Response to China Question 15-5
Electrical Engineering Branch
Office of New Reactors

Question 15-5

The time delay assumed between turbine trip and loss of offsite power. The assumptions of loss of offsite power (LOOP) used in AP1000 accident analyses are: LOOP is assumed in accident analysis after turbine trip. LOOP is not considered as a single failure, and the analysis of accident analysis is performed without changing the event category. The design provisions of AP1000 electrical system can provide power to RCPs for a minimum 3 seconds following turbine trip. This time delay (RCPs can run normally by additional 3s) has significantly effect on the results of accident analysis by giving large benefit. Please explain in detail what safety requirements are needed to evaluate that the design of the electrical system can support 3s time delay.

Response

The safety requirements needed to evaluate that the design of the electrical system can support 3 second time delay assumed in accident analysis for AP1000 design are contained in General Design Criteria (GDC) 17, "Electric Power Systems," of Appendix A, "General Design Criteria for Nuclear Power Plants," to Title10, Part 50, of the Code of Federal Regulations. The Nuclear Regulatory Commission (NRC) staff reviews the offsite power source provided from the transmission network to assure that it satisfies the requirements of GDC 17 with respect to its capacity and capability by requiring a grid stability analysis of the applicant's electrical grid. The results of the grid stability analysis must show that loss of the largest single supply to the grid, removal of the largest load from the grid, or loss of the most critical transmission line does not result in the complete loss of offsite power to the station. Meeting the requirements of GDC 17 provides assurance that a reliable electric power supply can be provided for all facility operating modes, including anticipated operational occurrences and design basis accidents to permit safety functions and other vital functions to be performed.

In NUREG1793, "Final Safety Evaluation Report Related to Certification of the AP 1000 Standard Design," September 2004, the NRC staff specified an interface requirement for Combined Operating License (COL) applicants to perform a grid stability analysis to show that the grid will stay stable and that the Reactor Coolant Pump bus voltage will remain above the voltage required to maintain the flow assumed in DCD Tier 2, Chapter 15, "Accident Analyses," for a minimum of 3 seconds following a turbine trip. This COL information is discussed in Design Control Document (DCD) Tier 2, Section 8.2.5, "Combined License Information for Offsite Electrical Power," and in Item 8.3 of DCD

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Tier 2, Table 1.8-1, "Summary of AP1000 Plant Interfaces with Remainder of Plant." This is COL Action Item 8.2.3.1-1.

All COL applicants must submit a stability analysis of their grid to demonstrate that their grid remains stable and that the Reactor Coolant Pump bus voltage will remain above the voltage required to maintain the flow assumed in DCD Tier 2, Chapter 15, for a minimum of 3 seconds following a turbine trip to satisfy the above interface requirements. The NRC staff's review of the grid stability analysis provided by the COL applicants ensures that the grid remains stable for a minimum of 3 seconds following a turbine trip to support the assumptions made in the safety analyses for the AP1000 designs.