Held, Wesley

From: Held, Wesley
Sent: Tuesday, June 04, 2013 2:07 PM
To: Sisk, Robert B.
Cc: Bradford, Anna; Costa, Arlon; Goodwin, Cameron; Frankl, Istvan; Hsii, Yi-Hsiung; Donoghue, Joseph; 'Monahan, Jill S.'
Subject: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 1 FOR THE REVIEW OF THE WESTINGHOUSE SMR PHENOMENA IDENTIFICATION AND RANKING TABLE TOPICAL REPORT WCAP-17573-NP, REVISION 1
Attachments: W-SMR PIRT Topical Report RAI Letter 1.doc

Dear Mr. Sisk:

By letter dated April 25, 2012, Westinghouse Electric Company submitted, for U.S. Nuclear Regulatory Commission (NRC) staff review, Topical Report WCAP-17573-NP, Revision 1, "Westinghouse SMR Small Break Loss-of-Coolant Accident Phenomena Identification and Ranking Table" (ML12125A319). The NRC staff has identified that additional information is needed to continue portions of the review. The staff's requests for additional information (RAIs) are contained in the enclosure to this email.

Please provide responses by July 3, 2013.

If you have any questions, please let us know.

Thanks,

Wes

Wesley Held
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OFFICE	PM:RES/DSA/RSAB	BC:NRO/DSRA/SRSB	PM:NRO/DARR/SMRLB2	PM:NRO/DARR/SMRLB2
NAME	IFrankl*	JDonoghue*	WHeld**	Acosta*
DATE	6/3/2013	5/22/13	5/30/2013	6/3/2013

*via email **via electronic RAI system

Request for Additional Information 1

Issue Date: 5/30/2013
Application Title: Westinghouse SMR Pre-Application Activities
Operating Company: Westinghouse Electric Company
Docket No. PROJ 0797
Review Section: TR SBLOCA PIRT
Application Section: WSMR SBLOCA PIRT Topical Report

QUESTIONS

TR SBLOCA PIRT-1

Please provide the latest detailed W-SMR design information supporting the Westinghouse Licensing Topical Report (LTR) for the W-SMR Small-break Loss of Coolant Accident (SBLOCA) PIRT.

TR SBLOCA PIRT-2

Please provide the In-containment Pool (ICP) tank normal operating pressure and describe any inventory of non-condensable gases.

TR SBLOCA PIRT-3

Please provide the rupture disk rupture pressure difference for the rupture disk at the top of the Sump Injection Tanks (SITs).

TR SBLOCA PIRT-4

Please provide detailed inputs (including assumptions, initial conditions, Emergency Core Cooling System (ECCS) setpoints, credited Engineered Safety Features (ESFs), operator actions, etc.) and analysis results (including event sequences, etc.) for the SBLOCA simulations.

TR SBLOCA PIRT-5

Please provide the analysis results for the SBLOCA simulations presented in pages A4-1 through A4-30 during the audit on May 2, 2013 in electronic format. The event progression and description is essential for understanding the scenario and for the review of the Westinghouse LTR on the SBLOCA PIRT.

TR SBLOCA PIRT-6

Please provide the setpoints for the activation of all ECCS components. This includes the activation setpoints for various valves that are involved in the SBLOCA progression and the time delays between various Automatic Depressurization System Stage One (ADS-1) and ADS-2 openings. This information is also requested in electronic format for easy reference during PIRT Panel deliberations.

TR SBLOCA PIRT-7

Please provide description, accompanied by a schematic diagram, of the connections (e.g., rupture disk, valves, etc.) at the top of the two SITs (also called "upper ICP tanks"). Also explain the purpose, function, and operational characteristics of each connection. Clarify whether the SITs are "water-solid" during normal operation, if this is the case; please explain how the rupture disk can function if it discharges into a water solid tank. If SITs are not water solid, provide the volume of the gas space at the top of the SITs.

TR SBLOCA PIRT-8

Please clarify the operation of the SIT/ICP during injection. It would seem from the SBLOCA PIRT LTR that SIT/ICP flow begins when RPV pressure is low enough and the upper SIT rupture disc opens due to Containment Vessel (CV) over-pressure. But, the audit indicates that an S signal opens the SIT upper vent valve (maybe an Air Operated Valve (AOV)) and another AOV on the ICP injection line. Please provide more information on the operation and design of this system. In particular,
a) What is the arrangement of valves in the SIT/ICP system?
b) What types of valves are used? If the valves are AOV, is air required to open the valves?
c) How often is the system vented to remove non-condensable gases (NCGs)?
d) If the SIT/ICP is water solid, it is likely to have a cooling requirement. What is this requirement? How is it achieved? Could a single failure remove cooling to both SITs?

TR SBLOCA PIRT-9

Please clarify the modeling of the AOV in the ICP injection line. It does not appear that the AOV in the ICP injection line is simulated in the WEC analysis. 9) Please clarify the modeling of the AOV in the ICP injection line. It does not appear that the AOV in the ICP injection line is simulated in the WEC analysis.

TR SBLOCA PIRT-10

Since the SIT vents, or appears to vent to CV, please specify the expected inventory of NCG in the CV.

TR SBLOCA PIRT-11

The diagrams of the Core Makeup Tank (CMT) piping indicate a pressure balance line local high point. Please clarify how the accumulation of NCG in the high point of the piping is managed.

TR SBLOCA PIRT-12

Please specify the maximum and (if non zero) normal flow rate in the Spray Line from the Reactor Coolant Pump (RCP) discharge to Pressurizer spray.

TR SBLOCA PIRT-13

Please confirm that the only path for injection of water from the sump to the downcomer is via the lower ICP tanks, i.e., water from the sump enters the lower ICP tanks through the Sump Coupling Valves (SCVs), and subsequently enters the reactor vessel via the sump injection valves.

TR SBLOCA PIRT-14

Various schematic diagrams presented during the audit on May 2, 2013 show the SCVs to be located at an elevation below the sump injection valves. Please confirm that this is an accurate description of the actual layout and provide the elevations for these valves from a specified datum.

TR SBLOCA PIRT-15

Has Westinghouse performed any sensitivity analyses using the computational models for W-SMR to determine/alter the importance ranking of phenomena in the W-SMR SBLOCA PIRT? If yes, please provide a description of the sensitivities and their impact on the importance rankings. If sensitivity calculations have not been performed, please provide the rationale for arriving at the various importance rankings, and the reasons for not supporting the rankings with sensitivity analyses.

TR SBLOCA PIRT-16

Please describe the type of debris anticipated in the W-SMR containment during an SBLOCA event? If possible, please compare and contrast with the debris profile that was the subject of GSI-191. Please explain the planned approach for demonstrating the effect of debris on blockage in the core, carryover of solids via ADS-2 and long term cooling performance. Please provide the bases for the type and quantity of debris being considered for any relevant testing.

TR SBLOCA PIRT-17

Please describe how the presence of debris and its retention was considered during the simulation of the SBLOCA that was used to inform Westinghouse's W-SMR SBLOCA PIRT. Please provide the values and the bases for the loss coefficients used for the sump screen and "trash rack".

TR SBLOCA PIRT-18

Please describe the process that will be followed by Westinghouse to change the importance rankings in the W-SMR SBLOCA PIRT based on the results of the planned integral and separate effects tests.

TR SBLOCA PIRT-19

Please provide length and spring force of the plenum spring. Does the plenum spring have the same length and spring force as for the full-length assembly? If yes, what is its impact on the fuel pellets in a shorter stack?

TR SBLOCA PIRT-20

Please provide design pressure of the containment.

TR SBLOCA PIRT-21

Please describe and clarify the reactor trip after the SBLOCA initiation. Does the SBLOCA WEC analysis presume coincident Loss of Offsite Power (LOOP)? If so, does the reactor trip on LOOP? What is the assumed transient power?

TR SBLOCA PIRT-22

The ADS-2 wet steam quality seems high for the SBLOCA simulation with the Direct Vessel Injection (DVI) line break. Please also describe how the steam quality was determined for the RSG outlet.

TR SBLOCA PIRT-23

Please list and describe the automatic trips of the RCPs.

TR SBLOCA PIRT-24

Please discuss the extent of RCP vibration and countermeasures, including monitoring, trips, etc.

TR SBLOCA PIRT-25

Please clarify and provide detailed information on how the specific separate and integral effects tests planned for the W-SMR, i.e. the test plan or test matrix, correlate with the "gaps" in knowledge identified with the W-SMR SBLOCA PIRT.

TR SBLOCA PIRT-26

Please provide the information presented in pages B1-1 through B1-8 during the audit on May 2, 2013 in electronic format. The "gaps" in knowledge identified with the W-SMR SBLOCA PIRT are required to understand important SBLOCA phenomena.

TR SBLOCA PIRT-27

Please clarify what, if any, separate effects experiments are planned for the prototypic sump screen and "trash rack" to determine the fouling, pressure drop and debris non-retention in those components due to W-SMR specific debris (see Question #16 on type of debris). If no tests are planned, please provide the basis for the design of these components.

TR SBLOCA PIRT-28

Please provide clarification on whether the sump screen and "trash rack" will be included in the integral effects testing. If yes, please provide information on the scaling methodology for these components (note that information on the prototypic design is sought above). If not, please provide the rationale for the exclusion of these components.

TR SBLOCA PIRT-29

Please explain the approach for determining the prototypic pressure drops or loss coefficients in the core and the primary circuit. Please provide information on how these parameters will be scaled in the test facility during integral testing.

TR SBLOCA PIRT-30

Please provide detailed inputs (including assumptions, initial conditions, ECCS setpoints, credited ESFs, operator actions, etc.) and analysis results (including event sequence, etc.) for the following potential limiting events for consideration:
a) Loss of forced reactor coolant flow (e.g. limiting trip of multiple RCPs)
b) Limiting decrease in Reactor Coolant Pressure Boundary (RCPB) temperature event (e.g. inadvertent Steam Generator Dump Valve (SGDV) opening or recirculation pump overspeed)
c) Limiting increase in RCPB temperature event (e.g. Main Steam Isolation Valve (MSIV) closure)
d) Steam Generator Tube Rupture (SGTR)
e) Inadvertent ADS Actuation
f) Inadvertent pressurizer Safety or Relief Valve (RV) opening
g) Malfunction of the Chemical and Volume Control System (CVCS)
h) Main steam line break inside CV
i) Control Rod (CR) ejection accident
j) Inadvertent / Uncontrolled Rod Withdrawal
k) Station Blackout
l) Anticipated Transient Without Scram (ATWS).

TR SBLOCA PIRT-31

Please provide the information presented in pages C-1 through C-90 and C.h-1 through C.h-10 during the audit on May 2, 2013 including all tables, such as Table 1 for Trip Signals and Actuations and Table 2 for Control System Setpoints, etc., in electronic format. The event progressions and descriptions are essential for identifying limiting events for the PIRT reviews and for confirming the scope of the SBLOCA PIRT LTR.

TR SBLOCA PIRT-32

The uncontrolled rod withdrawal accident analysis is presented in pages C-71 through C-77 of a document made available during the audit on May 2, 2013. The event analyzed therein was an uncontrolled rod withdrawal from hot full power. Please provide the rationale for simulating the event from full power. In addition, provide similar uncontrolled rod withdrawal accident analyses from other power levels including hot zero power and subcritical conditions. Specifically, the staff is interested in the uncontrolled rod withdrawal scenario that provides the limiting 'high startup rate' and the conditions under which this rate occurs. Please also provide the power (or count rate) at which the detector threshold condition is met for detection of this event.

TR SBLOCA PIRT-33

Please describe how the maximum reactivity insertion rate is determined for inadvertent CR withdrawal. Is there an associated design or Technical Specification (TS) that determines this rate? What feedback parameters are considered in the analysis? Were the analyses done with point or multi-dimensional kinetics? Are the consequences worse at Cold Zero Power (CZP)?

TR SBLOCA PIRT-34

Please provide a description of each of the 'reactor modes' for the W-SMR.

TR SBLOCA PIRT-35

Please provide Departure from Nucleate Boiling Ratio (DNBR) plots that demonstrate the conclusion that DNBR criteria are met for the transients with Min DNBR acceptance criteria.

TR SBLOCA PIRT-36

Please provide sequence of events for the Pressurizer Spray Malfunction and Uncontrolled Rod Withdrawal events.

TR SBLOCA PIRT-37

Please clarify why the Loss of Recirculation Feedwater event is the bounding Station Blackout (SBO).

TR SBLOCA PIRT-38

Please provide the point kinetics data used to support the transient analyses (reactivity coefficients, delayed neutron fractions, decay constants, etc).

TR SBLOCA PIRT-39

Please describe normal alignment of the CVCS. Is there a possible normal alignment of the CVCS that could result in unborated water injection?