



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

June 8, 2020

Mr. G. T. Powell  
President and Chief Executive Officer  
STP Nuclear Operating Company  
South Texas Project  
P.O. Box 289  
Wadsworth, TX 77483

SUBJECT: SOUTH TEXAS PROJECT, UNITS 1 AND 2 - RESOLUTION OF ISSUES PERTAINING TO BORIC ACID PRECIPITATION RELATED TO THE CLOSEOUT OF GENERIC LETTER, 2004-02, "POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY RECIRCULATION DURING DESIGN BASIS ACCIDENTS AT PRESSURIZED-WATER REACTORS"

Dear Mr. Powell:

By letter dated July 11, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17045A620), the U.S. Nuclear Regulatory Commission (NRC) staff documented that STP Nuclear Operating Company (STPNOC, the licensee) had provided sufficient information in its responses to NRC Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors" (ADAMS Accession No. ML042360586), to close out the matter for South Texas Project (STP), Units 1 and 2. STPNOC closed GL 2004-02 by using a risk-informed evaluation to provide reasonable assurance that debris would not inhibit operation of an emergency core cooling system and containment spray system following a loss-of-coolant accident (LOCA). STPNOC submitted a license amendment request (LAR) and exemption requests for NRC review and approval of the risk-informed methodology. In its safety evaluation (SE) of the LAR (ADAMS Accession No. ML17038A223), the NRC staff determined that STPNOC's analysis was acceptable to show that core cooling would not be adversely affected by debris. For cold-leg break LOCAs, the scenarios for which boric acid precipitation (BAP) is a concern, the NRC staff found that STPNOC met the intent of Topical Report WCAP-16793-NP-A, Revision 2, and the associated NRC staff SE (ADAMS Accession No. ML13239A114). In its SE of Topical Report WCAP-16793-NP-A, Revision 2, the NRC staff concluded that plants with relatively low fiber amounts reaching the core could use the topical report methodology to show that core cooling would not be adversely affected by debris. However, the SE of the topical report stated that the potential for debris to change flow patterns or inhibit the mixing of boric acid in the core that might result in earlier BAP had not been evaluated. The NRC staff reiterated this conclusion in its SE for the STP LAR. This left the question of the effects of debris of the plant licensing basis for BAP unresolved.

In its response to GL 2004-02, STPNOC demonstrated that STP has a very small amount of fiber that may arrive at the core inlet following a cold-leg break, and the NRC staff accepted this conclusion in its SE of the LAR. Later NRC staff evaluations for hot-leg break LOCAs found that BAP would not occur, even when conservative assumptions were used in the analyses. Therefore, the NRC staff has determined that debris will not significantly affect BAP timing for

STP and STP can maintain its current licensing basis for BAP. See the NRC staff technical evaluation report (ADAMS Accession No. ML19178A252), staff guidance (ADAMS Accession No. ML19228A011), and the enclosed NRC staff documentation of BAP concerning GL 2004-02 for more information. The NRC staff has no further questions related to potential effects of post-accident debris of the reactor vessel.

If you have any questions, please contact me at 301-415-6256 or via e-mail at [Dennis.Galvin@nrc.gov](mailto:Dennis.Galvin@nrc.gov).

Sincerely,

*/RA/*

Dennis J. Galvin, Project Manager  
Plant Licensing Branch IV  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. 50-498 and 50-499

Enclosure:  
NRC Staff Documentation of BAP  
concerning GL 2004-02

cc: Listserv



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

U.S. NUCLEAR REGULATORY COMMISSION STAFF DOCUMENTATION  
OF BORIC ACID PRECIPITATION CONCERNING GENERIC LETTER 2004-02,  
“POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY RECIRCULATION  
DURING DESIGN BASIS ACCIDENTS AT PRESSURIZED-WATER REACTORS”  
STP NUCLEAR OPERATING COMPANY  
SOUTH TEXAS PROJECT, UNITS 1 AND 2  
DOCKETS 50-498 AND 50-499

In September 2004, the U.S. Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 2004-02, “Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors” (Agencywide Documents Access and Management System (ADAMS) Accession No. ML042360586), to holders of operating licenses for pressurized-water reactors. In GL 2004-02, the NRC staff requested that licensees perform an evaluation of their emergency core cooling system (ECCS) and containment spray system (CSS) recirculation functions, considering the potential for debris-laden coolant to be circulated by the ECCS and the CSS after a loss-of-coolant accident (LOCA) or high-energy line break inside containment, and, if appropriate, take additional action to ensure system function. GL 2004-02 required, per Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.54(f), that licensees provide the NRC a written response describing the results of their evaluation and any modifications made, or planned, to ensure ECCS and CSS system function during recirculation following a design-basis event, or any alternate action proposed, and the basis for its acceptability.

By letter dated July 11, 2017 (ADAMS Accession No. ML17045A260), the NRC staff documented that the STP Nuclear Operating Company (STPNOC, the licensee) had provided sufficient information in its responses to GL 2004-02 to close out the matter for South Texas Project (STP), Units 1 and 2. STPNOC closed GL 2004-02 by using a risk-informed evaluation to provide reasonable assurance that debris would not inhibit operation of ECCS or CSS following a LOCA. STPNOC submitted a license amendment request (LAR) and exemption requests for NRC review and approval of the risk-informed methodology. In its safety evaluation (SE) of the LAR (ADAMS Accession No. ML17038A223), the NRC staff determined that STP’s analysis was acceptable to show that core cooling would not be adversely affected by debris. For cold-leg break LOCAs, the scenarios for which boric acid precipitation (BAP) is a concern, the NRC staff found that STPNOC met the intent of Topical Report (TR) WCAP-16793-NP-A, Revision 2, “Evaluation of Long-Term Cooling Considering Particulate, Fibrous and Chemical Debris in the Recirculating Fluid,” and the associated NRC staff SE (ADAMS Accession

No. ML13239A114). In its SE of the TR, the NRC staff concluded that plants with relatively low fiber amounts reaching the core could use the TR methodology to show that core cooling would not be adversely affected by debris. However, the SE of the TR stated that the potential for debris to change flow patterns or inhibit the mixing of boric acid in the core that might result in earlier BAP had not been evaluated. The NRC staff reiterated this conclusion in its SE for the STP LAR. This left the question of the effects of debris on the plant licensing basis for BAP open.

The Pressurized Water Reactors Owners Group continued to evaluate the effects of larger amounts of debris on long-term core cooling. This work is documented in TR WCAP-17788, Revision 1 (ADAMS Package Accession No. ML20010F181). The NRC staff performed a thorough review of this TR but was unable to conclude that the methodology used for evaluating reactor core debris limits was acceptable for licensing basis calculations. However, the NRC staff found that the TR methodology provided meaningful safety and regulatory insights regarding the treatment of BAP. The NRC staff's technical review of the TR methodology is documented in its technical evaluation report (ADAMS Accession No. ML19178A252). WCAP-17788, Revision 1 evaluated the potential for debris to affect current BAP analyses and found that BAP timing would not be adversely affected. The NRC staff performed sensitivity studies during its review of WCAP-17788, Revision 1. These analyses explicitly modeled the physical phenomena that affect the potential for BAP and were conducted for reactor designs considered to be the most limiting with respect to BAP. The analyses found that debris collecting at the core inlet would not adversely affect BAP timing under conditions that conservatively modeled the effects of debris, for both hot-leg break and cold-leg break scenarios. As discussed in NRC staff guidance dated September 4, 2019 (ADAMS Accession No. ML19228A011), the NRC staff determined that licensees that demonstrate that their plants fall within specific bounds can maintain their current licensing basis as it relates to BAP, even with debris amounts greater than those approved in TR WCAP-16793-NP-A, Revision 2.

In its response to GL 2004-02, STP demonstrated that it has a very small amount of fiber that may arrive at the core inlet following a cold-leg break, and the NRC staff accepted this conclusion in its SE of the LAR. NRC staff evaluations for hot-leg break LOCAs, as documented in the technical evaluation report, found that BAP would not occur, even when conservative assumptions were used in the analyses. Therefore, the NRC staff has determined that debris will not significantly affect BAP timing for STP and STP can maintain its current licensing basis for BAP. The NRC staff has no further questions related to potential effects of post-accident debris on the reactor vessel.

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**ADAMS Accession No. ML20156A364****\*by e-mail**

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