

October 11, 2012

Tom Gurdziel  
[tgurdziel@twcny.rr.com]

SUBJECT: CONCERNS WITH AP1000 AC POWER

Dear Mr. Gurdziel:

I am responding to your July 31, 2012, email regarding several concerns about loss of alternating current (ac) power and the AP1000 design. In your email you commented that 1) (AP1000 reactors) will not have safety related emergency (diesel or other) generators; 2) you have a concern with the U.S. Nuclear Regulatory Commission's (NRC) approval of an exemption to the requirement of GDC 17 for two physically independent offsite circuits; and 3) you have a concern that the generator is apparently left connected to plant auxiliary loads after a load reject signal for some special purpose. These three AP1000 concerns coupled with your reference to the complete loss of ac electrical power, a condition known as station blackout (SBO) that struck Japan at the Fukushima Dai-ichi site will be discussed in the following paragraphs. The NRC has been working to understand the events in Japan and relay important information to U.S. nuclear power plants. In particular, the NRC established a task force of senior agency experts to determine lessons learned from the accident and to initiate a review of NRC regulations to determine if additional measures needed to be taken immediately to ensure the safety of U.S. plants. Based on your email I will provide responses that will focus on your concern in maintaining emergency core cooling systems in the event of a (total) loss of ac power with the AP1000 design.

**1) (AP1000 reactors) and emergency (diesel or other) generators**

The AP1000 design employs passive safety-related systems that rely on gravity and natural processes, such as convection, evaporation, and condensation. For the first 72 hours of an accident, including a SBO, the station direct current (dc) batteries and associated dc distribution system provide power to the safety systems. These batteries and the distribution system are safety-related (Class 1E) systems and satisfy the requirements of IEEE 603, as incorporated by reference in *Code of Federal Regulations* (10 CFR) 50.55a(h). Because of the passive nature of the AP1000 plant safety systems; the station dc batteries are the only safety related electric power systems incorporated into the design.

Neither the offsite power circuit nor the station diesels are relied upon for the first 72 hours of accident. Therefore, neither of these power sources are relied upon to assure (1) the integrity of the reactor coolant pressure boundary, (2) the capability to shut down the reactor and maintain it in a safe shut down condition, or (3) the capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to the applicable guideline exposures set forth in § 50.34(a)(1). Accordingly, none of these ac power sources needs to be safety related.

In addition, the AP1000 design provides for commercial, skid-mounted ancillary diesel generators, which are capable of supplying power through regulating transformers to the safety-related buses that supply power to the safety equipment. The SBO rule in 10 CFR 50.63 does not require the use of safety-related alternate ac power sources to cope with an SBO. The ancillary diesel generators are not needed for the first 72 hours following an SBO. Accordingly, 10 CFR 50.63 does not require that these ancillary diesel generators be safety-related.

The purpose of the ancillary diesel generators is to provide an added measure of defense-in-depth, as they are redundant to the other equipment described above.

**2) You have a concern with NRC's approval of an exemption to the requirement of GDC 17 for two physically independent offsite circuits**

Item B(3) of 10 CFR 52, Appendix D, Section V identifies that the AP1000 design is exempt from Appendix A to 10 CFR Part 50, GDC 17—Second offsite power supply circuit.

As previously mentioned, for the first 72 hours of an accident, including a SBO, the station dc batteries and associated dc distribution system provide power to the safety systems. Neither the offsite power circuit nor the station diesels are relied upon for the first 72 hours of accident. Accordingly, AP1000 design is exempt from having two physically independent offsite circuits.

For post 72-hour actions, the Commission approved that systems, structures, and components (SSCs) are not required to be safety related. However, additional regulatory oversight consistent with SSCs captured under regulatory treatment of non-safety related systems (RTNSS) process will be applied to post 72-hour SSCs. Those licensees or applicants referencing the AP1000 design will need to assure appropriate control of ancillary diesel generators. This includes periodic testing in order to demonstrate availability.

**3) You have a concern that the generator is apparently left connected to plant auxiliary loads after a load reject signal for some special purpose.**

The following information is taken from the Final Safety Evaluation Report Related to Certification of the AP1000 Standard Plant Design Division (NUREG-1793 Supplement 2). See Agencywide Documents Access and Management System (ADAMS) Accession Number ML112061231, Section 8.3.2, starting on page 8-13. The AP1000 is designed to sustain a load rejection from 100 percent power with the turbine generator continuing stable operation while supplying the plant house loads. Staff's initial concern was with the potential for transient conditions where a significant voltage spike during islanding could cause high dc voltage conditions on the output side of the battery chargers. Operating experience (see NRC Information Notice (IN) 2006-18, "Significant Loss of Safety-Related Electrical Power at Forsmark, Unit 1, in Sweden" dated August 17, 2006) showed that a voltage spike due to a malfunction of the main generator exciter or during islanding could go as high as 130 percent, which could go undetected by normally-provided relaying and could cause damage to the safety-related equipment or mis-operation.

During their review of the AP1000 design, the staff took into account this issue and verified the battery charger protective function provided isolation between input ac and the dc system during such transients. Staff concluded that the level and timing of the battery charger and inverter trip setpoints met the requirements of GDC 17 with respect to the capability of dc systems to perform their safety function during transient conditions.

### **Fukushima Dai-ichi Nuclear Power Station SBO Discussion (Tier 1 NRC Action)**

On May 11, 2011, following the events at the Fukushima Dai-ichi Nuclear Power Station after the March 11, 2011, earthquake and tsunami, the NRC issued Bulletin 2011-01, "Mitigating Strategies," to comprehensively verify licensee compliance with Title 10 of 10 CFR 50.54(hh)(2) and to obtain information associated with licensee mitigating strategies (ADAMS Accession Number ML11250360).

The results of analysis of the responses to Bulletin 2011-01 informed the development of the interim staff guidance for the March 12, 2012, Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," and was used as an input to the SBO rulemaking pursuant to Near-Term Task Force (NTTF) Recommendation 4.1.

On July 12, 2011, the task force concluded that there was no imminent risk from continued operation and licensing activities. The Task Force also concluded that enhancements to safety and emergency preparedness are warranted and made a dozen recommendations for Commission consideration. The staff subsequently prioritized and expanded upon the task force recommendations and continues to make additions and modifications, as appropriate.

In SRM-SECY-11-0137, "Prioritization of Recommended Actions to Be Taken in Response to Fukushima Lessons Learned," the Commission approved the staff's proposed prioritization of NTTF Recommendation 4.1 on strengthening SBO mitigation capability and directed the staff to initiate a rulemaking in the form of an advanced notice of proposed rulemaking (ANPR). The SBO ANPR was published in the *Federal Register* (FR) on March 20, 2012 (77 FR 16175), which began the process of considering amendments to the NRC's regulations that address SBO (ADAMS Accession Number ML11272A203).

Your concerns from the Japanese events of March 11, 2011, on existing and new reactors are being pursued by NRC staff. A full account of their findings can be found on the NRC's public website under: <http://www.nrc.gov/reactors/operating/ops-experience/japan-info.html>

T. Gurdziel

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Thank you for your interest in the AP1000 design. I trust that the above information will be beneficial to you. If you have any questions regarding this response, please contact me at (301) 415-6715 or at [bruce.bavol@nrc.gov](mailto:bruce.bavol@nrc.gov).

Sincerely,

*/RA/*

Bruce Bavol, Project Manager  
Licensing Branch 4  
Division of New Reactor Licensing  
Office of New Reactors

Docket No. 52-006  
SECY CCT NRO-LTR-12-0393

cc: See next page

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Bruce Bavol, Project Manager  
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