[7590-01-P]

NUCLEAR REGULATORY COMMISSION

June 7, 2016

[NRC-2016-0097]

Consequential SGTR Analysis for Westinghouse and Combustion Engineering Plants with Thermally-Treated Alloy 600 and 690 Steam Generator Tubes

AGENCY: Nuclear Regulatory Commission.

ACTION: Draft NUREG; request for comment.

SUMMARY: The U.S. Nuclear Regulatory Commission (NRC) is issuing for public comment a draft NUREG, NUREG-2195, "Consequential SGTR Analysis for Westinghouse and Combustion Engineering Plants with Thermally Treated Alloy 600 and 690 Steam Generator Tubes." This report summarizes severe accident-induced consequential steam generator tube rupture (C-SGTR) analyses recently performed by the NRC's Office of Nuclear Regulatory Research. The analyses described in this report include risk assessment, thermal-hydraulic analyses, and materials behavior analyses.

DATES: Submit comments by **[INSERT DATE THAT IS 60 DAYS AFTER THE DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**. Comments received after this date will be considered if it is practical to do so, but the Commission is able to ensure consideration only for comments received before this date.

ADDRESSES: You may submit comments by any of the following methods (unless this document describes a different method for submitting comments on a specific subject):

- **Federal Rulemaking Web Site:** Go to http://www.regulations.gov and search for Docket ID **NRC-2016-0097**. Address questions about NRC dockets to Carol Gallagher; telephone: 301-415-3463; e-mail: Carol.Gallagher@nrc.gov. For technical questions, contact the individual listed in the FOR FURTHER INFORMATION CONTACT section of this document.
- **Mail comments to:** Cindy Bladey, Office of Administration, Mail Stop: OWFN-12-H08, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

For additional direction on accessing information and submitting comments, see "Obtaining Information and Submitting Comments" in the SUPPLEMENTARY INFORMATION section of this document.

FOR FURTHER INFORMATION CONTACT: Selim Sancaktar, Office of Nuclear Regulatory Research; U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; telephone: 301-415-2391; e-mail: Selim.Sancaktar@nrc.gov.

SUPPLEMENTARY INFORMATION:

I. Obtaining Information and Submitting Comments

A. Obtaining Information

Please refer to Docket ID **NRC-2016-0097** when contacting the NRC about the availability of information for this action. You may obtain publicly-available information related to this action by any of the following methods:

- **Federal Rulemaking Web Site:** Go to http://www.regulations.gov and search for Docket ID **NRC-2016-0097**.

- **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. Draft NUREG-2195 can be found in ADAMS under at Accession No. ML16134A029.

- **NRC's PDR:** You may examine and purchase copies of public documents at the NRC's PDR, Room O1-F21, One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852.

B. Submitting Comments

Please include Docket ID **NRC-2016-0097** in your comment submission.

The NRC cautions you not to include identifying or contact information that you do not want to be publicly disclosed in your comment submission. The NRC posts all comment submissions at http://www.regulations.gov as well as entering the comment submissions into ADAMS. The NRC does not routinely edit comment submissions to remove identifying or contact information.

If you are requesting or aggregating comments from other persons for submission to the NRC, then you should inform those persons not to include identifying or contact information that they do not want to be publicly disclosed in their comment submission. Your request should state that the NRC does not routinely edit comment submissions to remove such information before making the comment submissions available to the public or entering the comment submissions into ADAMS.

II. Discussion

This report summarizes severe accident-induced consequential steam generator tube rupture (C-SGTR) analyses recently performed by the NRC's Office of Nuclear Regulatory Research. The C-SGTRs are potentially risk-significant events because thermally-induced steam generator (SG) tube failures caused by hot gases from a damaged reactor core can result in a containment bypass event and a large release of fission products to the environment. The main accident scenarios of interest are those that lead to core damage with high reactor pressure, dry SG, and low SG pressure (high-dry-low) conditions. A typical example of such an accident scenario is a station blackout with loss of auxiliary feedwater. The analyses described in this report include risk assessment, thermal-hydraulic analyses, and materials behavior analyses. This work builds on, and updates, previous NRC work.

The current analyses evaluate replacement SGs with thermally-treated Alloy 600 and Alloy 690 heat exchange tubes and use the latest tube flaw data available in the 2010 time frame. A main focus of this work was to compare C-SGTR results for the different SG geometries associated with Westinghouse and Combustion Engineering plant designs. It has been previously understood that the geometry of the SG reactor coolant inlet plenum region and the hot-leg (HL) influences the temperature of the gases reaching the steam generator tubes during closed-loop-seal natural circulation conditions. Hotter gases reaching the SG tube reduce the time before tube failure, which increases the likelihood of containment bypass. However, if a thermally-induced failure sufficient to depressurize the reactor coolant system (RCS) develops in another location, fission product release through failed SG tubes may be prevented or minimized. Therefore, the possibility of an earlier failure of other RCS components (such as the reactor coolant HL) is also considered. Pressure-induced steam generator tube rupture (SGTR) scenarios, which also may lead to tube failure and subsequent containment bypass, were also studied, but are deemed to be of lesser potential impact on overall plant risk.

The methods developed were intended to address the contribution of thermally-induced SGTR during severe accidents and pressure-induced SGTR during a number of design-basis accidents. The methods and the pilot applications were developed in a manner that can establish the framework to perform a more comprehensive Probabilistic Risk Assessment that can address the C-SGTR at a level of detail suitable for other NRC needs.

Dated at Rockville, Maryland, this 26th day of May 2016.

For the Nuclear Regulatory Commission.

Kevin Coyne, Branch Chief, ***/RA/***
Probabilistic Risk Assessment Branch,
Division of Risk Analysis,
Office of Nuclear Regulatory Research.