



[7590-01-P]

## NUCLEAR REGULATORY COMMISSION

[Docket Nos. 50-498 and 50-499; NRC-2016-0092]

STP Nuclear Operating Company

South Texas Project, Units 1 and 2

**AGENCY:** Nuclear Regulatory Commission.

**ACTION:** Exemption; issuance.

**SUMMARY:** The U.S. Nuclear Regulatory Commission (NRC) is granting exemptions from certain portions of the acceptance criteria for emergency core cooling, and the general design criteria for emergency core cooling, containment heat removal, and atmosphere cleanup for the use of a risk-informed analysis to evaluate the effects of debris in containment following a loss-of-coolant accident (LOCA) for the South Texas Project (STP), Units 1 and 2, located in Matagorda County, Texas, Docket Nos. 50-498 and 50-499, respectively. The exemptions are in response to a request dated June 19, 2013, from the STP Nuclear Operating Company (STPNOC, the licensee) related to STPNOC's proposed approach to resolve a generic safety concern for pressurized water reactors (PWRs) associated with potential clogging of emergency core cooling and containment spray system strainers during certain design basis events.

**DATES:** The exemption was issued on July 11, 2017.

**ADDRESSES:** Please refer to Docket ID **NRC-2016-0092** when contacting the NRC about the availability of information regarding this document. You may obtain publicly-available information related to this document using any of the following methods:

- **Federal Rulemaking Web Site:** Go to <http://www.regulations.gov> and search for Docket ID **NRC-2016-0092**. Address questions about NRC dockets to Carol Gallagher; telephone: 301-415-3463; e-mail:

[Carol.Gallagher@nrc.gov](mailto:Carol.Gallagher@nrc.gov). For technical questions, contact the individual listed in the FOR FURTHER INFORMATION CONTACT section of this document.

- **NRC's Agencywide Documents Access and Management System (ADAMS):** You may obtain publicly-available documents online in the ADAMS Public Documents collection at <http://www.nrc.gov/reading-rm/adams.html>. To begin the search, select "[ADAMS Public Documents](#)" and then select "[Begin Web-based ADAMS Search](#)." For problems with ADAMS, please contact the NRC's Public Document Room (PDR) reference staff at 1-800-397-4209, 301-415-4737, or by e-mail to [pdr.resource@nrc.gov](mailto:pdr.resource@nrc.gov). For the convenience of the reader, the ADAMS accession numbers are provided in a table in the "Availability of Documents" section of this document.

- **NRC's PDR:** You may examine and purchase copies of public documents at the NRC's PDR, Room 01-F21, One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852.

**FOR FURTHER INFORMATION CONTACT:** Lisa Regner, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Washington DC 20555-0001; telephone: 301-415-1906, e-mail: [Lisa.Regner@nrc.gov](mailto:Lisa.Regner@nrc.gov).

**SUPPLEMENTARY INFORMATION:**

**I. Background**

The licensee is the holder of Facility Operating License Nos. NPF-76 and NPF-80, which authorize operation of the STP Units 1 and 2, respectively. The licenses provide, among other things, that the facility is subject to all rules, regulations, and orders of the NRC now or hereafter in effect. The facility consists of two PWRs located in Matagorda County, Texas.

In 1996, the NRC identified Generic Safety Issue (GSI)-191 associated with the effects of debris accumulation on PWR sump performance during design-basis accidents. As part of the actions to resolve GSI-191, the NRC issued Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized-Water Reactors," dated September 13, 2004, to holders of operating licenses for PWRs. In GL 2004-02, the NRC staff requested that licensees perform an evaluation of their emergency core cooling systems (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 LOCA or high energy line break inside containment and, if appropriate, take additional actions to ensure system function. The GL required that licensees provide a written response to the NRC, pursuant to section 50.54(f) of title 10 of the *Code of Federal Regulations* (10 CFR), describing the results of their evaluation and any modifications made, or planned, to ensure the ECCS and CSS remain functional.

## **II. Request/Action**

By letter dated June 19, 2013, as supplemented by letters dated August 20, 2015, and April 13, 2016, STPNOC submitted requests for exemptions pursuant to 10 CFR 50.12, “Specific exemptions,” from the requirements of 10 CFR 50.46, “Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors,” and 10 CFR part 50, appendix A, General Design Criterion (GDC) 35, “Emergency core cooling,” GDC 38, “Containment heat removal,” and GDC 41, “Containment atmosphere cleanup,” to use a risk-informed methodology instead of the traditional deterministic methodology, to resolve the concerns associated with GSI-191 and respond to GL 2004-02.

Specifically, the licensee requested an exemption from 10 CFR 50.46(a)(1)(i), which, in part, requires ECCS cooling performance to be calculated in accordance with an acceptable evaluation model, as described in 10 CFR 50.46(a)(1), for postulated LOCAs of different sizes, locations and other properties sufficient to provide assurance that the most severe LOCAs are evaluated in order to demonstrate that acceptance criteria in 10 CFR 50.46(b) are met. The NRC staff interprets 10 CFR 50.46(a)(1) requirement to calculate ECCS performance for “other properties” as requiring licensees to consider the impacts of debris generation and transport in containment. The most significant form of debris in nuclear power reactor containments is piping and component insulation that becomes debris during LOCAs, is transported and accumulates in the sumps, and clogs the sumps strainers, thus creating resistance to coolant

flow. Fibrous debris from this insulation can also enter the reactor core and directly impede heat transfer from the fuel to the coolant. The licensee also requested exemptions from GDC 35, which contain ECCS performance requirements, and GDCs 38 and 41, which respectively set performance requirements for reactor containment heat removal following a LOCA and for containment atmosphere cleanup following postulated accidents.

The approval of a risk-informed methodology would require exemptions from 10 CFR 50.46(a)(1)(i) and GDCs 35, 38, and 41 because the NRC has interpreted these regulations as requiring a deterministic approach and bounding calculation to show compliance with ECCS and CSS performance criteria in 10 CFR 50.46(b) and GDCs 35, 38 and 41. Issuance of exemptions is an appropriate means to grant relief from the use of a deterministic approach to show compliance with these requirements.

The licensee's 10 CFR 50.46 deterministic analysis considered the debris in containment and demonstrated that the debris loading could prevent acceptable ECCS and CSS operation and core cooling for certain pipe ruptures. Based on its analysis, the licensee concluded that the amount of debris in the STP containment would need to be reduced to demonstrate compliance with 10 CFR 50.46 criteria using a deterministic analysis for certain large-break LOCA sizes because, for those breaks, the plant-specific testing threshold for generation and transport of debris was exceeded.

Additionally, the licensee's deterministic thermal-hydraulic (TH) analysis could not show that hot-leg LOCAs greater than 16 inches could maintain adequate cooling. While not all large-break hot-leg LOCAs resulted in a loss of in-core cooling due to strainer blockage, the licensee categorized all hot-leg breaks greater than 16 inches as assumed to fail in order to simplify the TH analysis.

The licensee requested exemptions from the requirement to use a deterministic analysis for specific scenarios of LOCA breaks producing and transporting debris in excess of the plant-specific tested debris limits and for large hot-leg breaks. Since it determined that the probability

of consequences from debris effects is very low, the licensee requested an exemption to use a risk-informed analysis to show adequate assurance of ECCS and CSS functionality, in accordance with the criteria in Regulatory Guide (RG) 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis." The RG 1.174 was developed in consideration of the Commission's Policy Statements on safety goals and the use of probabilistic risk assessment methods in nuclear regulatory activities ("Safety Goals for the Operations of Nuclear Power Plants; Policy Statement," August 4, 1986, 51 FR 30028; and "Use of Probabilistic Risk Assessment Methods in Nuclear Activities; Final Policy Statement," August 16, 1995, 60 FR 42622, respectively). Therefore, RG 1.174 provides an acceptable method for licensees and NRC staff to use in assessing the impact of licensing basis changes when the licensee chooses to use risk information.

The GDC 35, in part, requires that the ECCS safety system functions adequately to transfer heat from the reactor core following a LOCA and in the presence of a worst single failure, at a rate such that (a) fuel and clad damage that could interfere with continued effective core cooling is prevented and (b) clad metal-water reactor is limited to negligible amounts. The licensee stated in its submittal that the function of the ECCS emergency sump is assumed to fail for debris that exceeds the amount determined in acceptable plant-specific testing. Failure of the sump and strainers result in loss of cooling to the core. The licensee requested an exemption from the deterministic requirements of GDC 35 to use a risk-informed approach to show ECCS function for those LOCA breaks that exceed the plant-specific testing debris threshold, and for large hot-leg breaks. The use of a risk-informed analysis, in accordance with the criteria in RG 1.174, would allow the licensee to show that the risk from debris effects is very low.

The GDC 38 requires containment heat removal, rapid reduction of containment pressure and temperature, and maintenance of pressure and temperature at an acceptably low

level following a LOCA, and in the presence of a single failure, to preserve containment function. The STPNOC proposed that an exemption be granted from the deterministic requirements in GDC 38, for those LOCA breaks that exceed the plant-specific testing debris threshold. Current STP design basis calculations are based on the reactor containment fan coolers functioning in conjunction with the CSS and ECCS, both of which can be affected by debris. Using deterministic assumptions, STPNOC's analysis and testing does not assure that the emergency sump strainers will be available to support the CSS and ECCS function considering the effects of debris produced by those breaks that can generate and transport debris amounts greater than the plant-specific testing threshold. The licensee requested an exemption from the deterministic requirements of GDC 38 to use a risk-informed analysis, in accordance with the criteria in RG 1.174, to show that the risk from debris effects is very low.

The GDC 41, in part, requires containment atmosphere cleanup to control substances that may be released into the reactor containment, to reduce the concentration and quality of fission products released to the environment following postulated accidents, and to control the concentration of hydrogen or oxygen and other substances in the containment atmosphere following postulated accidents, assuming a single failure. The licensee stated that using deterministic assumptions, STPNOC's analysis and testing cannot demonstrate that the emergency sump strainers will be available to support the CSS function considering the effects of debris produced and transported by breaks not bounded by acceptable plant-specific testing. The licensee requested an exemption from the deterministic requirements of GDC 41 to use a risk-informed analysis, in accordance with the criteria in RG 1.174, to show that the risk from debris effects is very low.

### **III. Discussion**

Pursuant to 10 CFR 50.12, the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR part 50, when (1) the exemptions are authorized by law, will not present an undue risk to public health or

safety, and are consistent with the common defense and security; and (2) when special circumstances are present. Under 10 CFR 50.12(a)(2)(ii), special circumstances are present “when application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule.”

The licensee proposed to use a risk-informed methodology instead of a deterministic approach to account for the effects of debris in containment for portions of the LOCA analysis applicable to breaks that exceed the STP plant-specific debris testing threshold and large hot-leg piping breaks. The STPNOC methodology, termed Risk over Deterministic, or RoverD, divides the loss of core cooling design-basis analysis into two portions: the “deterministic analysis” and the “risk-informed analysis.” The risk-informed analysis is used by the licensee for breaks that generate and transport debris exceeding the plant-specific testing threshold. These breaks result in low density fiber glass fiber fines estimated to arrive in the ECCS sump post-LOCA in amounts that are equal to or greater than the amount of fines used in acceptable strainer testing. The acceptable limit was determined using testing methods intended to determine the maximum ECCS strainer head loss for the tested condition.

Also, the licensee evaluated the in-core TH aspects of fibrous debris to prevent adequate fuel cooling, finding that hot-leg breaks greater than 16 inches have the potential to prevent adequate in-core cooling. In order to simplify its TH evaluation, the licensee assumed that all large breaks greater than 16 inches in the hot-leg will result in the loss of the cooling function. For ECCS and CSS analyses other than the postulated large-break LOCAs in the hot-leg piping in containment and those breaks that exceed the STP plant-specific testing limit, STPNOC applied a deterministic methodology. If the exemptions were granted for these postulated breaks, the requirement to use a deterministic methodology for all other postulated LOCA breaks would continue to apply.

#### **A. Special Circumstances**

Under the regulations in 10 CFR 50.12, the Commission may grant exemptions from the requirements of 10 CFR part 50 provided certain findings are made; namely, that special circumstances are present, the exemptions present no undue risk to public health and safety, the exemptions are consistent with the common defense and security, and the exemptions are authorized by law. The exemptions would allow the licensee to use a risk-informed methodology to show compliance with 10 CFR 50.46(b), and GDCs 35, 38, and 41, specifically for the analyses of debris in containment impacting emergency cooling function during postulated large-break hot-leg LOCAs and those breaks that exceed the plant-specific testing threshold.

The licensee requested exemptions citing the special circumstances criteria of 10 CFR 50.12(a)(2)(ii), because compliance in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule. The licensee stated that these special circumstances are common to all of the requested exemptions.

The licensee stated that an objective of each of the regulations for which an exemption is proposed is to maintain low risk to the public health and safety through the adequate functioning of the ECCS and CSS safety systems. These systems must be supported by adequate functioning of the containment sumps. The regulations in 10 CFR 50.46(a)(1)(i) and GDCs 35, 38, and 41 are met when the licensee is able to demonstrate, using a bounding calculation or other deterministic method that the ECCS and CSS are capable of functioning during design basis events. The STPNOC stated that its risk-informed analysis to show adequate functioning of ECCS and CSS considering the impacts of debris during certain LOCA events demonstrates that the risk of failure of these systems is very small. The licensee stated that special circumstances exist because the underlying intent of the regulations, to ensure adequate protection of public health and safety is met when applying a risk-informed approach to address GSI-191 and respond to GL 2004-02. Further, it states that the risk-informed

approach is consistent with RG 1.174, and supports operation of those functions with a high degree of reliability. Thus, the licensee concludes that the underlying intent of each regulation is met and the special circumstances described in 10 CFR 50.12(a)(2)(ii) apply to each of the exemptions proposed by STPNOC.

The NRC staff evaluated the STPNOC submittal and supplements, and discussed the details of its evaluation of the risk-informed approach in an NRC safety evaluation available in ADAMS under Accession No. ML17019A001. Although 10 CFR 50.46(a)(1) requires a deterministic approach, the GDCs do not specify that a risk-informed methodology may not be used to show compliance; however, because the NRC has interpreted each of these regulations as requiring a deterministic approach, an exemption is an appropriate means to grant the licensee relief to use an alternative approach. The underlying purpose of each regulation is to protect public health and safety in the event of a LOCA by establishing criteria for emergency core cooling, containment cooling and containment atmosphere cleanup system performance. In its safety evaluation, the NRC staff concluded, in part, that the licensee adequately demonstrated that the change in risk attributable to debris in postulated hot-leg LOCAs greater than 16 inches, and those breaks that exceed the plant specific threshold, is very small. The NRC staff also concluded that the licensee's proposal for demonstrating compliance with the ECCS and CSS performance requirements meet the risk acceptance guidelines in RG 1.174 because the approach is related to a permissible exemption request, is consistent with defense-in-depth philosophy, maintains sufficient safety margins, results in a small increase in risk, and the impact of this approach is monitored by the licensee using performance measurement strategies. Therefore, the licensee's use of the risk-informed analysis to consider the impacts of debris meets the underlying requirements of 10 CFR 50.46 and GDCs 35, 38, and 41, to ensure that a licensee demonstrates that the ECCS and CSS will provide adequate cooling for the reactor core and containment, as well as containment atmosphere cleanup following postulated design-basis accidents.

Based on the above, the NRC staff concludes that special circumstances under 10 CFR 50.12(a)(2)(ii) exist because compliance with the deterministic requirements of 10 CFR 50.46(a)(1)(i), and GDCs 35, 38, and 41 is not necessary to achieve the underlying purpose of each rule.

**B. The Exemption Presents no Undue Risk to Public Health and Safety**

The provisions of 10 CFR 50.46 and GDCs 35, 38, and 41 establish criteria for the emergency core cooling, containment cooling, and containment atmosphere cleanup system performance. As part of the amendment requests, the STPNOC submitted exemption requests to change its design-basis analysis specified in the Updated Final Safety Analysis Report (UFSAR) to use new risk-informed and deterministic methodologies to specifically account for the impacts of debris in containment. The licensee justified its use of the risk-informed approach by stating that the proposed risk-informed approach meets the key principles in RG 1.174 in that it is consistent with defense-in-depth philosophy, maintains sufficient safety margins, results in a small increase in risk, and is monitored by the licensee using performance measurement strategies.

Additionally, the licensee stated that the proposed exemptions to use the risk-informed method are consistent with Key Principle 1 in RG 1.174 that requires a proposed change to the licensing basis (or amendment) to meet current regulations unless the change is explicitly related to a requested exemption. The licensee's probabilistic risk analysis results provided by the licensee and evaluated by the NRC staff in its safety evaluation, showed that the increase in risk associated with debris generation and transport on ECCS and CSS function following postulated LOCAs is very low, in accordance with the criteria in RG 1.174.

The NRC staff concluded that the risk is consistent with the guidance in RG 1.174 and with the Commission policy statements on safety goals and the use of probabilistic risk

assessment methods in nuclear regulatory activities; therefore, the requested exemption presents no undue risk to public health and safety.

**C. The Exemption is Consistent with the Common Defense and Security**

The requested exemptions to use a risk-informed methodology allow STPNOC to resolve a generic safety concern for PWRs associated with potential clogging of the ECCS and CSS strainers during certain design-basis events. The change is adequately controlled by safety acceptance criteria and technical specification requirements and is not related to security issues. Because the common defense and security is not impacted by the exemption, the exemption is consistent with the common defense and security.

**D. The Exemptions are Authorized by Law**

The exemptions to use a risk-informed methodology allow STPNOC to show compliance with 10 CFR 50.46(a)(1)(i), and GDCs 35, 38, and 41, when considering debris in containment generated and transported during postulated hot-leg LOCA breaks greater than 16 inches, and those breaks that exceed the plant-specific testing threshold. These regulations were promulgated under, and are consistent with the Commission's authority under Section 161 of the Atomic Energy Act. Because the application of a risk-informed methodology to show compliance with 10 CFR 50.46, and GDC 35, 38, and 41 would not violate the Atomic Energy Act of 1954, as amended, or the Commission's regulations, the exemptions are authorized by law provided all requisite findings are made.

**E. Environmental Considerations**

Pursuant to 10 CFR 51.21, "Criteria for and identification of licensing and regulatory actions requiring environmental assessments," the NRC has prepared an Environmental Assessment (EA) summarizing the findings of its review of the environmental impacts of the

proposed action under the National Environmental Policy Act. The NRC staff determined that special circumstances under 10 CFR 51.21 exist to warrant preparation of an EA because STP is the pilot plant to propose a risk-informed approach to resolve GSI-191 as recognized in Staff Requirement Memorandum SECY-12-0093, "Closure Options for Generic Safety Issue-191, Assessment of Debris Accumulation on Pressurized-Water Reactor Sump Performance," dated December 14, 2012. Because this is the first approval of a risk-informed approach, the NRC staff considered preparations of an EA to be a prudent course of action that would further the purposes of the National Environmental Policy Act. Based on its review, the NRC concluded that an environmental impact statement is not required and that the proposed action will have no significant impact on the environment.

The NRC published a final EA on the proposed action in the *Federal Register* on May 9, 2017 (82 FR 21568).

#### **IV. Conclusions**

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12, exemptions are authorized by law, will not present an undue risk to the public health and safety, are consistent with the common defense and security, and special circumstances are present pursuant to 10 CFR 50.12(a)(2)(ii). Therefore, the NRC hereby grants STPNOC a one-time exemption from 10 CFR 50.46(a)(1), and 10 CFR part 50, appendix A, GDCs 35, 38, and 41 to use a risk-informed methodology in lieu of a deterministic methodology to show conformance with the ECCS and CSS performance criteria accounting for debris in containment for large-break hot-leg LOCAs and those breaks that exceed the plant-specific STP testing threshold.

## V. Availability of Documents

The documents identified in the following table are available for public inspection through the NRC's Agencywide Documents Access and Management System (ADAMS).

| Title  | Date       | ADAMS Accession No.      |
|--|------------|--------------------------|
| NRC Generic Letter 2004-02, Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors   | 9/13/2004  | ML042360586              |
| STPNOC letter to NRC, Revised STP Pilot Submittal and Requests for Exemptions and License Amendment for a Risk-Informed Approach to Resolving Generic Safety Issue (GSI)-191   | 6/19/2013  | ML131750250<br>(Package) |
| STPNOC letter to NRC, Supplement 2 to STP Pilot Submittal and Requests for Exemptions and License Amendment for a Risk-Informed Approach to Address Generic Safety Issue (GSI)-191 and Respond to Generic Letter (GL) 2004-02  | 8/20/15    | ML15246A125<br>(Package) |
| STPNOC letter to NRC, South Texas Project, Units 1 and 2 – Revision to Proposed Exemption to 10 CFR 50.46 Described in Pilot Submittal and Requests for Exemptions and License Amendment for a Risk-Informed Approach to Address Generic Safety Issue (GSI)-191 and Respond to Generic Letter (GL) 2004-02 | 4/13/2016  | ML16111B204              |
| Regulatory Guide 1.174, Revision 2, “An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis”  | 5/2011     | ML100910006              |
| NRC letter to STPNOC, South Texas Project, Units 1 and 2 – Issuance of Amendment Nos. 212 and 198 – Risk-Informed Approach to Resolve Generic Safety Issue-191 (includes Safety Evaluation)  | 7/11/2017  | ML17019A001<br>(Package) |
| Commission SRM-SECY-12-0093, Staff Requirements – SECY-12-0093 – Closure Options for Generic Safety Issue – 191, Assessment of Debris Accumulation on Pressurized-Water Reactor Sump Performance   | 12/14/2012 | ML12349A378              |
| NRC Letter to STPNOC, South Texas Project, Units 1 and 2 – Letter, Environmental Assessment and Finding of No Significant Impact, Revise Licensing Basis as Documented in the UFSAR and Request for Exemptions, Risk-Informed approach to Address GSI-191  | 5/02/2017  | ML16278A598              |

Dated at Rockville, Maryland, this 11<sup>th</sup> day of July 2017.

For the Nuclear Regulatory Commission.

Eric J. Benner, Deputy Director,  
Division of Operating Reactor Licensing,  
Office of Nuclear Reactor Regulation.

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