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

June 27, 2017

Mr. Mark E. Reddemann
Chief Executive Officer
Energy Northwest
P.O. Box 968 (Mail Drop 1023)
Richland, WA 99352-0968

SUBJECT: COLUMBIA GENERATING STATION - ISSUANCE OF AMENDMENT RE: REDUCTION OF REACTOR STEAM DOME PRESSURE SPECIFIED IN THE TECHNICAL SPECIFICATION 2.1.1, "REACTOR CORE SLS [SAFETY LIMITS]" (CAC NO. MF8116)

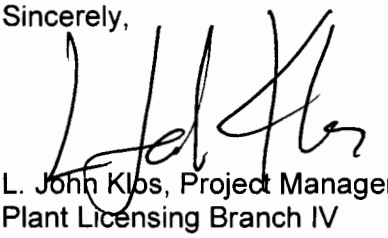
Dear Mr. Reddemann:

The U.S. Nuclear Regulatory Commission (NRC or the Commission) has issued the enclosed Amendment No. 242 to Renewed Facility Operating License No. NPF-21 for the Columbia Generating Station (Columbia). The amendment consists of changes to the technical specifications (TSs) in response to your application dated July 12, 2016, as supplemented by letter dated November 17, 2016.

The amendment reduces the minimum reactor dome pressure associated with the critical power correlation from 785 pounds per square inch gauge (psig) to 686 psig in TS 2.1.1, "Reactor Core SLs [Safety Limits]." The proposed change addresses a condition with the potential to momentarily violate the reactor core SLs during a pressure regulator failure maximum demand (open) transient. General Electric Energy–Nuclear identified this condition and notified the NRC under Title 10 of the *Code of Federal Regulations* Part 21, "Reporting of Defects and Noncompliance." The NRC staff notes that if Columbia transitions to a new fuel design, the licensee should review the critical power correlation to determine if further changes to the reactor core SLs are required.

A copy of the related Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's next biweekly *Federal Register* notice.

Sincerely,



L. John Klos, Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-397

Enclosures:
1. Amendment No. 242 to NPF-21
2. Safety Evaluation

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

ENERGY NORTHWEST

DOCKET NO. 50-397

COLUMBIA GENERATING STATION

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 242
License No. NPF-21

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Energy Northwest (licensee), dated July 12, 2016, as supplemented by letter dated November 17, 2016, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act) and the Commission's regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Renewed Facility Operating License No. NPF-21 is hereby amended to read as follows:

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, as revised through Amendment No. 242 and the Environmental Protection Plan contained in Appendix B, are hereby incorporated in the renewed license. The licensee shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. The license amendment is effective as of its date of issuance and shall be implemented within 60 days from the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Robert J. Pascarelli, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Renewed Facility
Operating License No. NPF-21
and Technical Specifications

Date of Issuance: June 27, 2017

ATTACHMENT TO LICENSE AMENDMENT NO. 242

COLUMBIA GENERATING STATION

RENEWED FACILITY OPERATING LICENSE NO. NPF-21

DOCKET NO. 50-397

Replace the following pages of the Renewed Facility Operating License No. NPF-21 and Appendix A, Technical Specifications with the attached revised pages. The revised pages are identified by amendment number and contain vertical lines indicating the areas of change.

Facility Operating License

REMOVE	INSERT
-4-	-4-

Technical Specification

REMOVE	INSERT
2.0-1	2.0-1

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, as revised through Amendment No. 242 and the Environmental Protection Plan contained in Appendix B, are hereby incorporated in the renewed license. The licensee shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

a. For Surveillance Requirements (SRs) not previously performed by existing SRs or other plant tests, the requirement will be considered met on the implementation date and the next required test will be at the interval specified in the Technical Specifications as revised in Amendment No. 149.

(3) Deleted.

(4) Deleted.

(5) Deleted.

(6) Deleted.

(7) Deleted.

(8) Deleted.

(9) Deleted.

(10) Deleted.

(11) Shield Wall Deferral (Section 12.3.2, SSER #4, License Amendment #7)

The licensee shall complete construction of the deferred shield walls and window as identified in Attachment 3, as amended by this license amendment.

(12) Deleted.

(13) Deleted.

*The parenthetical notation following the title of many license conditions denotes the section of the Safety Evaluation Report and/or its supplements wherein the license condition is discussed.

2.0 SAFETY LIMITS (SLs)

2.1 SLs

2.1.1 Reactor Core SLs

2.1.1.1 With the reactor steam dome pressure < 686 psig or core flow < 10% rated core flow:

THERMAL POWER shall be ≤ 25% RTP.

2.1.1.2 With the reactor steam dome pressure ≥ 686 psig and core flow ≥ 10% rated core flow:

The MCPR shall be ≥ 1.10 for two recirculation loop operation or ≥ 1.13 for single recirculation loop operation.

2.1.1.3 Reactor vessel water level shall be greater than the top of active irradiated fuel.

2.1.2 Reactor Coolant System Pressure SL

Reactor steam dome pressure shall be ≤ 1325 psig.

2.2 SL Violations

With any SL violation, the following actions shall be completed within 2 hours:

2.2.1 Restore compliance with all SLs; and

2.2.2 Insert all insertable control rods.

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 242 TO

RENEWED FACILITY OPERATING LICENSE NO. NPF-21

ENERGY NORTHWEST

COLUMBIA GENERATING STATION

DOCKET NO. 50-397

1.0 INTRODUCTION

By application dated July 12, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16194A515), as supplemented by letter dated November 17, 2016 (ADAMS Accession No. ML16326A443), Energy Northwest (the licensee) requested changes to the technical specifications (TSs) to Renewed Facility Operating License No. NPF-21 for the Columbia Generating Station (Columbia). The requested change would reduce the minimum reactor dome pressure associated with the critical power correlation from 785 pounds per square inch gauge (psig) to 686 psig in TS 2.1.1, "Reactor Core SLs [Safety Limits]."[1] The proposed change addresses a condition with the potential to momentarily violate the reactor core SLs during a pressure regulator failure maximum demand open (PRFO) transient. General Electric Energy–Nuclear (GE) identified this condition and notified the U.S. Nuclear Regulatory Commission (NRC) under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 21, "Reporting of Defects and Noncompliance."[2]

On October 25, 2016, the NRC staff published a proposed no significant hazards consideration (NSHC) determination in the *Federal Register* (81 FR 73433) for the proposed amendment. Subsequently, by letter dated November 17, 2016, the licensee provided additional information that expanded the scope of the amendment request as originally noticed in the *Federal Register*. Accordingly, the NRC published a second proposed NSHC determination in the *Federal Register* on April 25, 2017 (82 FR 19102), which superseded the original notice in its entirety.

[1] The licensee originally requested to change the minimum reactor dome pressure from 785 psig to 685 psig. However, by letter dated November 17, 2016, the licensee requested a new value of 686 psig and submitted revised TS pages.

[2] GE Energy–Nuclear, "10 CFR 21 Reportable Condition Notification: Involving Potential to Exceed Low Pressure Technical Specification Safety Limit," dated March 29, 2005 (ADAMS Accession No. ML050950428).

2.0 REGULATORY EVALUATION

2.1 Background

Columbia TS 2.1.1.1 currently requires that thermal power shall be less than or equal to 25 percent of rated thermal power (RTP) when the steam dome pressure is less than 785 psig or core flow is less than 10 percent of rated core flow. The GE Part 21 notification identified (as a result of using newer computer analysis codes) that a PRFO transient could result in a condition where the reactor steam dome pressure momentarily decreases below 785 psig while thermal power is above the plant-specific thermal power limit specified in TS 2.1.1.1. This condition would violate the reactor core SL in TS 2.1.1.1 at Columbia.

Initially, the Boiling Water Reactor (BWR) Owners' Group (BWROG) attempted to generically resolve the issue identified in the GE Part 21 notification. On July 18, 2006, the Technical Specifications Task Force (TSTF) and the BWROG submitted TSTF-495, Revision 0, "Bases Change to Address GE Part 21 SC05-03," dated July 18, 2006 (ADAMS Accession No. ML061990227), which proposed a modification to the Standard TSs (STS) bases for BWRs. The proposed change would clarify that the SL did not apply to momentary depressurization transients by revising the "Applicable Safety Analysis" portion of the STS bases for the reactor core SL (Section B 2.1.1). By letter dated August 27, 2007 (ADAMS Accession No. ML072340113), the NRC staff denied TSTF-495, Revision 0, because the proposed change to the STS bases would modify the corresponding TSs by providing an exception to the explicit safety limit. The staff's safety evaluation (SE) enclosed with the letter stated in part:

> The staff agrees with the applicant's position that the PRFO transient does not threaten fuel cladding integrity, since the margin to SLMCPR [SL minimum critical power ratio (MCPR)] increases with decreasing reactor pressure. However, the staff is concerned that in some depressurization events which occur at or near full power, there may be enough bundle stored energy to cause some fuel damage. If a reactor scram does not occur automatically, the operator may have insufficient time to recognize the condition and to take the appropriate actions to bring the reactor to a safe configuration.

Consequently, the BWROG discontinued its effort to resolve the issue generically. Subsequently, affected BWR licensees have proposed resolution of the GE Part 21 issue on a plant-specific basis by submittal of license amendment requests that lower the reactor steam dome pressure SL value in the TSs. This approach takes advantage of the fact that some advanced fuel designs have a critical power correlation with a lower-bound pressure significantly below the reactor steam dome pressure currently specified in TS 2.1.1.

Currently, TS 2.1.1 for Columbia specifies a reactor steam dome pressure of 785 psig. The licensee proposes in the license amendment request to reduce the reactor steam dome pressure consistent with the lower-bound pressure of the critical power correlations for the fuel designs, which currently comprise the Columbia reactor core.

2.2 Proposed TS Changes

The licensee's proposed changes would reduce the reactor steam dome pressure specified in TS 2.1.1.1 and TS 2.1.1.2 from 785 psig to 686 psig for Columbia. The current and revised TS for the facility is listed below.

Current TS 2.1.1.1 and TS 2.1.1.2 state, that:

> 2.1.1.1 With the reactor steam dome pressure < 785 psig or core flow < 10% rated core flow:
>
> THERMAL POWER shall be ≤ 25% RTP.
>
> 2.1.1.2 With the reactor steam dome pressure ≥ 785 psig and core flow ≥ 10% rated core flow:
>
> The MCPR shall be ≥ 1.10 for two recirculation loop operation or ≥ 1.13 for single recirculation loop operation.

Revised TS 2.1.1.1 and TS 2.1.1.2 state, that:

> 2.1.1.1 With the reactor steam dome pressure < 686 psig or core flow < 10% rated core flow:
>
> THERMAL POWER shall be ≤ 25% RTP.
>
> 2.1.1.2 With the reactor steam dome pressure ≥ 686 psig and core flow ≥ 10% rated core flow:
>
> The MCPR shall be ≥ 1.10 for two recirculation loop operation or ≥ 1.13 for single recirculation loop operation.

The licensee's application also provided revised TS Bases pages to be implemented with the associated TS changes. These pages were provided for information only. Changes to the TS Bases would be made in accordance with the TS Bases Control Program.

2.3 Applicable Regulatory Requirements

The regulatory requirements and guidance documents the NRC staff considered in its review of the proposed license amendment are discussed below.

Section 50.36, "Technical specifications," of 10 CFR establishes the regulatory requirements related to the content of TSs. As stated, in part, in 10 CFR 50.36(c)(1)(i)(A):

> Safety limits for nuclear reactors are limits upon important process variables that are found to be necessary to reasonably protect the integrity of certain of the physical barriers that guard against the uncontrolled release of radioactivity. If any safety limit is exceeded, the reactor must be shut down. The licensee shall notify the Commission, review the matter, and record the results of the review, including the cause of the condition and the basis for corrective action taken to preclude recurrence. Operation must not be resumed until authorized by the Commission.

Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50 establishes the minimum requirements for the principal design criteria for water-cooled nuclear power plants. Section 3.1, "Conformance with NRC General Design Criteria," of the Columbia's Final Safety Analysis Report concludes that Columbia fully satisfies and complies with the general

design criteria (GDC) in 10 CFR Part 50, Appendix A. The licensee states in its application that the proposed amendments satisfy the requirements of GDC 10, "Reactor design," regarding acceptable fuel design limits.

GDC 10 was considered in the NRC staff's review of the proposed amendment. GDC 10 requires the reactor core and associated coolant, control, and protection systems be designed with appropriate margin to assure that specified acceptable fuel design limits (SAFDLs) are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences.

NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR [Light-Water Reactor] Edition," provides guidance on the acceptability of the reactivity control systems, the reactor core and fuel system design. Specifically, Section 4.2, "Fuel System Design," of NUREG-0800 (ADAMS Accession No. ML070740002) specifies the criteria for evaluation of fuel damage and whether fuel designs meet the SAFDLs. Section 4.4, "Thermal and Hydraulic Design," of NUREG-0800 (ADAMS Accession No. ML070550060) provides guidance on the review of thermal-hydraulic design in meeting the requirement of GDC 10 and the fuel design criteria established in Section 4.2. It states that the critical power ratio is to be established such that at least 99.9 percent of fuel rods in the core would not be expected to experience departure from nucleate boiling, or onset of transition boiling, during normal operation or anticipated operational occurrences.

3.0 TECHNICAL EVALUATION

Each fuel vendor has developed critical power correlations valid over specified pressure and flow ranges (mass flow rates). These critical power correlations have become increasingly dependent on fuel design as advanced fuel designs evolved. The critical power correlations for some advanced fuel designs have received NRC approval, or were developed using NRC-approved methodologies down to a lower pressure than those approved previously. The lower bound of the extended pressure ranges for these advanced fuel designs can be used to justify a lower reactor steam dome pressure than specified in the TSs for previous fuel designs. As such, a wider pressure range would be available for transients to demonstrate compliance with MCPR limits. The licensee proposes to reduce the reactor steam dome pressure specified in TS 2.1.1.1 and TS 2.1.1.2 from 785 psig to 686 psig at Columbia based on the lower-bound pressure for the critical power correlation for the fuel currently used in the reactor core for the facility.

In its application, the licensee stated that Columbia currently has a mixed core of GE14 and GNF2 fuel produced by Global Nuclear Fuel – Americas, LLC (GNF). The critical power ratio calculations for GE14 and GNF2 fuel use the critical power correlations known as GEXL14 and GEXL17, respectively. The GEXL14 correlation is documented in GNF report NEDC-32851P-A, "GEXL14 Correlation for GE14 Fuel," Revision 5, dated April 2011 (ADAMS Package Accession No. ML111290540)[3]. The GEXL17 correlation is documented in GNF report NEDC-33292P, "GEXL17 Correlation for GNF2 Fuel," Revision 3, dated June 2009.[4] As discussed in these reports, the GEXL14 and GEXL17 correlations are used in the core design process to determine the expected thermal margin for the operating cycle. In the safety analysis process, the correlations are used to determine the change in critical power ratio during postulated transients and to determine the MCPR SL.

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[3] A public version of NEDC-32851P-A is available at ADAMS Accession No. ML111290532.
[4] A public version of NEDC-33292P is available at ADAMS Accession No. ML091830624.

The acceptability of the GEXL14 and GEXL17 correlations is associated with the NRC-approved GNF Licensing Topical Report (LTR) NEDE-24011-P-A, "General Electric Standard Application for Reactor Fuel" (referred to as GESTAR II). This LTR provides generic information relative to the fuel design and analyses of BWRs that use the GE and GNF fuel designs. This LTR consists of a description of the fuel licensing criteria and fuel thermal-mechanical, nuclear, and thermal-hydraulic analyses bases. In accordance with TS 5.6.3, "Core Operating Limits Report," Columbia may use the analytical methods in versions of GESTAR II, which have been previously reviewed and approved by the NRC to determine the core operating limits.

GESTAR II includes a methodology for development of critical power correlations, and also contains criteria for when NRC approval of new critical power correlations is needed. The GEXL14 correlation report was approved by the NRC, and a copy of the associated NRC SE is included with NEDC-32851P-A. The GEXL17 correlation report did not require NRC approval. The acceptability of the GEXL17 correlation is based on the NRC staff's approval of Amendment 33 to GESTAR II.[5] As such, the GEXL17 correlation for GNF2 fuel is approved for use per GESTAR II by reference. By letter dated March 5, 2010 (ADAMS Package Accession No. ML100700464), GNF submitted proposed Amendment No. 33 to GESTAR II for NRC review and approval. Enclosure 7 of the letter also provided GNF report NEDC-33270P, "GNF2 Advantage Generic Compliance with NEDE-24011-P-A (GESTAR II)," Revision 3, dated March 2010[6]. NEDC-33270P documented the completion of the requirements for the new GNF2 fuel design per the criteria in GESTAR II, including an explanation of how the development of the GEXL17 correlation complies with the GESTAR II methodology. Based on this, the NRC staff considers the use of GEXL14 and GEXL17 correlations for GE14 and GNF2 fuel, respectively, to be acceptable for use in critical power ratio calculations at Columbia.

The GEXL14 and GEXL17 correlation reports discuss the pressure range over which the critical power correlations are valid for the GE14 fuel and GNF2 fuel, respectively. As discussed in Section 4.0, "Technical Evaluation," of the application dated July 12, 2016, the lower bound pressure limit for the GEXL14 and GEXL17 correlations is 700 pounds per square inch absolute (psia). The licensee's application proposed to reduce the reactor steam dome pressure specified in Columbia TS 2.1.1.1 and TS 2.1.1.2 to 685 psig, which is approximately (685 + 14.7 =) 699.7 psia. Since 699.7 psia is outside the pressure range in which the GEXL17 and GEXL14 correlations are valid for GNF2 and GE14 fuel, the NRC staff requested that the licensee provide further justification for this value. The licensee submitted a supplement, dated November 17, 2016, to revise its application and proposed a reactor steam dome pressure limit of 686 psig instead of 685 psig. The proposed revised 686 psig value falls within the pressure range over which the critical power correlations are valid for both the GE14 fuel and GNF2 fuel. Therefore, the NRC staff determined that the proposed 686 psig limit for TS 2.1.1.1 and TS 2.1.1.2 is acceptable for the fuel in the Columbia core.

The proposed TS 2.1.1.1 requires thermal power to be less than or equal to 25 percent RTP when the reactor steam dome pressure is less than 686 psig or core flow is less than 10 percent rated core flow. The proposed TS 2.1.1.2 specifies MCPR limits when the reactor steam dome pressure is greater than or equal to 686 psig and core flow is greater than or equal to 10 percent rated core flow. Thus, the proposed change offers a greater pressure margin in TS 2.1.1.1 for

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[5] Amendment No. 33 was incorporated in Revision 17 to NEDE-24011-P-A by GNF letter dated September 22, 2010 (ADAMS Package Accession No. ML102660094). A copy of the NRC staff's approval and SE for Amendment No. 33 is included in NEDE-24011-P-A.

[6] A public version of NEDC-33270, Revision 3 is available at ADAMS Accession No. ML100700443 (Enclosure 8).

the PRFO transient than what is currently available such that, the reactor pressure remains above the proposed low pressure SL of 686 psig, and is acceptable.

3.1 Technical Conclusion

Based on the above findings, the NRC staff concludes that as long as the core pressure and flow are within the range of validity of the critical power correlation applicable to the current Columbia reactor core, the proposed changes to TS 2.1.1.1 and TS 2.1.1.2 provide reasonable assurance that 99.9 percent of the fuel rods in the core are not expected to experience onset of transition boiling during normal operation or anticipated operational occurrences. As such, the SLs will continue to ensure that SAFDLs are not exceeded during normal operation or anticipated operational occurrences, consistent with the requirements in GDC 10. Furthermore, the staff concludes that the proposed changes establish reactor core SLs, reasonably certain to protect the integrity of the fuel cladding barrier and guard against an uncontrolled release of radioactivity, consistent with the requirements in 10 CFR 50.36(c)(1). Therefore, the NRC staff concludes that the proposed amendments are acceptable.

The NRC staff notes that if Columbia transitions to a new fuel design in the future where the lower bound of the fuel's critical power ratio correlation has not been approved for use down to the reactor steam dome pressure specified in the TS reactor core SLs, NRC approval would be required prior to transitioning to that fuel design. As long as the lower bound pressure associated with the correlation for the new fuel design is less than or equal to the TS 2.1.1.1 and TS 2.1.1.2 reactor steam dome pressure, then an LAR would not be required.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Washington State official was notified of the proposed issuance of the amendment on June 5, 2017. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration and there has been no public comment on such finding published in the *Federal Register* April 25, 2017 (82 FR 19102). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) there is reasonable assurance that such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributor: Muhammad Razzaque, NRR

Date: June 27, 2017

SUBJECT: COLUMBIA GENERATING STATION - ISSUANCE OF AMENDMENT RE: REDUCTION OF REACTOR STEAM DOME PRESSURE SPECIFIED IN THE TECHNICAL SPECIFICATION 2.1.1, "REACTOR CORE SLS [SAFETY LIMITS]" (CAC NO. MF8116) DATED JUNE 27, 2017

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