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Your ref: Docket No. 52-006
Our ref: DCP/NRC2461

May 6, 2009

Subject: AP1000 Response to Request for Additional Information (SRP 15)

Westinghouse is submitting a response to the NRC request for additional information (RAI) on SRP Section 15. This RAI response is submitted in support of the AP1000 Design Certification Amendment Application (Docket No. 52-006). The information included in this response is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification and the AP1000 Design Certification Amendment Application.

Enclosure 1 provides the response for the following RAI(s):

RAI-SRP15.0-SRSB-02

Questions or requests for additional information related to the content and preparation of this response should be directed to Westinghouse. Please send copies of such questions or requests to the prospective applicants for combined licenses referencing the AP1000 Design Certification. A representative for each applicant is included on the cc: list of this letter.

Very truly yours,

D. H. Lindgren /FOR

Robert Sisk, Manager
Licensing and Customer Interface
Regulatory Affairs and Standardization

/Enclosure

1. Response to Request for Additional Information on SRP Section 15

D063
NRO

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ENCLOSURE 1

Response to Request for Additional Information on SRP Section 15

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP15.0-SRSB-02
Revision: 0

Question:

In AP1000 DCD Revision 17, Section 15.0.3.2, "Initial Conditions," "Footnote a." to Table 15.0-2, and various places in Chapter 15, the following statement is added:

> "The main feedwater flow measurement supports a 1-percent power uncertainty; use of a 2-percent uncertainty is conservative."

Although, in DCD Rev 17, a 2% power uncertainty is assumed for the initial condition for most accidents that are not DNB limited, a 1% power uncertainty is assumed for the initial reactor power for the large-break LOCA analysis in DCD Section 15.6.5.4A, as well as the mass and energy release calculations in DCD Sections 6.2.1.3 and 6.2.1.4. However, the AP1000 DCD does not describe the instrumentation or methodology for the main feedwater flow measurement, nor provide a basis for the statement that the main feedwater flow measurement supports a 1-percent power uncertainty.

a. Describe the mechanism, such as the AP1000 DCD and ITAAC or a COL action item, by which the information will be provided to support claimed 1-percent power measurement uncertainty and how it will be verified and confirmed.

b. The following information should be provided to support the claimed 1-percent power measurement uncertainty:

   (1) A description of the instrumentation and methodology used for the main feedwater flow measurement and calorimetric power measurement.

   (2) Either of the following:

      A. A reference to the NRC approval of the main feedwater and power measurement methodology, instrumentation, and associated uncertainties. Or

      B. A detailed description of the analyses of the main feedwater flow measurement and power measurement uncertainties, respectively. The description should include information such as:

         1) the parameters measured, e.g., feedwater flow rate, pressure, and inlet and outlet temperatures;

         2) the instrument string, including applicable sensors or transducers, process rack, analog/digital converter, process computer, and readout devices, etc., for each parameter measured;

3) the accuracy of allowance associated with each instrument component, such as sensor reference, calibration, and measurement accuracies, respectively; rack calibration and measurement accuracies; sensor pressure and temperature effects; rack pressure and temperature effects; drift; process measurement accuracy; instrument range, span, and operating limits, etc.;

4) the methodology for combining uncertainties, allowances, or errors of the instrument components associated with each parameter to arrive at the overall uncertainty of each measured parameter; and

5) the methodology used to arrive at the total uncertainties for the main feedwater flow rate and reactor thermal power, respectively.

Westinghouse Response:

The AP1000 has been designed to utilize proven technologies and methodologies in order to increase reliability and performance. In this regard, the AP1000 will utilize the proven application of high-accuracy ultrasonic feedwater flow measurement and high-accuracy feedwater temperature measurement to affect a high accuracy primary plant calorimetric.

As required by 10 CFR 50 Appendix K, the standard calorimetric uncertainty utilized for the design and licensing of nuclear power plants is 2%. However, given a detailed analysis of the primary plant calorimetric uncertainty, licensees may reduce the design uncertainty. The AP1000 has been designed to utilize a primary plant calorimetric uncertainty of 1% for use in DCD Chapter 4 fuels analyses, Chapter 6 containment mass and energy analyses, and Chapter 15 design basis accident analyses.

In accordance with the Code of Federal Regulations, the AP1000 licensees will calculate the plant calorimetric uncertainty and verify the actual plant instrumentation performance is bounded by the design value of 1% calorimetric uncertainty. For traceability, a combined license information item has been included in this response. Additionally, references to this combined license information item will be references in applicable Chapters of the AP1000 DCD for completeness.

Design Control Document (DCD) Revision:

Table 1.8-2 (Sheet 11 of 13)

SUMMARY OF AP1000 STANDARD PLANT COMBINED LICENSE INFORMATION ITEMS

Item No.	Subject	Subsection	Addressed by Westinghouse Document	Action Required by COL Applicant	Action Required by COL Holder
14.4-6	First-Plant-Only and Three-Plant-Only Tests	14.4.6	APP-GW-GLR-021	Yes	Yes
15.0-1	**Documentation of Plant Calorimetric Uncertainty Methodology**	**15.0.15**	**N/A**	–	**Yes**
15.7-1	Consequences of Tank Failure	15.7.6	N/A	Yes	–
17.5-3	Design Reliability Assurance Program/Site Specific List of Systems, Structures and Components	17.5.3	APP-GW-GLR-117	No	No

4.3.1.3 Control of Power Distribution

4.3.1.3.1 Basis

The nuclear design basis is that, with at least a 95 percent confidence level:

- The fuel will not operate with a power distribution that would result in exceeding the departure from nucleate boiling (DNB) design basis (i.e., the departure from nucleate boiling ratio (DNBR) shall be greater than the design limit departure from nucleate boiling ratio as discussed in subsection 4.4.1) under Condition I and II occurrences, including the maximum overpower condition.

- Under abnormal conditions, including the maximum overpower condition, the peak linear heat rate (PLHR) will not cause fuel melting, as defined in subsection 4.4.1.2.

- Fuel management will be such as to produce values of fuel rod power and burnup consistent with the assumptions in the fuel rod mechanical integrity analysis of Section 4.2.

- The fuel will not be operated at Peak Linear Heat Rate (PLHR) values greater than those found to be acceptable within the body of the safety analysis under normal operating conditions, including an allowance of one percent for calorimetric error **(calorimetric uncertainty calculation will be provided per 15.0.15.1)**.

The above basis meets General Design Criterion 10.

6.2.1.3.2.1 Mass and Energy Sources

The following are accounted for in the long-term LOCA mass and energy calculation:

- Decay heat
- Core stored energy
- Reactor coolant system fluid and metal energy
- Steam Generator fluid and metal energy
- Accumulators core make-up tanks (CMTs), and the in-containment refueling water storage tank (IRWST)
- Zirconium-water reaction

The methods and assumptions used to release the various energy sources during the blowdown phase are given in Reference 4.

The following parameters are used to conservatively analyze the energy release for maximum containment pressure **(calorimetric uncertainty calculation will be provided per 15.0.15.1)**:

- Maximum expected operating temperature
- Allowance in temperature for instrument error and dead band
- Margin in volume (+1.4 percent)
- Allowance in volume for thermal expansion (+1.6 percent)
- 100 percent full power operation
- Allowance for calorimetric error (+1.0 percent of full power)
- Conservatively modified coefficients of heat transfer
- Allowance in core stored energy for effect of fuel densification
- Margin in core stored energy (+15.0 percent)
- Allowance in pressure for instrument error and dead band
- Margin in steam generator mass inventory (+10.0 percent)
- One percent of the Zirconium surrounding the fuel is assumed to react

15.0.15 Combined License Information

15.0.15.1 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 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

PRA Revision:
None

Technical Report (TR) Revision:
None