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Your ref: Docket No. 52-006
Our ref: DCP_NRC_002806

March 5, 2010

Subject: AP1000 Response to Request for Additional Information (SRP 5)

Westinghouse is submitting a response to the NRC request for additional information (RAI) on SRP Section 5. 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-SRP5.4.1-CQVB-01

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,

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

/Enclosure

1. Response to Request for Additional Information on SRP Section 5

D063
NRO

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ENCLOSURE 1

Response to Request for Additional Information on SRP Section 5

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP5.4.1-CQVB-01
Revision: 0

Question:

Variable frequency drives, discussed in DCD section 5.4.1.2.1, are used for RCP startup and operation when the reactor trip breakers are open. There is no discussion of variable speed drive overspeed trips in the DCD, and there are no ITAAC for ensuring that such trips exist, are properly designed, are tested, and are operational. The variable frequency drives for the AP1000 RCPs are non-safety related and could potentially fail (or be mis-calibrated) in a way that would result in flow rates in the reactor coolant system in excess 104% best estimate analysis referenced in the DCD. Paragraph 5.1.4.4 of Revision 16 of the DCD states that the "Mechanical design flow is the conservatively high flow used as the basis for the mechanical design of the reactor vessel internals, fuel assemblies, and other system components. Mechanical design flow is established at 104 percent of best-estimate flow."

Is it possible for the variable frequency drives to fail or be mis-calibrated in a way that would result in reactor coolant system flow in excess of 104 percent? If so, please describe the provisions for ensuring that failure of the variable frequency drives will not cause a RCP overspeed condition in excess of the 104 percent best estimate flow rate?

The basis for the methodology should be incorporated into the AP1000, Tier 2 information.

Westinghouse Response:

For AP1000 plants located in the United States, the source of power to the reactor coolant pumps must be switched from the variable frequency drives (VFD) to unit transformers (grid) before the reactor trip breakers are closed. This is ensured by adherence to Technical Specification 3.4.4, RCS Loops. Therefore, when the reactor is critical the speed of the reactor coolant pumps is controlled by the grid and not the VFDs. Therefore potential overspeed conditions resulting from a failure of the VFDs is limited to periods of reactor coolant system heatup and cooldown when the reactor coolant pumps are operating on the VFDs. Since the reactor is not critical during these times, any pump overspeed which occurs during these periods does not compromise core cooling or result in a reactor power transient that would be required to be mitigated by safety systems.

The VFDs will be programmed with a few specific pump speed setpoints (which are maintained within ±0.5hz steady state). The VFD does have non-safety controls, and therefore, a failure in the VFD which could result in the reactor coolant pump speed exceeding the setpoint, while unlikely, is possible. The mechanical design flow (104% of best estimate flow) is the maximum allowed continuous flow assuming lower than expected loop resistance and/or higher than expected pump performance. Therefore, mechanical design flow is the design basis flow for component analyses over 60 years of operation and is the assumed initial flow for transient

evaluations of components. The reactor internals, fuel, and other system components, however, are designed to comply with Level B service limits for transient conditions up to 120 percent of mechanical design flow. An example of a transient in which the reactor coolant pump exceeds 104 percent of best estimate flow is the Large Step Load Decrease with Steam Dump transient in which the electrical load on the generator is lost. In this transient, steam is dumped and the turbine is throttled back in order to continue operation at reduced power (house load level).

Most of the time during heatup and cooldown operations the reactor coolant pumps will be operating at less than full speed, which provides additional margin to the transient evaluation flow of 120% of mechanical design flow. Overspeed of the pump during system heatups and cooldowns, therefore, would only pose a risk to overheating the reactor coolant pump motor. Pump motor protection is provided not only by the VFD controls, but also by IEEE standard protection equipment (non-safety) such as high current protection. Therefore, Westinghouse believes that sufficient design features are in place to provide reactor coolant pump investment protection if there is a failure in the VFD speed control setpoint.

Westinghouse believes that additions to the AP1000 DCD Tier 2 information are not necessary to address this issue.

Design Control Document (DCD) Revision:
None

PRA Revision:
None

Technical Report (TR) Revision:
None