March 9, 2011

MEMORANDUM TO: Stephen J. Campbell, Chief
Watts Bar Special Projects Branch
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

FROM: Anthony P. Ulses, Chief **/RA/**
Reactor Systems Branch
Division of Safety Systems
Office of Nuclear Reactor Regulation

SUBJECT: AUDIT PLAN – WATTS BAR NUCLEAR PLANT UNIT 2 COMPLETION of LICENSING ACTIVITIES

By letter dated January 29, 2008, the Tennessee Valley Authority, the applicant for an operating license for the Watts Bar Nuclear Plant Unit 2 (WB2), submitted a description of the regulatory framework for the completion of licensing activities for WB2. Consequently, the SRXB staff resumed its review of TVA's license application. In order to complete its review, the SRXB staff needs to conduct an audit at the applicant's fuel vendor facilities, in order to understand the bases for certain accident analyses, reported in the applicant's FSAR.

The staff's proposed audit plan is enclosed.

Enclosure:
As Stated

Contact: Samuel Miranda, NRR/DSS/SRXB
(301) 415-2303

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Date	3/9/11	3/9/11

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AUDIT PLAN
FSAR ACCIDENT ANALYSES
TENESSEE VALLEY AUTHORITY
WATTS BAR NUCLEAR PLANT UNIT 2
DOCKET NO. 50-391

By letter dated January 29, 2008, the Tennessee Valley Authority, the applicant for an operating license for the Watts Bar Nuclear Plant Unit 2 (WB2), submitted a description of the regulatory framework for the completion of licensing activities for WB2. Consequently, the SRXB staff resumed its review of TVA's license application. In order to complete its review, the SRXB staff needs to conduct an audit, in order to understand the bases for certain accident analyses, reported in the applicant's FSAR.

An audit is expected to expedite the staff's review of the application by permitting the staff (1) to read additional material that might be proprietary in nature, (2) to discuss the content of said material with cognizant technical experts, and (3) to minimize the need to write further requests for additional information.

Audit Agenda

The audit is expected to last one day (March 15, 2011), and will be conducted at Westinghouse's office in Rockville, MD.

Topics to be considered

Steamline break analyses and methods

The applicant's analyses of the major steamline break, reported in Chapter 15 of the FSAR, indicate that the most severe case, identified as the 1.4 ft^2 break without offsite power available, produces a post-trip peak power level of less than five percent. The most severe case, in other plants of WB2's size and design, is identified as the 1.4 ft^2 break with offsite power available, and produces a post-trip peak power level that is two to six times greater. The applicant's fuel vendor, Westinghouse, attributed this to the effect of borated water, injected into the RCS by the accumulators, and to the presence of relatively favorable moderator reactivity coefficients. Since these moderator reactivity coefficients seem to be having a profound effect upon the WB2 analysis results, the staff seeks further information regarding how they're determined, verified, and applied. The staff would also request information regarding the boron worth of the ECCS water, and how that is modeled.

Mass addition event analyses and methods

These analyses, inadvertent operation of the ECCS at power, and CVCS malfunction, are currently in progress. Analysis methods and assumptions will be discussed. Analysis results, if available, will be reviewed and discussed, focusing upon the analyses' demonstration that the

ENCLOSURE

FSAR acceptance criterion, that prohibits the development of a more severe event from a less severe event, is satisfied.

RCS and main steam system overpressure analysis

Results of WB2 overpressure analyses, and analysis methods will be reviewed and discussed. This part of the audit will be guided by SRP 5.2.2, Overpressurization Protection.

Post-LOCA boron precipitation

The applicant's post-LOCA long-term core cooling and boric acid precipitation calculation will be reviewed and discussed, in order to assess its adequacy, and to determine whether further analysis is necessary to demonstrate compliance with 10 CFR 50.46. 10 CFR 50.46 requires each pressurized light water nuclear power reactor must be provided with an ECCS that must be designed so that its calculated cooling performance following postulated loss-of-coolant accidents conforms to, among others, a requirement for long-term cooling. After any calculated successful initial operation of the ECCS, the calculated core temperature shall be maintained at an acceptably low value and decay heat shall be removed for the extended period of time required by the long-lived radioactivity remaining in the core.

To compensate for positive reactivity effects, the PWR emergency core cooling system contains borated water, with a boron concentration maintained at a level that is governed by the facility Technical Specifications. Due to the cooling phenomena present in a reactor core following a LOCA, boron tends to concentrate in the core region. In extreme cases, the concentration of boron could become sufficiently high as to begin precipitating in the core. This precipitation could inhibit decay heat removal and cause unacceptable temperature increases over a period of time following the LOCA.

While analyses account for the effects of boric acid precipitation, and operator manual actions are prescribed to flush boric acid from the core, the NRC staff has found previously that PWR post-LOCA long-term core cooling analyses may not contain a consistently conservative or otherwise justified set of assumptions. The staff communicated these concerns in two letters, one to the Westinghouse Electric Company dated August 1, 2005 (ADAMS Accession ML051920310), and one to the Westinghouse Owner's Group dated November 23, 2005 (ADAMS Accession ML052930272).

These letters identified fifteen concerns regarding the post-LOCA long-term core cooling calculations, and communicated an expectation that the NRC staff's concerns, in summary form, be addressed by applicants on a plant-specific basis in any future submittals regarding post-LOCA long-term core cooling.

In consideration of the information discussed above, the NRC staff will review the applicant's post-LOCA long-term core cooling calculation to ensure that the concerns discussed in the November 23, 2005 letter to the Westinghouse Owner's group are appropriately addressed, using the fifteen items discussed in the August 1, 2005, letter to the Westinghouse Electric Company as review guidance.

The staff also wants to see the responses, if available, to the following RAI questions:

RAI 2. Please provide the following information for the Watts Bar Unit 2 NSSS:

a. Volume of the lower plenum, core and upper plenum below the bottom elevation of the hot leg, each identified separately. Also provide heights of these regions

b. Loop friction and geometry pressure losses from the core exit through the steam generators to the inlet nozzle of the reactor vessel. Also, provide the locked rotor RCP k-factor. Please provide the mass flow rates, flow areas, k-factors, and coolant temperatures for the pressure losses provided(upper plenum, hot legs, SGs, suction legs, RCPs, and discharge legs). Please include the reduced SG flow areas due to plugged tubes. Please also provide the loss from each of the intact cold legs through the annulus to a single broken cold leg. Please also provide the equivalent loop resistance for the broken loop and separately for the intact loop.

c. Capacity and boron concentration of the RWST.

d. Capacity of the condensate storage tank

e. Flushing flow rate at the time of switch to simultaneous injection

f. HPSI runout flow rate

g. Capacities and boron concentrations for high concentrate boric acid storage tanks

RAI 4. Please provide the following elevation data:

a. bottom elevation of the suction leg horizontal leg piping

b. top elevation of the cold leg at the reactor coolant pump discharge

c. top elevation of the core (also height of core)

d. bottom elevation of the downcomer

RAI 5. Please provide the limiting bottom and top skewed axial power shapes.

RAI 15. Please provide the results of a failure of a single bottom-mounted instrument tube in the lower head of the reactor vessel. (If a generic solution is offered, then indicate how it is applicable to WB2.)

Audit Team

The audit team will consist of:

Samuel Miranda and Benjamin Parks, Reactor Systems Branch
Leonard Ward, Nuclear Performance Code Review Branch
Paul Clifford, Division of Safety Systems
And other reviewers that may be asked to attend by their branch chiefs

The following support personnel are requested:

Licensing staff from the Tennessee Valley Authority
Cognizant staff engineers from Westinghouse Electric Company

Documents Requested for Staff Examination

- Most recent post-LOCA, long-term core cooling calculation for WB2
- Any documents describing the computer codes or analytic methods used to develop the WB2-specific post-LOCA, long-term core cooling calculation
- Any generic documentation referenced by the WB2-specific, post-LOCA, long-term core cooling assessment
- Documentation regarding the validation of the neutronic computer codes used to predict reactor coolant system critical boron concentration and the ECCS minimum boron concentration
- Documentation regarding the determination and validation of the moderator reactivity coefficients used by LOFTRAN, including boron worth coefficients
- Documentation to support the inadvertent operation of the ECCS at power, CVCS malfunction, steamline break, and the overpressure protection analyses

Documentation of Audit

Within 45 days of the audit exit, the NRC staff will prepare a detailed audit report documenting the information reviewed during the audit, and any open items identified as a result of the audit. The NRC staff will also document its understanding of the proposed resolution of any identified open items. The audit report will be provided to the applicant in draft form for proprietary markup.