



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

February 1, 2018

Mr. Bryan C. Hanson  
Senior Vice President  
Exelon Generation Company, LLC  
President and Chief Nuclear Officer  
Exelon Nuclear  
4300 Winfield Road  
Warrenville, IL 60555

SUBJECT: R. E. GINNA NUCLEAR POWER PLANT – STAFF ASSESSMENT OF  
FLOODING FOCUSED EVALUATION (CAC NO. MG0089; EPID L-2017-JLD-  
0004)

Dear Mr. Hanson:

By letter dated March 12, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340), the U.S. Nuclear Regulatory Commission (NRC) issued a request for information to all power reactor licensees and holders of construction permits in active or deferred status, under Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.54(f), (hereafter referred to as the “50.54(f) letter”). The request was issued in connection with implementing lessons learned from the 2011 accident at the Fukushima Dai-ichi nuclear power plant, as recommended in the NRC’s Near-Term Task Force (NTTF) report (ADAMS Accession No. ML111861807). Enclosure 2 to the 50.54(f) letter requested that licensees reevaluate flood hazards for their sites using present-day methods and regulatory guidance used by the NRC staff when reviewing applications for early site permits and combined licenses (ADAMS Accession No. ML12056A046). By letter dated March 11, 2015 (ADAMS Accession No. ML15072A009), Exelon Generation Company, LLC (Exelon, the licensee) responded to this request for R. E. Ginna Nuclear Power Plant (Ginna).

After its review of the licensee’s response, by letter dated December 4, 2015 (ADAMS Accession No. ML15334A453), the NRC issued an interim staff response (ISR) letter for Ginna. The ISR letter provided the reevaluated flood hazard mechanisms that exceeded the current design basis (CDB) for Ginna and parameters that are a suitable input for the mitigating strategies assessment (MSA). As stated in the letter, because the local intense precipitation (LIP) and riverine flood-causing mechanisms at Ginna are not bounded by the plant’s CDB, additional assessments of the flood hazard mechanisms are necessary. Along with its mitigating strategies assessment, the licensee submitted a revised reevaluated hazard for riverine flooding by letter dated November 18, 2016 (ADAMS Accession No. ML16323A173). The NRC found the new site-specific probable maximum precipitation study and its resulting elevations to be acceptable by letter dated December 21, 2017 (ADAMS Accession No. ML17345A990).

By letter dated March 10, 2017 (ADAMS Accession No. ML17069A004), the licensee submitted the focused evaluation (FE) for Ginna. The FEs are intended to confirm that licensees have adequately demonstrated, for unbounded mechanisms identified in the ISR letter, that: 1) a

flood mechanism is bounded based on further reevaluation of flood mechanism parameters; 2) effective flood protection is provided for the unbounded mechanism; or 3) a feasible response is provided if the unbounded mechanism is local intense precipitation. The purpose of this letter is to provide the NRC's assessment of the Ginna FE.

As set forth in the attached staff assessment, the NRC staff has concluded that the Ginna FE was performed consistent with the guidance described in Nuclear Energy Institute (NEI) 16-05, Revision 1, "External Flooding Assessment Guidelines" (ADAMS Accession No. ML16165A178). Guidance document NEI 16-05, Revision 1, has been endorsed by Japan Lessons-Learned Division (JLD) interim staff guidance (ISG) JLD-ISG-2016-01, "Guidance for Activities Related to Near-Term Task Force Recommendation 2.1, Flood Hazard Reevaluation" (ADAMS Accession No. ML16162A301). The NRC staff has further concluded that the licensee has demonstrated that effective flood protection, if appropriately implemented, exists for the LIP and riverine flooding mechanisms during a beyond-design-basis external flooding event at Ginna. This closes out the licensee's response for Ginna for the reevaluated flooding hazard portion of the 50.54(f) letter and the NRC's efforts associated with CAC No. MG0089.

If you have any questions, please contact me at 301-415-1056 or at [Lauren.Gibson@nrc.gov](mailto:Lauren.Gibson@nrc.gov).

Sincerely,



Lauren K. Gibson, Project Manager  
Beyond-Design-Basis Management Branch  
Division of Licensing Projects  
Office of Nuclear Reactor Regulation

Enclosures:

1. Staff Assessment Related to the Flooding Focused Evaluation for Ginna
2. Audit Summary Related to the Flooding Focused Evaluation for Ginna

Docket No: 50-244

cc w/encl: Distribution via Listserv

STAFF ASSESSMENT BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO THE FOCUSED EVALUATION FOR

R. E. GINNA NUCLEAR POWER PLANT

AS A RESULT OF THE REEVALUATED FLOODING HAZARD NEAR-TERM TASK FORCE

RECOMMENDATION 2.1 - FLOODING

(CAC NO. MG0089; EPID L-2017-JLD-0004)

1.0 INTRODUCTION

By letter dated March 12, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340), the U.S. Nuclear Regulatory Commission (NRC) issued a request for information to all power reactor licensees and holders of construction permits in active or deferred status, under Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.54(f) (hereafter referred to as the "50.54(f) letter"). The request was issued in connection with implementing lessons learned from the 2011 accident at the Fukushima Dai-ichi nuclear power plant, as recommended in the NRC's Near-Term Task Force (NTTF) report (ADAMS Accession No. ML111861807).

Enclosure 2 of the 50.54(f) letter requested that licensees reevaluate flood hazards for their respective sites using present-day methods and regulatory guidance used by the NRC staff when reviewing applications for early site permits and combined licenses (ADAMS Accession No. ML12056A046). If the reevaluated hazard for any flood-causing mechanism is not bounded by the plant's current design basis (CDB) flood hazard, an additional assessment of plant response would be necessary. Specifically, the 50.54(f) letter stated that an integrated assessment should be submitted, and described the information that the integrated assessment should contain. By letter dated November 30, 2012 (ADAMS Accession No. ML12311A214), the NRC staff issued Japan Lessons-Learned Division (JLD) interim staff guidance (ISG) JLD-ISG-2012-05, "Guidance for Performing the Integrated Assessment for External Flooding."

On June 30, 2015 (ADAMS Accession No. ML15153A104), the NRC staff issued COMSECY-15-0019, describing the closure plan for the reevaluation of flooding hazards for operating nuclear power plants. The Commission approved the closure plan on July 28, 2015 (ADAMS Accession No. ML15209A682). COMSECY-15-0019 outlines a revised process for addressing cases in which the reevaluated flood hazard is not bounded by the plant's CDB. The revised process describes a graded approach in which licensees with hazards exceeding their CDB flood will not be required to complete an integrated assessment, but instead will perform a focused evaluation (FE). As part of its FE, licensees will assess the impact of the hazard(s) on their site and then evaluate and implement any necessary programmatic, procedural, or plant modifications to address the hazard exceedance.

Nuclear Energy Institute (NEI) 16-05, Revision 1, "External Flooding Assessment Guidelines" (ADAMS Accession No. ML16165A178), has been endorsed by the NRC as an appropriate methodology for licensees to perform the focused evaluation in response to the 50.54(f) letter. The NRC's endorsement of NEI 16-05, including exceptions, clarifications, and additions, is described in NRC JLD-ISG-2016-01, "Guidance for Activities Related to Near-Term Task Force

Recommendation 2.1, Flood Hazard Reevaluation” (ADAMS Accession No. ML16162A301). Therefore, NEI 16-05, Revision 1, as endorsed, describes acceptable methods for demonstrating that R. E. Ginna Nuclear Power Plant (Ginna) has effective flood protection.

## 2.0 BACKGROUND

This provides the final NRC staff assessment associated with the information that the licensee provided in response to the reevaluated flooding hazard portion of the 50.54(f) letter. Therefore, this background section includes a summary description of the reevaluated flood information provided by the licensee and the associated assessments performed by the NRC staff. The reevaluated flood information includes: 1) the flood hazard reevaluation report (FHRR); 2) the mitigation strategies assessment (MSA); and 3) the focused evaluation.

### Flood Hazard Reevaluation Report

By letter dated March 11, 2015 (ADAMS Accession No. ML15072A009), Exelon Generation Company, LLC (Exelon, the licensee) submitted the FHRR for Ginna. The report was supplemented by letters dated September 30, 2015, October 4, 2016, and November 18, 2016 (ADAMS Accession Nos. ML15273A138, ML16278A530, and ML16323A173, respectively).

After reviewing the licensee’s response, by letter dated December 4, 2015 (ADAMS Accession No. ML15334A453), the NRC issued an interim staff response (ISR) letter for Ginna. The ISR letter discusses the reevaluated flood hazard mechanisms that exceeded the CDB for Ginna and parameters that are a suitable input for the MSA. As stated in the ISR letter, because the local intense precipitation (LIP) and riverine flood-causing mechanisms at Ginna are not bounded by the plant’s CDB, additional assessments of the flood hazard mechanisms are necessary. The NRC staff issued a final staff assessment of the FHRR in a letter dated November 18, 2016 (ADAMS Accession No. ML16295A334). In the staff assessment, the NRC staff’s conclusions regarding LIP and riverine flooding exceeding the Ginna CDB remained unchanged from the information provided in the ISR letter. However, by letter dated November 18, 2016 (ADAMS Accession No. ML16323A173), the licensee submitted a supplement based on a site-specific probable maximum precipitation (PMP) study that led to lower elevations than those discussed in the FHRR and ISR. The November 2016 elevations were not fully bounded by the CDB. The NRC found the revised, site-specific PMP elevations to be suitable, as described by letter dated December 21, 2017 (ADAMS Accession No. ML17345A990).

### Mitigation Strategies Assessment

By letter dated November 18, 2016 (ADAMS Accession No. ML16323A173), the licensee submitted the MSA for Ginna for review by the NRC staff (the same letter also contained information on the site-specific PMP). The MSAs are intended to confirm that licensees have adequately addressed the reevaluated flooding hazards within their mitigation strategies for beyond-design-basis external events. By letter dated December 21, 2017 (ADAMS Accession No. ML17345A990), the NRC issued its assessment of the Ginna MSA. The NRC staff concluded that the Ginna MSA was performed consistent with the guidance described in Appendix G of Nuclear Energy Institute 12-06, Revision 2, “Diverse and Flexible Coping Strategies (FLEX) Implementation Guide” (ADAMS Accession No. ML16005A625). The NRC’s endorsement of NEI 12-06, Revision 2, is described in JLD-ISG-2012-01, Revision 1, “Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events” (ADAMS Accession No.

ML15357A163). The NRC staff further concluded that the licensee has demonstrated that the mitigation strategies, if appropriately implemented, are reasonably protected from reevaluated flood hazards conditions for beyond-design-basis external events.

### Focused Evaluation

By letter dated March 10, 2017 (ADAMS Accession No. ML17069A004), the licensee submitted its FE for Ginna. The FEs are intended to confirm that licensees have adequately demonstrated, for unbounded mechanisms identified in the ISR letter, that: 1) a flood mechanism is bounded based on further reevaluation of flood mechanism parameters; 2) effective flood protection is provided for the unbounded mechanism; or 3) a feasible response is provided if the unbounded mechanism is local intense precipitation. These 3 options associated with performing an FE are referred to as Path 1, 2, or 3, as described in NEI 16-05, Revision 1. The purpose of this staff assessment is to provide the results of the NRC's evaluation of the Ginna FE.

## 3.0 TECHNICAL EVALUATION

Exelon stated that its FE followed Path 2 of NEI 16-05, Revision 1 and utilized Appendices B and D. The Ginna FE addresses the LIP and riverine probable maximum storm surge flooding mechanisms, which were found to exceed the plant's CDB as described in the FHRR and ISR letter, by creating a bounding set of flood parameters. This technical evaluation will address the following topics: characterization of flood parameters; evaluation of flood impact assessments; evaluation of available physical margin; reliability of flood protection features; and overall site response.

### 3.1 Characterization of Flood Parameters

Associated effects (AE) and flood event duration (FED) parameters were assessed by Exelon and have already been reviewed by the NRC, as summarized by letter December 21, 2017 (ADAMS Accession No. ML17345A990). For the FE, Exelon created a bounding set of flood parameters using the riverine flood hazard with the shorter available warning time for LIP. Exelon used these parameters as input to the Ginna FE and concluded that the site's flood strategy is effective in protecting structures, systems, and components (SSCs) that support key safety functions (key SSCs). Exelon supported its conclusion of effective flood protection by demonstrating adequate available physical margin (APM) and reliable flood protection features for the bounding flood parameters. Manual actions by plant personnel are required to protect key SSCs; therefore, an evaluation of the overall site was performed.

According to Updated Final Safety Analysis Report (UFSAR), Revision 21, the site grade at Ginna is 270 feet (ft.) mean sea level (MSL) around the power block and 253 ft. between the turbine building and Lake Ontario. (Elevations in the Ginna USFAR are given relative to MSL; this datum is taken to be equivalent to National Geodetic Vertical Datum of 1929 in this staff assessment). The bounding water elevation exceeds the site grade and the CDB at the battery rooms, the screen house, and the diesel generator building. For flood protection, the licensee relies on permanent flooding protections features, including those that require a manual action to complete installation, to demonstrate that effective protection is available. The potential impacts from the bounding flood-causing mechanism were further evaluated by Exelon as part of the Ginna FE.

### 3.2 Evaluation of Flood Impact Assessment

#### 3.2.1 Description of Impact of Unbounded Hazard

The bounding water elevation exceeds the site grade and the CDB at the screen house, the turbine building, and the diesel generator building.

Table 3.2.1 Current Design Basis Compared to Reevaluated Flood Hazard

Location	Threshold Elevation	Current Design Basis Flood Hazard – Combined Effects (FHRR)	Reevaluated Flood Hazard- Bounding
Screen house	253.5 ft.	256.6 ft.	257.0 ft. (MSA)
Battery Rooms and Air Handling Rooms	253.5 ft.	256.6 ft.	257.1 ft.
Diesel Generator Building	253.5 ft. (FE)	256.6 ft.	257.1 ft.

Water ingress is expected at the screen house. The depth of the water will affect diesel generator buses 17 and 18. However, as discussed during the audit, the licensee’s existing high water (flood) plan (ER-SC.2) directs them to provide alternate cooling for the diesel generators and cooling water for the Standby Auxiliary Feedwater pumps. Water is available from a source unaffected by the flood. Therefore, although the reevaluated flood level does affect safety-related equipment, the NRC does not find sufficient justification to pursue backfitting since the licensee has adequate alternate means of providing the safety function.

In the battery rooms and the diesel generator building, water ingress is expected to be prevented by installed approved flood protection doors, including certain doors (Presray) that require a manual action to complete installation. Note that the flooding strategies discussed herein do not reflect the entirety of the site’s flood response; rather, the NRC has focused on those particular areas in which the reevaluated hazard exceeds the design-basis.

#### 3.2.2 Evaluation of Available Physical Margin and Reliability of Flood Protection Features

The licensee relies on existing, approved flood doors to prevent water ingress at the locations where the design-basis flood is exceeded. At the Diesel Generator Building North Wall, Doors 15, 16, 17, and 18, Presray Barriers are used. The barriers provide 7 ft. of flood protection, which is well above the expected flood depth of 3.6 ft. The APM is therefore 3.4 ft.

Installed Overly doors are used to prevent water ingress through the South Wall of the Diesel Generator Building. These doors provide flooding protection up to 9.4 ft. The same type of doors are used to provide flood protection for the control building air handling room, battery room A, and battery room B. The doors in those locations are elevated 1.6 ft. above the floor; therefore, the total available flood protection is 11 ft. (1.6 ft. plus 9.4 ft.) and the available physical margin is 7.4 ft.

Furthermore, the site also has additional Presray barriers and an AquaFence that would be available for defense-in-depth in certain areas.

The Presray barriers and the approved flooding protection doors are part of the licensee’s current licensing basis. As stated in the licensee’s MSA, “the hydrostatic and hydrodynamic loads generally do not exceed 600 and 1,000 lbs. per foot, respectively.” The NRC staff

compared the loads produced from the wind velocities discussed in the UFSAR and determined that the wind loads bound the hydrostatic and hydrodynamic loads produced by the flood elevation described in the MSA.

Because increased focus has been placed on flood protection since the accident at Fukushima, licensees and NRC inspectors have identified deficiencies with equipment, procedures, and analyses relied on to either prevent or mitigate the effects of external flooding at a number of licensed facilities. Recent examples include those found in Information Notice 2015-01, "Degraded Ability to Mitigate Flooding Events" (ADAMS Accession No. ML14279A268). In addition, the NRC is cooperatively performing research with the Electric Power Research Institute to develop flood protection systems guidance that focuses on flood protection feature descriptions, design criteria, inspections, and available testing methods in accordance with a memorandum of understanding dated September 28, 2016 (ADAMS Accession No. ML16223A495). The NRC staff expects that licensees will continue to maintain flood protection features in accordance with their current licensing basis. The NRC staff further expects that continued research involving flood protection systems will be performed and shared with licensees in accordance with the guidance provided in Management Directive 8.7, "Reactor Operating Experience Program" (ADAMS Accession No. ML122750292), as appropriate.

The NRC staff concludes that the Ginna flood protection features described above meet the definition of being reliable to maintain key safety functions found in Appendix B of NEI 16-05, Rev 1.

### 3.2.3 Overall Site Response

Manual actions are required, therefore, the overall site response was evaluated. The licensee identified the critical path actions as weather monitoring in accordance with plant procedure 0-6.11, initiating level 1 or 2 actions in accordance with plant procedure ER-SC.2, and completing the installation of Presray barriers at select locations. The NRC audited procedures 0-6.11 and ER-SC-2, and found that there are adequate procedural triggers. The licensee performed a time critical assessment for the installation of the Presray barriers (specifically, engaging the door seal cam locks) and determined that it requires a total of 45 minutes to be performed. This is well within the warning time for the bounding set of flood parameters. The licensee also determined that the AquaFence, which is used for defense-in-depth, requires 32 hours to install.

The NRC staff concludes that the Ginna overall response to flooding is adequate, consistent with Appendix C of NEI 16-05, Rev 1.

## 4.0 CONCLUSION

The NRC staff concludes that Exelon performed the Ginna FE in accordance with the guidance described in NEI 16-05, Revision 1, as endorsed by JLD-ISG-2016-01, and that the licensee has demonstrated that effective flood protection exists against the reevaluated flood hazards. Furthermore, the NRC staff concludes that Ginna screens out of performing an integrated assessment based on the guidance found in JLD-ISG-2016-01. As such, in accordance with Phase 2 of the process outlined in the 50.54(f) letter, additional regulatory actions associated with the reevaluated flood hazard, beyond those associated with mitigation strategies assessment, are not warranted. The licensee has satisfactorily completed providing responses to the 50.54(f) activities associated with the reevaluated flood hazards.

AUDIT SUMMARY BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO THE FOCUSED EVALUATION FOR

R. E. GINNA NUCLEAR POWER PLANT

AS A RESULT OF THE REEVALUATED FLOODING HAZARD NEAR-TERM TASK FORCE

RECOMMENDATION 2.1: FLOODING

(CAC NO. MG0089; EPID L-2017-JLD-0004)

BACKGROUND AND AUDIT BASIS

By letter dated March 12, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340), the U.S. Nuclear Regulatory Commission (NRC) issued a request for information to all power reactor licensees and holders of construction permits in active or deferred status, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.54(f) (hereafter referred to as the "50.54(f) letter"). Enclosure 2 of the 50.54(f) letter requested that licensees reevaluate flood hazards for their respective sites using present-day methods and regulatory guidance used by the NRC staff when reviewing applications for early site permits and combined licenses (ADAMS Accession No. ML12056A046). If the reevaluated hazard for any flood-causing mechanism is not bounded by the plant's current design basis (CDB) flood hazard, an additional assessment of plant response would be necessary. On June 30, 2015 (ADAMS Accession No. ML15153A104), the NRC staff issued COMSECY-15-0019, describing the closure plan for the reevaluation of flooding hazards for operating nuclear power plants. COMSECY-15-0019 outlines a revised process for addressing cases in which the reevaluated flood hazard is not bounded by the plant's CDB. The revised process describes a graded approach in which licensees with hazards exceeding their CDB flood will not be required to complete an integrated assessment, but instead will perform a focused evaluation (FE). As part of the FE, licensees will assess the impact of the hazard(s) on their site and then evaluate and implement any necessary programmatic, procedural, or plant modifications to address the hazard exceedance. By letter dated March 10, 2017 (ADAMS Accession No. ML17069A004), Exelon Generation Company, LLC (the licensee) submitted its FE for R. E. Ginna Nuclear Power Plant (Ginna).

By letter dated July 18, 2017 (ADAMS Accession No. ML17192A452), the NRC issued a generic audit plan and entered into the audit process described in Office Instruction LIC-111, "Regulatory Audits," dated December 29, 2008 (ADAMS Accession No. ML082900195), to assist in the timely and efficient closure of activities associated with the 50.54(f) letter. Ginna was included in the list of applicable licensees.

REGULATORY AUDIT SCOPE AND METHODOLOGY

The areas of focus for the regulatory audit are the information contained in the FE submittal and all associated and relevant supporting documentation used in the development of the FE submittal.

## AUDIT ACTIVITIES

The Ginna audit took place virtually and via teleconference.

The NRC began the audit by requesting that References 13 through 18 of the FE be added to an electronic portal for review. Following review, the NRC e-mailed particular questions to the licensee. Those questions, and the licensee's response, are available in ADAMS under Accession No. ML18009A137. The NRC had further information needs and discussed these with the licensee by teleconference on January 17, 2018. During the call, the licensee provided clarifying information and the NRC requested that the information be provided in a written format. The licensee responded by e-mail dated January 23, 2018 (ADAMS Accession No. ML18025A983).

A list of the licensee staff and NRC staff that participated in the audit is contained in the table below.

<b>NRC Personnel</b>		<b>Licensee Personnel</b>	
<i>Name</i>	<i>Title</i>	<i>Name</i>	<i>Title</i>
Lauren Gibson	Project Manager	David Distel	Corporate Licensing
Mohamed Shams	Branch Chief	George Worbel	Site Engineering Flooding Hazards Lead
		Joe Bellini	Exelon Flooding Hazards Engineering Lead (Aterra Solutions)
		Bradley Franklin Lanka	Corporate Engineering Manager

## DOCUMENTS AUDITED

The following documents were audited:

### Site Procedures

- 0-6.11, Surveillance Requirement/Routine Operations Check Sheet, Revision 182
- ER-SC.2, High Water (Flood) Plan, Revision 15
- SC-3,17, Auxiliary Building Flood Barrier Installation/Removal/Inspection, Revision 00500
- SC-3.17.1, SAFW Annex Flood Barrier Installation/Removal/Inspection, Revision 00000
- GMM-23-99-FLOODBARRIER, Flood Barrier Installation and Removal in Turbine Building Basement, Revision 00100

### Calculations

- CORRES-20170216-00001, Flooding Capacity versus Demand for Ginna Structures, Revision 000

In addition, the licensee's e-mailed responses as described above and their attachments were also reviewed.

OPEN ITEMS AND REQUEST FOR INFORMATION

There are no additional open items or information needs following the January 23, 2018, e-mail response from the licensee.

DEVIATIONS FROM AUDIT PLAN

There were no deviations from the July 18, 2017, generic audit plan.

AUDIT CONCLUSION

The issuance of this document, containing the staff's review of the FE submittal, concludes the audit process for Ginna.

**SUBJECT: R. E. GINNA NUCLEAR POWER PLANT – STAFF ASSESSMENT OF FLOODING FOCUSED EVALUATION DATED February 1, 2018**

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**ADAMS Accession No.: ML18025B757**

**\*via email**

<b>OFFICE</b>	NRR/DLP/PBMB/PM	NRR/DLP/PBMB/LA	NRR/DLP/PBMB/BC(A)	NRR/DLP/PBMB/PM
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<b>DATE</b>	1/29/18	1/27/18	1/29/18	2/1/18

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