



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

August 7, 2015

Ms. Susan Brown
La Mesa, CA

Dear Ms. Brown:

I am responding to your e-mail dated January 6, 2015, regarding your concern about the effects of an electromagnetic pulse (EMP) or solar flare on the San Onofre Nuclear Generating Station, Units 2 and 3 (SONGS), which is currently undergoing decommissioning. You also expressed concern about the durability of the electrical grid and nuclear power plants in general in the event of a solar flare or EMP. I would like to express my appreciation for your effort in bringing these matters to the attention of the Nuclear Regulatory Commission (NRC).

The NRC is well aware of the potential significance of electromagnetic threats to the Nation's nuclear power plants. In the late 1970s, concerns with EMP-induced large currents and voltages in electrical systems led the NRC to undertake research to study the effects of EMP on operating nuclear power plant safe-shutdown systems. The NRC study's results are documented in NUREG/CR-3069, "Interaction of Electromagnetic Pulse with Commercial Nuclear Power Plant Systems," issued in February 1983 and available at <http://www.osti.gov/scitech/biblio/6391155>. The study concluded that the safe shutdown capability of nuclear power plants would not be disabled by an EMP event.

In light of the modernization of nuclear plants with digital systems, the NRC conducted an additional study to assess the effects of an EMP on digital systems, which potentially could be more susceptible to EMP. The study, completed in 2009, also concluded that nuclear power plants could achieve safe shutdown, following a manmade EMP event. A supplemental study, completed in 2010, compared the potential impacts on nuclear power plants from solar-induced events, such as solar flares, coronal mass ejections or geomagnetic storms, to those of the EMP events previously analyzed. The results of the supplemental study reached a similar conclusion of the study completed in 2008. These additional studies are not publicly available because they address sensitive subjects beyond nuclear power plants. However, the 2010 study was recently made available, and can be found in the NRC Agencywide Documents Access and Management System (ADAMS) under Accession No. ML15209A895.

Concerning the national power grid itself, the NRC does not have regulatory authority over the reliability of bulk electric power systems, except with regard to nuclear power plants. The Federal Energy Regulatory Commission (FERC) has direct regulatory authority over the reliability of the electrical grid, and the North American Electric Reliability Corporation (NERC) develops and enforces reliability standards for these systems. FERC has been evaluating the potential impact of an EMP caused by a solar flare, also known as a coronal mass ejection or geomagnetic storm. In 2013, FERC published a final rule directing NERC to submit Reliability Standards requiring owners and operators of Bulk-Power Systems to conduct initial and on-going assessments of the potential impact of benchmark geomagnetic disturbance events on Bulk-Power System equipment and Bulk-Power Systems as a whole. More information about the most recent FERC final rule was published in the *Federal Register* on May 23, 2013.

(78 FR 30747), and may be found at <https://www.federalregister.gov/articles/2013/05/23/2013-12141/reliability-standards-for-geomagnetic-disturbances>.

In the event that all alternating current power from the electrical grid is lost (station blackout), nuclear power plants are required, under the regulation in Title 10 of the *Code of Federal Regulations* (10 CFR) 50.63, "Loss of all alternating current power," to be capable of withstanding and recovering from a station blackout.

In 2012, in response to the earthquake and tsunami events at the Fukushima Daiichi nuclear power plants in Japan, the NRC issued orders to all U.S. licensees of nuclear power plants for Mitigating Strategies for beyond design-basis events, including loss of spent fuel pool cooling. Licensees for operating nuclear power plants are currently implementing these mitigation strategies to address a beyond design-basis extended station blackout, and spent fuel pool cooling capabilities.

More information about mitigating strategies at operating nuclear power plants may be found on the NRC public website at <http://www.nrc.gov/reactors/operating/ops-experience/japan-dashboard/emergency-procedures.html>.

Concerning the SONGS nuclear power plant, SONGS Units 2 and 3 permanently ceased power operations in 2013 and are no longer operating plants. Because the plant had already achieved safe and permanent shutdown when the plant permanently ceased power operations and the fuel was moved to the spent fuel pool (SFP), those systems pertaining to power generation (e.g., the reactor vessel, reactor coolant system, containment, and associated piping and electrical systems) are no longer in use; and therefore no longer subject to impact from an EMP or solar flare. The spent fuel is currently stored either in the SFPs or in dry cask storage in the independent spent fuel storage installation (ISFSI).

Unlike operating plants, SONGS is no longer required to continue implementing the Fukushima-ordered Mitigating Strategies for the SFPs for extended station blackout. This is because the decay heat of the aged fuel assemblies stored in the SONGS SFPs is lower, which increases the time it would take to reach boiling in the SFP in the event of loss of cooling. In 2014, NRC staff determined that this low decay heat and increased time to boil allowed sufficient time for the licensee to obtain offsite resources to sustain cooling of the SFPs indefinitely, if necessary, eliminating the need to implement additional measures. More information regarding the applicability of Fukushima-ordered Mitigating Strategies at SONGS can be found in the NRC Agencywide Documents Access and Management System under Accession No. ML14113A572. Although SONGS no longer implements these additional measures, the safe operation of the isolated SFPs at SONGS continues to be maintained under the same applicable regulations as that for an SFP in an operating plant; that is, 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities." This includes the capability of withstanding and recovering from a station blackout in accordance with 10 CFR 50.63, as described above.

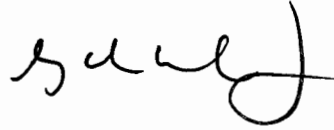
The spent fuel assemblies in the ISFSI are stored in casks that are passively cooled by natural air circulation, and therefore, do not require a power source. Because the casks at the ISFSI are designed to operate indefinitely with no power source, they are not vulnerable to an electrical interruption resulting from an EMP.

S. Brown

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I hope this information is useful to you. If you have any questions, please contact Thomas J. Wengert at 301-415-4037 or by e-mail at Thomas.Wengert@nrc.gov.

Sincerely,

A handwritten signature in black ink, appearing to read "G. Wilson", with a stylized flourish at the end.

George A. Wilson, Deputy Director
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

S. Brown

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I hope this information is useful to you. If you have any questions, please contact Thomas J. Wengert at 301-415-4037 or by e-mail at Thomas.Wengert@nrc.gov.

Sincerely,

/RA/

George A. Wilson, Deputy Director
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

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