

PMVogleCOLPEm Resource

From: Sebrosky, Joseph
Sent: Wednesday, October 06, 2010 2:44 PM
To: PMVogleCOLPEm Resource
Subject: Summary of October 5, 2010 Public Phone Call to Discuss Issues Associated with the Vogle Units 3 and 4 Combined License Application Review
Attachments: draft info for Chapter 14 SUT LC revisions.pdf; COL-SER-OI-Ch15 S3 draft 20100927 R8 info.pdf

MEMORANDUM TO: File (Vogle Units 3 and 4 (Dockets 52-25 and 52-26))

From: Joseph Sebrosky, Project Manager
AP1000Projects Branch (NWE1)
Division of New reactor Licensing
Office of New Reactors

Subject: Summary of October 5, 2010 Public Phone Call to Discuss Issues Associated with the Vogle Units 3 and 4 Combined License Application Review

The NRC headquarters attendees were:

Ravi Joshi, Terri Spicher, Donald Habib, Juan Peralta, Tony Nakanishi, Tanya Simms, Stacy Joseph, and Tom Galletta

Participants on the call that supported the discussions for Southern were:

Amy Aughtman (SNC), Wesley Sparkman (SNC), Gary Becker (SNC), Eddie Grant (NuStart), Bob Hirmanpour (NuStart), Richard Grumbir (NuStart), Don Lindgren (Westinghouse), and Jim Hesler (Bechtel)

In addition to the Southern participants several other members of the public attended the call

The agenda for the meeting appears below and the result of the discussion are provided below.

1. Chapter 15 draft open item response

Summary of Discussion: The applicant's draft response is attached. The staff provided the following proposal regarding a license condition associated with the Caldon flow measurement system:

"The plant operating instrumentation installed for feedwater flow measurement is a Caldon [Cameron] LEFM CheckPlus™ System. The power calorimetric uncertainty calculation documented for that instrumentation must be based on the methodology described in Appendix A of ER-157, and the calculated calorimetric values must be bounded by the uncertainty value assumed for the initial reactor power in the FSAR. The administrative controls must be in place to implement maintenance and contingency activities related to the system."

In addition, the staff stated that the FSAR 15.0.3.2 initial conditions, should specify the Caldon flowmeter. The staff also noted that there appeared to be a global typographical error associated with EP-157 which should reference ER-157.

Southern indicated that it would consider the proposed license condition wording and inform the staff if it had any issues. Southern also indicated that it would revise FSAR 15.0.3.2 and fix the typographical error to address the staff's concerns.

The staff asked if proposed license condition 6 should have an implementation milestone associated with it. Southern indicated that the purpose of license condition 6 was to provide a schedule at specified intervals to allow the staff to plan for inspections. Southern believes an implementation milestone for

installation of the caldon flow measurement system was not necessary in license condition 6 because license condition 2 contained in the draft response states that the documentation of plant calorimetric uncertainty methodology will be available prior to initial fuel load. The staff took an action to again review the license conditions and determine if additional implementation license conditions were needed.

The staff asked Southern to look at the wording for FSAR 15.0.3.2 in the draft response because it was not clear. Southern agreed to review the wording, however, they indicated that the wording may be based on a COL information item and their ability to change the wording could be limited.

Action: Southern to revise response based on feedback provided during the meeting. The staff to consider whether additional license conditions are needed and provide Southern with its thoughts.

2. Chapter 14 initial test program license conditions

Summary of Discussion: The applicant's proposal regarding the chapter 14 initial test program license conditions is attached. The applicant discussed its reasons for the proposed changes. The staff indicated that the proposed changes go beyond the issue that the staff was trying to resolve. The staff indicated the proposed changes to license condition 7 and license condition 9 where the areas that were identified in its draft safety evaluation as areas needing further discussion with the applicant before the SE was published. The staff expressed concern that the draft SE may need a major revision if Vogtle submitted its proposed changes. In addition, the staff expressed concern that Southern's proposal could deviate from the resolution of the issue that the staff was developing to support issuance of a SECY paper containing a proposed 10CFR Part 52 generic license. The proposed generic license will include license conditions associated with the initial test program. The staff stated it would have internal discussions on how best to proceed and get back to the applicant after these discussions. The staff also indicated that it would review the rest of the response to identify areas outside of license condition 7 and 9 that may need changes.

Southern indicated that it would not submit the proposed response until after further discussions with the staff, however, Southern did alert the staff to changes it intended to make to license condition 7 to allow for the use of first plant only testing from China. Specifically, Southern indicated that it would change the proposed response for this license condition in the following manner:

First-Plant-Only and First-Three-Plant-Only Testing

A licensee ~~completing the testing~~ shall provide written identification of the applicable references for documentation for the completion of the testing to the Director of the Office of New Reactors (or equivalent NRC management) within thirty (30) calendar days of the licensee confirmation of acceptable test results.

Subsequent plant licensees crediting completion of testing by the first-plant or by the first-three-plants shall provide a report referencing the applicable documentation identified by the plant(s) ~~completing~~ **confirming** the testing to the Director of the Office of New Reactors (or equivalent NRC management). This report shall be provided to NRC either prior to initiation of pre-operational testing, or within 60 days of the identification of the documentation for the completion of the testing by the first plant (or third plant, as appropriate), whichever is later.

Subsequent to the phone call Southern indicated that additional changes to the wording may be forthcoming to this license condition. For example the second sentence may be changed as follows: *"first-plant or by the first-three-plants shall provide a report referencing the applicable documentation identified by the (first plant or first three)plant(s)."* In addition, subsequent to the phone call Southern indicated that they believe the minimum set of changes that need to be made are the changes described in the draft response associated with license condition 2, license condition 3, license condition 7 and license condition 9.

Action: The staff took an action to discuss the issue internally and to consider how the issue will be resolved for the Vogtle COL and generically. The staff stated that it would have further discussions with the applicant after it developed a position on how to proceed.

Hearing Identifier: Vogtle_COL_Public
Email Number: 520

Mail Envelope Properties (36CF286628C20846A68047F24632330933FF9F0454)

Subject: Summary of October 5, 2010 Public Phone Call to Discuss Issues Associated with the Vogtle Units 3 and 4 Combined License Application Review
Sent Date: 10/6/2010 2:44:05 PM
Received Date: 10/6/2010 2:44:08 PM
From: Sebrosky, Joseph

Created By: Joseph.Sebrosky@nrc.gov

Recipients:
"PMVogtleCOLPEm Resource" <PMVogtleCOLPEm.Resource@nrc.gov>
Tracking Status: None

Post Office: HQCLSTR02.nrc.gov

Files	Size	Date & Time
MESSAGE	7170	10/6/2010 2:44:08 PM
draft info for Chapter 14 SUT LC revisions.pdf		37151
COL-SER-OI-Ch15 S3 draft 20100927 R8 info.pdf		249081

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

From: [Aughtman, Amy G.](#)
To: [Sebrosky, Joseph](#); [Spicher, Terri](#)
Cc: [Joshi, Ravindra](#); ["Eddie Grant"](#); [Sparkman, Wesley A.](#); ["Richard Grumbir"](#)
Subject: draft info for Chapter 14 SUT LC revisions
Date: Thursday, September 23, 2010 7:51:03 PM

Joe and Terri,

During a couple of the recent public calls, there have been some questions and concerns regarding the proposed license conditions related to startup testing. Below is a draft letter in which we would propose revisions to simplify some of the conditions and to address the NRC identified concerns. Following your review of this information, we would like to discuss these further at your earliest availability (potentially next Thurs).

Please contact me or Eddie Grant with any questions.
Amy A.

NuStart Qb Tracking No. #####
NRC eRAI No. #####

NRC has expressed some concerns regarding the proposed License Conditions for the initial test program. In particular, the proposed License Condition 2 to address COL Information Item No. 14.4-6 seems to indicate that the first-plant-only and three-plant-only testing would be required to be met "prior to preoperational testing." It is not clear how the testing can be done by this identified milestone. Secondly, the generic model COL is expected to be revised to address completion of testing between 5% and 100% power levels. The applicant was requested to consider this possible addition.

Response:

The following propose license conditions in Part 10 of the COLA have been identified as addressing the initial test program:

- LC #2, item 14.4-2, Test Specifics and Procedures
- LC #2, item 14.4-3, Conduct of Test Program
- LC #2, item 14.4-4, Review and Evaluation of Test Results
- LC #2, item 14.4-6, First-Plant-Only and Three-Plant-Only Tests
- LC #3, item H, Startup Testing
- LC #6, item c, Schedule for Test Procedure Availability
- LC #7, First-Plant-Only and Three-Plant-Only Tests
- LC #8, Startup Testing
- LC #9, Power-Ascension Test Phase

Some of these have been identified as duplicative and redundant. As a result, while considering the above NRC expressed concerns, we have also attempted to consolidate the items and arrange them to more closely align with the expected generic model license. Each of the existing items and proposed revisions are discussed below.

LC #2, item 14.4-2, Test Specifics and Procedures

As indicated in the COLA Part 10, this information item is address by proposed License Condition #6, item c. No changes are proposed for this item.

LC #2, item 14.4-3, Conduct of Test Program

This item calls for the availability of a site-specific startup administration manual (procedure), which contains the administration procedures and requirements that govern the activities associated with the plant initial test program, as identified in FSAR Section 14.2, prior to initiating the plant initial test program.

This item appears to be unnecessary as it can be adequately addressed by a combination of proposed License Condition #3 (which requires that the operational program that addresses startup testing be implemented prior to beginning the testing) and a revised proposed License Condition #6. The revision would specifically add the site-specific startup administration manual to the items for which a schedule of availability would be provided to the NRC. See proposed change to LC #6 below. With the revision to LC #6, the LC #2, item 14.4-3, would be revised to simply indicate that the information item is addressed by LCs #3 and #6.

LC #2, item 14.4-4, Review and Evaluation of Test Results

This item calls for review and evaluation of individual test results as well as final review of overall test results and for review of selected milestones or hold points within the test phases. Additionally, test exceptions or results which do not meet acceptance criteria are identified to the affected and responsible design organizations, and corrective actions and retests, as required, are performed.

Again, this item appears to be unnecessary as it can be adequately addressed by a revised proposed License Condition #9 (which also requires review and evaluation of individual test results, and that test exceptions or results which do not meet acceptance criteria are identified to the affected and responsible organizations, and corrective actions and retests, as required, are performed). The revision would specifically add the review and evaluation of test results for those tests conducted for pre-operational testing and for above low-power testing (<5% rated thermal power) up to and including testing at 100% rated thermal power. This condition would then cover the entire startup testing program and would be retitled as "Startup Program Test Results." See proposed change to LC #9 below. With the revision to LC #9, the LC #2, item 14.4-4, would be revised to simply indicate that the information item is addressed by LC #9.

LC #2, item 14.4-6, First-Plant-Only and Three-Plant-Only Tests

This item also calls for review and evaluation of individual test results. Additionally, test exceptions or results which do not meet acceptance criteria are identified to the affected and responsible design organizations, and corrective actions and retests, as required, are performed. Finally, this item calls for written notification of test results for these items.

Again, at least the first two portions of this item appear to be unnecessary as it can be adequately addressed by a revised proposed License Condition #9 (which also requires review and evaluation of individual test results, and that test exceptions or results which do not meet acceptance criteria are identified to the affected and responsible organizations, and corrective actions and retests, as required, are performed). The revision would specifically add the review and evaluation of test results for those tests

conducted during pre-operational testing and for those conducted during power ascension, i.e., above low-power testing (<5% rated thermal power) up to and including testing at 100% rated thermal power. See proposed change to LC #9 below. With the revision to LC #9, the LC #7 would be revised to simply address the written notifications for the pertinent testing. See proposed change to LC #7 below.

It should also be noted that this is a standard condition for all AP1000 COL applications. This condition may be appropriately revised for subsequent COLAs, however, once the first-plant and first-three-plant testing has been completed and appropriate documentation is available for reference.

LC #3, item H, Startup Testing

This proposed License Condition requires that the operational program that addresses startup testing be implemented prior to beginning the testing.

LC #6, item c, Schedule for Test Procedure Availability

This item requires a schedule for availability of initial testing procedures to be provided to NRC. The item is revised to specifically add the site-specific startup administration manual to the items for which the schedule would be provided to the NRC. See proposed change to LC #6 below.

LC #7, First-Plant-Only and Three-Plant-Only Tests

This item also calls for review and evaluation of individual test results. Additionally, test exceptions or results which do not meet acceptance criteria are identified to the affected and responsible design organizations, and corrective actions and retests, as required, are performed. Finally, this item calls for written notification of test results for these items. However, the basic need and intent of this item is to provide an appropriate reference for the completion of the testing that can be used by the subsequent COLs.

Again, at least the first two portions of this item appear to be unnecessary as it can be adequately addressed by a revised proposed License Condition #9 (which also requires review and evaluation of individual test results, and that test exceptions or results which do not meet acceptance criteria are identified to the affected and responsible organizations, and corrective actions and retests, as required, are performed). The revision would specifically add the review and evaluation of test results for those tests conducted during pre-operational testing and for those conducted during power ascension, i.e., above low-power testing (<5% rated thermal power) up to and including testing at 100% rated thermal power. See proposed change to LC #9 below. With the revision to LC #9, the LC #7 would be revised to simply address the written notifications to identify the applicable references for documentation for the pertinent testing. See proposed change to LC #7 below.

It should also be noted that this is a standard condition for all AP1000 COL applications. This condition may be appropriately revised for subsequent COLAs, however, once the first-plant and first-three-plant testing has been completed and appropriate documentation is available for reference.

LC #8, Startup Testing

This item calls for reporting of any changes made to the Initial Startup Test Program described in Chapter 14 of the FSAR (and the incorporated by reference DCD Chapter 14)

shall be reported in accordance with 50.59(d) within one month of such change. No changes are proposed for this item.

LC #9, Power-Ascension Test Phase

This item calls for review and evaluation of individual test results as well as notification of completion of the test phases. Additionally, test exceptions or results which do not meet acceptance criteria are identified to the affected and responsible design organizations, and corrective actions and retests, as required, are performed. Finally, the licensee would also be required to notify the NRC of its completion of the each phase of the testing program following the initial fuel loading.

The revision would specifically add the review and evaluation of test results for those tests conducted during pre-operational testing and for those conducted during power ascension, i.e., above low-power testing (<5% rated thermal power) up to and including testing at 100% rated thermal power. With these additions, the condition would then cover the entire startup testing program and would be retitled as "Startup Program Test Results." See proposed change to LC #9 below.

The changes identified in the COL Application Revisions section below will be included in a future COLA amendment.

This response is expected to be STANDARD for the S-COLAs.

Associated VEGP COL Application Revisions:

1. COLA Part 10, Proposed License Conditions, including ITAAC, proposed License Condition #2, item 14.4-3, Conduct of Test Program, will be revised from:

14.4-3 Conduct of Test Program 14.4.3 Prior to initiating test program
A site-specific startup administration manual (procedure), which contains the administration procedures and requirements that govern the activities associated with the plant initial test program, as identified in FSAR Section 14.2, is provided prior to initiating the plant initial test program.

To read:

14.4-3 Conduct of Test Program 14.4.3
NOTE –addressed by proposed License Conditions #3 and #6.

2. COLA Part 10, Proposed License Conditions, including ITAAC, proposed License Condition #2, item 14.4-4, Review and Evaluation of Test Results, will be revised from:

14.4-4 Review and Evaluation of Test Results 14.4.4 Prior to initial fuel load
The Combined License holder is responsible for review and evaluation of individual test results as well as final review of overall test results and for review of selected milestones or hold points within the test phases. Test exceptions or results which do not meet acceptance criteria are identified to the affected and responsible design organizations, and corrective actions and retests, as required, are performed.

To read:

14.4-4 Review and Evaluation of Test Results 14.4.4
NOTE –addressed by proposed License Condition #9.

3. COLA Part 10, Proposed License Conditions, including ITAAC, proposed License Condition #2, item 14.4-6, First-Plant-Only and Three-Plant-Only Tests, will be revised

from:

14.4-6 First-Plant-only and Three-Plant-Only Test 14.4.4 Prior to initial fuel load
The COL holder for the first plant and the first three plants will perform the tests listed in subsection 14.2.5. For subsequent plants, either tests listed in subsection 14.2.5 shall be performed, or the COL applicant shall provide a justification that the results of the first-plant-only tests or first-three-plant tests are applicable to the subsequent plant.
The Combined License holder(s) for the first AP 1000 plant (or first three plants) available for testing will perform the tests defined during preoperational and startup testing as identified in subsections 14.2.9 and 14.2.10. Combined License holders referencing the results of the tests will provide the report as necessary. The schedule for providing this information will be provided prior to preoperational testing.

To read:

NOTE –addressed by proposed License Conditions #7 and #9.

4. COLA Part 10, Proposed License Conditions, including ITAAC, proposed License Condition #6, Operational Program Readiness, will be revised from:

- c. the approved preoperational and startup test procedures in accordance with FSAR Subsection 14.2.3.

To read:

- c. the approved preoperational and startup test procedures (including the site-specific startup administration manual (procedure) prior to initiating the plant initial test program) in accordance with FSAR Subsection 14.2.3.

5. COLA Part 10, Proposed License Conditions, including ITAAC, will be revised to include a new License condition. Line item 7 will be revised from:

7. First-Plant-Only and First-Three-Plant-Only Testing

Certain design features of the AP1000 plant will be subjected to special tests to establish unique phenomenological performance parameters of the AP1000 design. Because of the standardization of the AP1000 design, these special tests (designated as first-plant-only tests and first-three-plant-only tests) are not required on subsequent plants. These tests will be controlled through license conditions to ensure that relevant test results are reviewed, evaluated, and approved by the designated licensee management before proceeding with the next testing phase. Accordingly, the following license condition is proposed:

First-Plant-Only and First-Three-Plant-Only Testing

Following completion of the testing, the licensee completing the testing shall review and evaluate individual test results. Test exceptions or results which do not meet acceptance criteria are identified to the affected and responsible organizations, and corrective actions and tests, as required, are performed.

Additionally, the licensee completing the testing shall also provide written notification of completion of the testing to the Director of the Office of New Reactors.

1. For testing completed during pre-critical testing, criticality testing, and during low-power testing, these reports may be in conjunction with the test completion reports required for the power ascension test phase as identified below.
2. For tests completed during operation above 5% RTP, the reports shall be provided for each individual test within thirty (30) calendar days of the licensee confirmation of completion of the testing.

Subsequent plant licensees crediting completion of testing by the first-plant or by the first-three-plants shall provide a report referencing the written notification of completion submitted by the plant(s) completing the testing to the Director of the Office of New Reactors.

To read:

7. First-Plant-Only and First-Three-Plant-Only Testing

Certain design features of the AP1000 plant will be subjected to special tests to establish unique phenomenological performance parameters of the AP1000 design. Because of the standardization of the AP1000 design, these special tests (designated as first-plant-only tests and

first-three-plant-only tests) are not required on subsequent plants. Once these tests are completed by the first plant (or first three plants) and appropriate documentation identified, the subsequent plants need only reference the applicable documentation to show that the first plant (or first three plants) completed the required testing. Accordingly, the following license condition is proposed:

First-Plant-Only and First-Three-Plant-Only Testing

A licensee completing the testing shall provide written identification of the applicable references for documentation for the completion of the testing to the Director of the Office of New Reactors (or equivalent NRC management) within thirty (30) calendar days of the licensee confirmation of acceptable test results.

Subsequent plant licensees crediting completion of testing by the first-plant or by the first-three-plants shall provide a report referencing the applicable documentation identified by the plant(s) completing the testing to the Director of the Office of New Reactors (or equivalent NRC management). This report shall be provided to NRC either prior to initiation of pre-operational testing, or within 60 days of the identification of the documentation for the completion of the testing by the first plant (or third plant, as appropriate), whichever is later.

6. COLA Part 10, Proposed License Conditions, including ITAAC, proposed License Condition #9, Power Ascension Test Phase, will be revised to address the complete startup testing program, with additions for pre-operational testing, and for above 5% up to and including 100% rated thermal power from:

9. Power Ascension Test Phase

Pre-critical and Criticality Testing

1. Following completion of pre-critical and criticality testing, the licensee shall review and evaluate individual test results. Test exceptions or results which do not meet acceptance criteria are identified to the affected and responsible organizations, and corrective actions and retests, as required, are performed.

2. The licensee shall provide written notification to the Director of the Office of New Reactors within fourteen (14) calendar days of completion of the pre-critical and criticality testing.

Low-Power (<5% RTP) Testing

1. Following completion of low-power (<5% RTP) testing, the licensee shall review and evaluate individual test results. Test exceptions or results which do not meet acceptance criteria are identified to the affected and responsible organizations, and corrective actions and retests, as required, are performed.

2. The licensee shall provide written notification to the Director of the Office of New Reactors within fourteen (14) calendar days of completion of the low power testing.

To read:

9. Startup Program Test Results

Pre-operational Testing

Following completion of pre-operational testing, the licensee shall review and evaluate individual test results. Test exceptions or results which do not meet acceptance criteria are identified to the affected and responsible organizations, and corrective actions and retests, as required, are performed.

Pre-critical and Criticality Testing

1. Following completion of pre-critical and criticality testing, the licensee shall review and evaluate individual test results. Test exceptions or results which do not meet acceptance criteria are identified to the affected and responsible organizations, and corrective actions and retests, as required, are performed.

2. The licensee shall provide written notification to the Director of the Office of New Reactors within fourteen (14) calendar days of completion of the pre-critical and criticality testing.

Low-Power (<5% RTP) Testing

1. Following completion of low-power testing (<5% RTP), the licensee shall review and evaluate individual test results. Test exceptions or results which do not meet acceptance criteria are

identified to the affected and responsible organizations, and corrective actions and retests, as required, are performed.

2. The licensee shall provide written notification to the Director of the Office of New Reactors within fourteen (14) calendar days of completion of the low-power testing.

At-Power (5%-100% RTP) Testing

1. Following completion of at-power testing (at or above 5% RTP up to and including testing at 100% RTP), the licensee shall review and evaluate individual test results. Test exceptions or results which do not meet acceptance criteria are identified to the affected and responsible organizations, and corrective actions and retests, as required, are performed.

2. The licensee shall provide written notification to the Director of the Office of New Reactors within fourteen (14) calendar days of completion of the at-power testing.

eRAI Tracking No. 3951

NuStart Qb Tracking No. 4161

NRC SER OI Number 15.00-01:

AP1000 COL Information Item- Summary of Application

· COL 15.0-1

This COL information item was provided in a response to a request for additional information (RAI) related to the AP1000 design certification amendment review. Specifically, in its response dated May 6, 2009, (Agencywide Documents Access and Management System (ADAMS) Accession Number ML091310260) to NRC RAI AP1000 DCD RAI-SRP15.0-SRSB-02, Westinghouse proposed COL Information Item 15.0-1 to provide documentation of the plant calorimetric uncertainty methodology. It should be noted that the BLN applicant has not yet proposed this item. RAI-SRP15.0-SRSB-02 noted that the AP1000 DCD assumes a 2 percent power uncertainty for the initial condition for most accidents that are not departure from nucleate boiling limited. However, a 1 percent power uncertainty is assumed for the initial reactor power for the large-break loss-of-coolant accident (LOCA) in DCD Section 15.6.5.4A, as well as the mass and energy release calculation in DCD Sections 6.2.1.3 and 6.2.1.4. In response to this RAI, Westinghouse proposed a new COL information item to be included in the AP1000 DCD Section 15.0.15 (Revision 18). COL Information Item 15.0-1 states that:

Following selection of the actual plant operating instrumentation and calculation of the instrumentation uncertainties of the operating plant parameters prior to fuel load, the Combined License holder will calculate the primary power calorimetric uncertainty. The calculations will be completed using an NRC acceptable method and confirm that the safety analysis primary power calorimetric uncertainty bounds the calculated values.

AP1000 COL Information Item - Technical Evaluation

· COL 15.0-1

Although Westinghouse has proposed COL Information Item 15.0-1, the BLN application does not address this item. Therefore, the staff cannot complete its evaluation until this information is provided. This is **Open Item 15.0-1**.

Supplemental Request:

As a follow-up item, NRC requested that the four items from the Safety Evaluation Report for use of the Caldon CheckPlus™ Leading Edge Flow Meter (LEFM) be addressed. The SER states:

“The ER recommended that each licensee will submit, as part of the power uprate package, a detailed accounting of the uncertainties applicable to the licensed facility, and will maintain, as part of the plant design documents, the LEFM calibration and other data justifying the proposed power uprate. In addition to the guidelines outlined in ER-80P and ER-157P, the following requirements shall be addressed by licensees referencing ER-157P in their request for a power uprate...”

These items are:

1. The licensee should discuss the maintenance and calibration procedures that will be implemented with the incorporation of the LEFM. These procedures should include processes and contingencies for an inoperable LEFM and the effect on thermal power measurement and plant operation.

2. For plants that currently have LEFM installed, the licensee should provide an evaluation of the operational and maintenance history of the installation and confirm that the installed instrumentation is representative of the LEFM system, and bounds the analysis and assumptions set forth in ER-80P.
3. The licensee should confirm that the methodology used to calculate the uncertainty of the LEFM in comparison to the current feed water instrumentation is based on accepted plant setpoint methodology (with regard to the development of instrument uncertainty). If an alternate methodology is used, the application should be justified and applied to both venturi and the LEFM for comparison.
4. Licensees for plant installations where the LEFM was not installed with flow elements calibrated to a site-specific piping configuration (flow profiles and meter factors not representative of the plant-specific installation), should provide additional justification for use. This justification should show either that the meter installation is independent of the plant-specific flow profile for the stated accuracy, or that the installation can be shown to be equivalent to known calibrations and the plant configuration for the specific installation, including the propagation of flow profile effects at higher Reynolds numbers. Additionally, for previously installed and calibrated LEFM, the licensee should confirm that the piping configuration remains bounding for the original LEFM installation and calibration assumptions.

SNC Response:

The measurement of the AP1000 reactor thermal power will be performed using a standard secondary side heat balance approach. This heat balance utilizes steam, feedwater, and steam generator blowdown enthalpies and flow rates as measured by plant process instrumentation. As a result, the AP1000 power measurement uncertainty will be based on the measurement of steamline pressure, feedwater pressure, feedwater temperature, feedwater flow, and steam generator blowdown flow. Industry experience with reactor power sensitivity studies have shown that the reactor power measurement uncertainty is significantly affected by the calculation of feedwater flow. Therefore, to facilitate measurement of reactor power with uncertainty of 1-percent, the plant operating instrumentation selected for feedwater flow is the Caldon CheckPlus™ Leading Edge Flow Meter (LEFM) ultrasonic flow measurement (UFM) instrumentation.

The Caldon CheckPlus™ LEFM system has been previously approved by NRC for supporting the 1 percent power measurement uncertainty. See Caldon Engineering Report (ER)-80P, "Improving Thermal Power Accuracy and Plant Safety While Increasing Operating Power Level Using the LEFM Check™ System," and the associated Safety Evaluation dated March 8, 1999 (ADAMS Accession No. 9903190065 – legacy library). ER-80P was supplemented by Caldon ER-157P, "Basis for a Power Uprate With the LEFM Check™ or LEFM CheckPlus™ System," and the associated NRC Safety Evaluation dated December 20, 2001 (ADAMS Accession No. ML013540256). The NRC reviewed and approved ER-80P and ER-157P again on July 5, 2006 (ADAMS Accession No. ML061700222), as part of its generic assessment of the hydraulic aspects of ultrasonic flow measurement application. (Note that Caldon, Inc. is now a part of the Measurement Systems Division of Cameron International Corporation ("Cameron"). The name "Caldon" continues to be used in describing their UFM's.) The four items from the Safety Evaluation Report for use of the Caldon CheckPlus™ Leading Edge Flow Meter (LEFM) are repeated and addressed below.

A statement is added to FSAR subsection 15.0.3.2 to identify that the actual selected plant operating instrumentation uncertainties are documented to calculate a power calorimetric uncertainty and confirm that the uncertainty assumed for the initial reactor power in the safety analysis bounds the calculated calorimetric values. A license condition is proposed to confirm that the instrumentation indicated above has been installed in the plant and the appropriate

administrative controls are in place. Additionally, the new AP1000 COL information item is addressed as shown in the COLA Application Revisions section below. The identified COLA revisions will be included in a future application amendment.

Information to address the Safety Evaluation Report conditions for EP157P Revision 5 regarding use of the Caldon CheckPlus™ Leading Edge Flow Meter (LEFM)

Each of the four items from the Caldon SER is repeated below and addressed immediately following the item.

1. The licensee should discuss the maintenance and calibration procedures that will be implemented with the incorporation of the LEFM. These procedures should include processes and contingencies for an inoperable LEFM and the effect on thermal power measurement and plant operation.

AP1000 COLA application

Implementation of the Leading Edge Flow Meter (LEFM) includes developing the necessary procedures and documents required for maintenance and calibration of the new Caldon LEFM CheckPlus System. Plant procedures are to be developed to incorporate Caldon's maintenance and calibration requirements prior to declaring the Caldon LEFM CheckPlus System operational. The incorporation of, and continued adherence to, these requirements provides proper maintenance and calibration of the Caldon LEFM CheckPlus System.

System maintenance and contingency plans for operation of the plant with the Caldon LEFM CheckPlus out of service are described below.

Maintenance Plans

Calibration and maintenance for the Caldon LEFM CheckPlus System hardware and instrumentation is performed using procedures developed based on the appropriate Caldon LEFM CheckPlus technical manuals. Other calorimetric process instrumentation and computer points are also maintained and periodically calibrated in accordance with procedures. Preventative Maintenance (PM) tasks are periodically performed within the plant control system and support systems to provide continued reliability. The work is planned and executed in accordance with the plant work control processes and procedures.

The LEFM Check-Plus System software configuration is also maintained in accordance with plant procedures developed for that purpose. The plant control system software configuration is maintained in accordance with a change control process which includes verification and validation of changes to software configuration. Configuration of the hardware associated with the LEFM CheckPlus System and the calorimetric process instrumentation is maintained in accordance with plant configuration control processes.

Contingency Plans

Plant instrumentation that affects the power calorimetric, including the Caldon LEFM CheckPlus inputs, are monitored by the plant system engineering personnel. These instruments are included in the plant PM program for periodic calibration. Problems that are detected are documented per the plant corrective action process and necessary actions are planned and implemented. Corrective action procedures, which provide compliance with the requirements of 10 CFR Part 50, Appendix B, include instructions for notification of deficiencies and error reporting.

In addition, an administrative control is provided for the operation of the plant at power with the device out of service. The controls provide for de-rating the plant output to power levels consistent with a 2% plant uncertainty. With the AP1000 operating at 100% load with 1% uncertainty, a de-rating to 99% would permit for a 2% safety margin to be maintained.

Monitoring of plant calorimetric power with the device out of service is supported by the use of the feedwater venturi elements installed in each feedwater line, as discussed in the AP1000 Design Control Document (DCD) Subsection 10.4.7.5.

A failure of an LEFM would not leave the plant in a condition where steady-state operation would be immediately compromised since it would not directly impact the calibration of the nuclear instrumentation utilized for power level related trips or safety system actuations. Thus, procedures require confirmation of the availability of alternate instrumentation (i.e., the feedwater venturi instrumentation) and initiation of the above described reduction in power within 48 hours. The LEFM out-of-service would result in a continuous derating of the unit until restored to service and thus, plant management would not allow this condition to exist for an extended period if restoration is possible. Note however, that once the plant is in a derated condition, continued steady-state operation in this condition (while not economically desired) would present no safety concern.

2. For plants that currently have LEFM installed, the licensee should provide an evaluation of the operational and maintenance history of the installation and confirm that the installed instrumentation is representative of the LEFM system, and bounds the analysis and assumptions set forth in ER-80P.

AP1000 COLA application

This application represents construction of a new plant with no previously installed LEFM equipment. As such, this item is not applicable.

3. The licensee should confirm that the methodology used to calculate the uncertainty of the LEFM in comparison to the current feed water instrumentation is based on accepted plant setpoint methodology (with regard to the development of instrument uncertainty). If an alternate methodology is used, the application should be justified and applied to both venturi and the LEFM for comparison.

AP1000 COLA application

The AP1000 is a new plant design and, as a result, the LEFM will not be installed with pre-existing feedwater instrumentation and associated setpoint methodology. Therefore, compliance with an existing plant setpoint methodology is not applicable. The methodology used to calculate the uncertainty of the LEFM is required to be in compliance with the AP1000 setpoint methodology (WCAP-16361). To meet this requirement, the AP1000 setpoint methodology includes power uncertainty values bounded by the licensing basis. (Reference NRC Safety Evaluation August 2007 - ADAMS Accession No. ML072260620)

The uncertainty of the LEFM is bounded by the uncertainty input values used in the AP1000 plant setpoint methodology. The documentation of the AP1000 calorimetric power is consistent with the revised thermal design procedure (RTDP).

4. Licensees for plant installations where the LEFM was not installed with flow elements calibrated to a site-specific piping configuration (flow profiles and meter factors not representative of the plant-specific installation), should provide additional justification for use.

This justification should show either that the meter installation is independent of the plant-specific flow profile for the stated accuracy, or that the installation can be shown to be equivalent to known calibrations and the plant configuration for the specific installation, including the propagation of flow profile effects at higher Reynolds numbers. Additionally, for previously installed and calibrated LEFM, the licensee should confirm that the piping configuration remains bounding for the original LEFM installation and calibration assumptions.”

AP1000 COLA application

This application represents construction of a new plant with no previously installed flow metering equipment. The AP1000 main feedwater flow measurement instrumentation, consistent with the use of normalized flow meters, is required to be calibrated at a certified test laboratory in hydraulic model geometry consistent with AP1000 plant design. The LEFM commissioning process (i.e., installation acceptance testing) confirms the actual instrument performance is consistent with the assumptions of the uncertainty calculation. Therefore, additional justification for use of the LEFM is not required.

Second Supplemental Request:

As a follow-up item, NRC requested that the five items from the recent Safety Evaluation Report for use of the Caldon LEFM be addressed. The SER states:

“The NRC staff has found that Engineering Report ER-157P, Revision 8, is acceptable for referencing in licensing applications for a measurement uncertainty recapture application for power uprate using the leading edge flow meter (LEFM) Check or LEFM CheckPlus system for feedwater flow and temperature measurements to the extent specified and under the limitations delineated in the TR and in the enclosed final SE.”

Information to address the Safety Evaluation Report conditions for EP157P Revision 8 regarding use of the Caldon CheckPlus™ Leading Edge Flow Meter (LEFM)

Each of the five items from the Caldon SER is repeated below and addressed immediately following the item.

1. Continued operation at the pre-failure power level for a pre-determined time and the decrease in power that must occur following that time are plant-specific and must be acceptably justified.

AP1000 COLA application

The AP1000 obtains measurement of feedwater flow using two different instrumentation technologies installed in series; a UFM and an ASME PTC-19.5 compliant venturi, respectively. Failure of the UFM will result in the use of the feedwater venturi as the input into the calorimetric calculation.

Details concerning the reduction in plant power and time limitations are discussed in the response to item 1 of the Revision 5 SER criteria provided in the response above under the heading “Contingency Plans.” The applicability and magnitude of the contingency actions are justified based on the application of a venturi-based calorimetric uncertainty and experience with comparable LEFM installations that have been reviewed and approved by the NRC staff.

2. A CheckPlus operating with a single failure is not identical to an LEFM Check. Although the effect on hydraulic behavior is expected to be negligible, this must be acceptably quantified if a licensee wishes to operate using the degraded CheckPlus at an increased uncertainty.

AP1000 COLA application

A degraded UFM resulting in an instrument uncertainty greater than the values assumed in the AP1000 calorimetric uncertainty calculation will be considered as failed and subject to compensatory actions as discussed in LEFM installation criteria #1.

Single failures (i.e., transducer failure) shall be quantitatively addressed as part of the calibration process, documented in the calibration report, and may be used to justify alternative compensatory actions.

3. An applicant with a comparable geometry can reference the above Section 3.2.1 finding to support a conclusion that downstream geometry does not have a significant influence on CheckPlus calibration. However, CheckPlus test results do not apply to a Check and downstream effects with use of a CheckPlus with disabled components that make the CheckPlus comparable to a Check must be addressed. An acceptable method is to conduct applicable Alden Laboratory tests.

AP1000 COLA application

The AP1000 feedwater flow measurement instrumentation is located in piping with downstream geometry more favorable than the arrangements referenced in Section 3.2.1 of the SER. Therefore, the effects of downstream piping geometry are not considered to have a significant influence on the accuracy of the UFM.

Failure of a single plane of transducers shall be tested as part of the calibration process and documented in the calibration report to support the resolution of any identified Check vs CheckPlus hydraulic effects.

4. An applicant that requests a MUR with the upstream flow straightener configuration discussed in Section 3.2.2 should provide justification for claimed CheckPlus uncertainty that extends the justification provided in Reference 17. Since the Reference 17 evaluation does not apply to the Check, a comparable evaluation must be accomplished if a Check is to be installed downstream of a tubular flow straightener.

AP1000 COLA application

The AP1000 UFM installation does not utilize an upstream flow straightener. Therefore, this conclusion is not applicable to the AP1000 design.

5. An applicant assuming large uncertainties in steam moisture content should have an engineering basis for the distribution of the uncertainties or, alternatively, should ensure that their calculations provide margin sufficient to cover the differences shown in Figure 1 of Reference 18.

AP1000 COLA application

Topical report ER-157P, Revision 8, contains justification for an overall power uncertainty of 0.4% with the use of a CheckPlus UFM. With this high accuracy, the use of an assumed steam separation/dryer performance will result in a large contribution to the overall power uncertainty.

However, it should be noted that this AP1000 application is for 1% overall power uncertainty. The result of this application of the LEFM at a lower accuracy is that the assumed steam separator/dryer performance becomes less of a relative contribution to the overall uncertainty.

Furthermore, an engineering basis for the AP1000 moisture content assumption is contained in the calorimetric uncertainty calculation, which is documented to support the plant setpoint methodology as discussed in the response to LEFM installation criteria #3.

This response is expected to be STANDARD for the S-COLAs.

Associated VEGP COL Application Revisions:

1. COLA Part 2, FSAR Chapter 1, Section 1.8, Table 1.8-202, will be revised to include a new line item for COL item 15.0-1 as follows:

15.0-1	Documentation of Plant Calorimetric Uncertainty Methodology	15.0.15.1	15.0.15	H
--------	---	-----------	---------	---

2. COLA Part 2, FSAR Chapter 15, Section 15.0, will be revised from:

This **section** of the referenced DCD is incorporated by reference with no departures or supplements.

To read (new sections will include LMA of STD COL 15.0-1):

This **section** of the referenced DCD is incorporated by reference with the following departures and/or supplements.

15.0.3.2 Initial Conditions

Add the following paragraph at the end of **DCD Subsection 15.0.3.2**.

The selected plant operating instrumentation has documented instrumentation uncertainties to calculate a power calorimetric uncertainty that confirms the uncertainty assumed for the initial reactor power in the safety analysis bounds the calculated calorimetric values.

15.0.15 Combined License Information

Add the following text to the end of **DCD Subsection 15.0.15.1**.

This COL item is addressed in **FSAR Subsection 15.0.3.2**.

3. COLA Part 10, Proposed License Conditions, LC#2, will be revised to include a new line item for COL item 15.0-1 as follows:

15.0-1	Documentation of Plant Calorimetric Uncertainty Methodology	15.0.15.1	Prior to initial fuel load
--------	---	-----------	----------------------------

The selected plant operating instrumentation has documented instrumentation uncertainties to calculate a power calorimetric uncertainty that confirms the uncertainty assumed for the initial reactor power in the safety analysis bounds the calculated calorimetric values. Additionally, confirm the administrative controls are in place to implement maintenance and contingency activities related to the system.

4. COLA Part 10, Proposed License Conditions, LC#6, will be revised to include a new line item for availability of documentation of plant calorimetric uncertainty methodology as follows (where # is the next appropriate letter designation):
 - #. the availability of documented instrumentation uncertainties to calculate a power calorimetric uncertainty.

DRAFT