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Attention: Mr. James E. Lyons

April 11, 2003

SUBJECT: Response to NRC Letter from J. E. Lyons to W. E. Cummins, "AP1000 Request for Data to Resolve Liquid Entrainment Requests for Additional Information," dated March 18, 2003.

Dear Mr. Lyons:

In the subject letter, you requested that Westinghouse present new test data to support AP1000 Design Certification. The stated purpose for the test data is to justify our treatment of the modeling of the processes associated with upper plenum entrainment that occur during a small-break loss-of-coolant accident (SBLOCA). This letter presents our response to your request.

During the AP1000 pre-certification review, Westinghouse submitted WCAP-15613 "AP1000 PIRT and Scaling Assessment" that provided justification that the tests completed for AP600 Design Certification were sufficiently scaled to the AP1000 such that additional testing was not required for AP1000 Design Certification. The integral system performance tests examined in this WCAP included the APEX test facility at Oregon State University, the SPES test facility in Italy, and the ROSA test facility in Japan. In your letter on March 25, 2002, you provided the NRC conclusions from the pre-certification review. In summary, the NRC concluded that the tests conducted in support of AP600 Design Certification were properly scaled to the AP1000 with respect to the overall system performance of the passive safety systems, with one exception being the liquid entrainment phenomena. With regards to liquid entrainment, the NRC staff concluded that the higher AP1000 power will result in increased liquid entrainment during the ADS-4 / IRWST injection phase of the small break loss of coolant accident (SBLOCA) event. The NRC commented that suitably scaled test data, such as from a higher-power scaled integral system performance test, could be used to demonstrate that the higher AP1000 liquid entrainment rates are conservatively accounted for in the safety analysis for the AP1000 plant.

To address the liquid entrainment issue, Westinghouse performed bounding parametric evaluations and sensitivity studies using a WCOBRA-TRAC model developed to address this issue. The AP1000 passive safety systems, like the AP600, provide automatic depressurization and gravity-driven safety injection which prevent the core from uncovering for a spectrum of postulated SBLOCA up to and including an

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8-inch double-ended direct vessel injection (DEDVI) line break. For such events, the core cladding temperature does not increase beyond its normal operating temperature, and there exists a large margin to the regulatory limits imposed by 10 CFR 50.46. The results of the bounding parametric evaluations and sensitivity studies are presented in WCAP-15833, and the results indicate:

- that the overall AP1000 passive system performance is not significantly impacted by variations in liquid entrainment rates
- the large margin to core safety limits is maintained for the spectrum of SBLOCA events.

As articulated in your March 18, 2003 letter, the staff agrees that the sensitivity studies documented in WCAP-15833 might lead one to conclude that entrainment out of ADS-4 is not a significant consideration for core cooling. Nevertheless, the NRC staff has concluded that additional test data is needed to fully resolve this issue. Therefore, to facilitate the timely disposition of this issue, Westinghouse plans to present new test data in support of AP1000 Design Certification.

Westinghouse plans on using test data from the APEX-1000 test facility at Oregon State University (OSU) to resolve the open issue regarding liquid entrainment. The APEX-1000 test program is being conducted under a NERI grant from the Department of Energy, under the direction of Dr. Jose Reyes, and in cooperation with Westinghouse. The APEX-1000 test program is being conducted in accordance with the OSU Quality Plan, and Westinghouse use of the APEX-1000 information to support AP1000 Design Certification will be treated in accordance with the Westinghouse Quality Plan and AP1000 Program Operating Procedures.

The APEX test facility was built by Westinghouse to support AP600 Design Certification. The original facility was designed as a ¼-height scale integral model of the AP600 reactor coolant and passive core cooling systems. Westinghouse conducted integral system performance tests that were used to validate the Westinghouse computer codes NOTRUMP and WCOBRA/TRAC that are used to perform the AP600 and AP1000 accident analysis. The original APEX scaling, analysis, and test program were reviewed and approved by the NRC as part of AP600 Design Certification. As discussed above, the original APEX tests are properly scaled for AP1000 for phenomena other than liquid entrainment. Westinghouse will use the APEX-1000 test data to address the effects of the AP1000 higher core power, and thus higher potential liquid entrainment rates, on overall system performance.

The APEX-1000 test facility has been modified to model AP1000 design features including higher core power and larger ADS-4 valves and piping. Westinghouse will use results from one or more integral system tests from the DOE APEX-1000 test program. Westinghouse plans to demonstrate that the APEX-1000 test facility is properly scaled to the AP1000 plant, and that the Westinghouse NOTRUMP computer code can appropriately simulate the APEX-1000 test. This assessment will provide confidence in the capability of the NOTRUMP computer code to conservatively model the AP1000 plant behavior.

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To support resolution of this issue in a timely manner, Westinghouse will provide the following documents to the NRC in support of AP1000:

APEX-1000 Scaling Report	May 15, 2003
APEX-1000 Facility Description Report	May 15, 2003
AP1000 Code Applicability Report (including APEX-1000 test results)	July 15, 2003

Westinghouse believes the proposed plan will provide the NRC with sufficient information for the staff to conclude their safety determination for AP1000. We request a technical progress meeting with the NRC next month to discuss additional details of the APEX-1000 test plan, and additional details of our proposed resolution plan for this issue. In the subject letter, you indicate that the NRC staff plans to perform a QA test control implementation inspection at the test facility. Mr. Michael M. Corletti of my staff will coordinate this activity with your Project Management Team, and with Oregon State University. Please direct inquires to him regarding this subject.

Very truly yours,



W. E. Cummins
AP600 & AP1000 Projects