 1.						
20) Not used	Not used						
21) Emergency Feedwater Flow	SA assumes 200 gpm (to each SG on LSCM indication)	± 90.3 gpm	300 gpm (to each SG on LSCM indication)			± 30 gpm	IP/0/A/0275/006 A & B; OSC-3221, OSC-2820
22) Low Pressure Service Water Flow to LPI Coolers	NA (12 month SR Frequency)						

		Example Process Limit[8]	Total Loop Uncertainty[2]	Example Functional Limit[9]			Setting Tolerance[6,7]	References
SR 3.3.10.2	**Wide Range Neutron Flux**	See PAM Table 3.3.8-1, Item 1.						
SR 3.3.11.3	**Automatic Feedwater Isolation System (AFIS) Instrumentation**	SA assumes 520 psig & 3.3 psi/sec	± 18.2 psi and 0.028 psi/sec	550 psig and 2.97 psi/sec			± 6.0 psig	IP/0/A/0270/013; OSC-4295, OSC-2820
SR 3.3.28.2	**Low Pressure Service Water Standby Pump Auto-Start Circuitry**	See response to RAI, Question 1.						

Notes:

1) An Analytical Limit (AL) is defined by EDM-102 as "Limit of a measured or calculated variable established by the Safety Analyses (SA) to ensure that a Safety Limit is not exceeded".
2) Total Loop Uncertainty (TLU).
3) Allowable Value (AV) as specified in Table 3.3.1-1 (RPS) or Table 3.3.5-1 (ESPS) of ONS Technical Specifications
4) Margin = AV - NTSP - CTE for increasing trip. Margin = NTSP - AV - CTE for decreasing trip.
5) Nominal Trips Setpoint (NTSP), which is the value actually calibrated to in the instrument procedures (IP's).
6) Device or rack string setting tolerance (CTE). In this case, the rack setting tolerance consists only of the bistable.
7) The setting tolerance (CTE) is equal to the As-Found Tolerance (AFT). At Oconee, it is also equal to the As-Left Tolerance (ALT).
8) Instrument loop functions do not have Analytical Limits. An example process limit is shown instead.
9) Instrument loop functions do not have Allowable Values. An example setpoint/decision point is shown instead.
10) Rated Thermal Power (RTP) = Full Power (FP)