



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

February 3, 2017

LICENSEE: Tennessee Valley Authority

FACILITY: Browns Ferry Nuclear Plant, Units 1, 2, and 3

SUBJECT: SUMMARY OF JANUARY 4, 2017, MEETING WITH TENNESSEE VALLEY AUTHORITY REGARDING MAXIMUM EXTENDED LOAD LINE LIMIT ANALYSIS PLUS PRE-APPLICATION MEETING FOR BROWNS FERRY NUCLEAR PLANT (CAC NOS. MF8947, MF8948, AND MF8949)

On January 4, 2017, a Category 1 public meeting was held between the U.S. Nuclear Regulatory Commission (NRC) staff and representatives of Tennessee Valley Authority (TVA, the licensee) and TVA's contractors (General Electric Hitachi (GEH) and AREVA) at NRC Headquarters, One White Flint North, 11555 Rockville Pike, Rockville, Maryland. The purpose of the meeting was for TVA to present to the NRC staff its planned Maximum Extended Load Line Limit Analysis Plus (MELLLA+) License Amendment Request (LAR) for Browns Ferry Nuclear Plant (BFN) Units 1, 2, and 3 (Browns Ferry). The meeting notice and agenda, dated November 8, 2016, are available in the Agencywide Documents Access and Management System (ADAMS) under Accession No. ML16313A309. A list of attendees is provided in Enclosure 1.

The licensee submitted the extended power uprate (EPU) LAR on September 21, 2015 (ADAMS Accession No. ML15282A152), as supplemented by many submittals. Upon approval of the EPU LAR, the licensee plans to implement the EPU in the spring of 2018 for Unit 3, the fall of 2018 for Unit 1, and the spring of 2019 for Unit 2. The proposed EPU amendment would increase the authorized maximum steady-state reactor core power level for each unit from 3,458 megawatts thermal (MWt) to 3,952 MWt. The licensee is planning to submit the MELLLA+ LAR in February 2018 with implementation for all three units prior to BFN Unit 3 end-of-cycle conditions during the first EPU operating cycle.

The licensee's presentation document, which was provided prior to the meeting and attached to the meeting notice, is available under ADAMS Accession No. ML16356A034. The licensee's presentation began with an overview of core flow operating window versus core thermal power after implementing EPU. The licensee explained (Slide 3) that the licensed flow window would be 99 percent to 105 percent core flow at rated EPU power that would be limited from 100 percent to 105 percent with the administrative margin. MELLLA+ raises the maximum allowed rod line license flow window to be 85 percent to 105 percent core flow at rated EPU power.

The licensee then presented (Slide 4) a list of benefits of the MELLLA+ for Browns Ferry as: reduction in number of end of cycle down-powers, fewer control rod manipulations to manage reactivity, improved core instability detection algorithm, and an increase of station capacity factor during the operating cycle. TVA explained that its goals (Slide 5) are high quality LAR, effective integration into plant systems, effective training, and smooth transition to plant operations. The NRC staff reminded the licensee that completeness is as important as quality.

TVA proceeded by presenting (Slide 6) its approach to fuel and plant licensing analysis. The licensee stated that all topical areas of the MELLLA+ Licensing Topical Report will be addressed in the LAR. GEH will address non-fuel impacts of MELLLA+ implementation, long term anticipated transient without scram (ATWS) and ATWS instability. AREVA will address fuel core design, core operating limit report, loss-of-coolant accident (LOCA), and transients. TVA will address modifications, probabilistic risk assessment regarding operator training associated with manual actions specific to MELLLA+, and application of the EPU analysis for MELLLA+. TVA continued its presentation by discussing details of these subjects. The licensee clarified that although there will be some coordination between AREVA and GEH, separate reports, similar to the EPU LAR, will be developed by GEH and AREVA for the LAR submittal. Specifically, TVA discussed the applicability of GEH methods to AREVA fuel. TVA explained that a conservative approach is used to ensure that correlations produced by AREVA for AREVA fuel are shared by GEH regarding the applicability of GEH methods to AREVA fuel. TVA also stated that at the time of implementation of MELLLA+, if approved, both ATRIUM-10 and ATRIUM 10XM fuel will be present in BFN Units 1 and 3 cores. However, BFN Unit 2 core will contain ATRIUM 10XM only.

The NRC staff asked clarifying questions throughout the presentation. The NRC staff and the licensee discussed issues related to updating ANP-3377, "Browns Ferry Units 1, 2, and 3 LOCA Break Spectrum Analysis for ATRIUM 10XM fuel (EPU)," and ANP-3409, "Fuel Related Emergent Regulatory Issues," at MELLLA+ conditions. The NRC staff also recommended that the licensee follow the issues associated with Title 10 of *Code of Federal Regulations* Section 50.46c and revised or interim regulatory guidance associated with treatment of reactivity initiated accidents. The NRC staff also mentioned Karlstein Thermal Hydraulic Test Facility (KATHY) testing that was completed in December 2016 and expressed that the results may be published in a near future. The NRC staff asked TVA to include a discussion about containment accident pressure (CAP) associated with MELLLA+, since TVA has not proposed to take any credit for CAP in the EPU LAR. TVA confirmed that the impact of MELLLA+ on the need for CAP credit will be included in the licensee's submittal. Further, the staff recommended to include a diversity discussion associated with using digital instrumentation and control based on requests for additional information (RAIs) from previously submitted/approved MELLLA+ LARs. The NRC staff added that the NRC has developed TRACE models for its previous reviews of MELLLA+ applications. The TRACE model will allow NRC staff to complete confirmatory studies of the licensee's evaluations. The NRC staff asked TVA to consider providing inputs for the TRACE model development prior to the submittal of the MELLLA+ LAR. Additionally, the NRC staff asked if the sensitivity studies that were completed as a result of RAI responses in previous MELLLA+ applications would be included in the submittal. TVA stated that they would review these sensitivities studies and include those necessary to ensure completeness of the MELLLA+ LAR. The NRC staff asked TVA to discuss the limitation and conditions associated with application of topical reports for Browns Ferry and providing justifications. The NRC staff and TVA staff are considering holding additional pre-application and post-application meetings, and regulatory audits to facilitate review of this LAR. Action items from this meeting are provided in Enclosure 2 of this meeting summary.

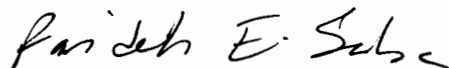
During the meeting, TVA also clarified that some of the hardware needed for implementing MELLLA+ has already been installed at BFN Unit 1. However, it would be upgraded to be the same as new hardware being installed in BFN Unit 2 and 3.

TVA continued its presentation discussing the TVA planned schedule (Slide 16) regarding MELLLA+ LAR submittal and its relation to the Browns Ferry units' outages. The NRC staff stated that the clock for the staff review starts after completion of the staff acceptance review.

Also, the NRC staff pointed out that the NRC is currently scheduled to complete its review for another plant within 24 months after its acceptance. The staff asked about the impacts of scheduling 24 months of review on the implementation of MELLLA+ and operation of Browns Ferry units. The TVA staff provided the NRC with charts showing BFN Unit 3 Cycle 19 (U3R19) Operating cycle with and without MELLLA+ starting August 2019 (see Enclosures 3 and 4). TVA explained that as shown on the charts BFN Unit 3 would go through more down powers and control rod manipulations at the end of the Cycle 19 if MELLLA+ is not implemented prior to this time.

There were two members of the public in attendance by telephone. Public Meeting Feedback forms were not received. At the end of the meeting, following questions and answers between the NRC staff and TVA representatives, a member of the public asked the NRC staff for the title and ADAMS accession number of ANP-3409. The NRC staff responded that the title of the document "Fuel-Related Emergent Regulatory Issues" is included in Slide 10 of the presentation and that the non-proprietary version of the document is available in ADAMS. This document will be updated for MELLLA+ conditions and TVA will provide details for the updated document in the MELLLA+ LAR. He also had concerns about impacts of cold weather on the Boron concentration in the pipes. The NRC staff explained that MELLLA+ will not have any impact on Boron concentration and operation of the standby liquid control system. This system will continue to be maintained as designed.

Please direct any inquiries to me at 301-415-1447 or [Farideh.Saba@nrc.gov](mailto:Farideh.Saba@nrc.gov).



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Plant Licensing Branch II-2  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. 50-259, 50-260, 50-296

Enclosures:

1. List of Attendees
2. Action Items
3. Chart – Unit 3 Operating Cycle 19 w/ MELLLA+
4. Chart – Unit 3 Operating Cycle 19 w/ and w/o MELLLA+

cc w/enclosures: Distribution via Listserv

LIST OF ATTENDEES  
 JANUARY 4, 2017, PRE-APPLICATION PUBLIC MEETING  
 WITH TENNESSEE VALLEY AUTHORITY  
 BROWNS FERRY NUCLEAR PLANT, UNITS 1, 2, AND 3  
 MAXIMUM EXTENDED LOAD LINE LIMIT PLUS

<b>Name</b>	<b>Organization</b>
Farideh Saba	Nuclear Regulatory Commission (NRC)
Russ Haskell	NRC
Andrew Hon	NRC
Ahsan Sallman	NRC
Mathew Panicker	NRC
Nathanael Hudson	NRC
Joshua Borromeo	NRC
Eric Oesterle	NRC
Diego Saenz	NRC
Todd Hilsmeier	NRC
Ravi Grover	NRC
John Parillo	NRC
Rich Stattel	NRC
Dianna Woodyatt	NRC
Victoria Huckabay	NRC
DaBin Ki	NRC
Muhammad Razzaque*	NRC
Kenneth Armstrong*	NRC
Shawn Marshal*	NRC
Kathy Gibson*	NRC
Gerard Doyle	Tennessee Valley Authority (TVA)
Pete Donahue	TVA
Dan Green	TVA
Ed Schrull	TVA
Greg Storey	TVA
William Baker	TVA
William Bird	TVA
Larry King	General Electric Hitachi (GEH)
Kent Halac	GEH
David McBurney	AREVA
Greg Preston*	TVA
Eric Frevold*	TVA
Joseph Bashore*	TVA
Brian Davidson*	TVA
Dominique Kenebrew*	TVA
Jason Gasque*	TVA
Ron Jarrett*	TVA
Tom Eichenberg*	TVA
Barry Myers*	TVA
Hoa Hoang*	GEH
Curt Robert*	GEH
Tyler Schweitzer*	GEH
Lee Dougherty*	GEH
Lisa Schichlein*	GEH

Mike Cook*	GEH
Jason Ingraham*	GEH
Jim Harrison*	GEH
Shawn Lamb*	GEH
Ralph Gummer*	AREVA
Scott Tylinski*	AREVA
Dan Tinkler*	AREVA
Alan Meginnis*	AREVA
Earl Riley*	AREVA
Marvin Lewis*	Public
Gary Morgan*	Public

\*Participated by phone

ACTION ITEMS FOR  
 JANUARY 4, 2017, PRE-APPLICATION PUBLIC MEETING REGARDING  
 MAXIMUM EXTENDED LOAD LINE LIMIT PLUS

<b>ACTION ITEMS</b>
1. With respect to the proposed 10CFR50.46c, follow the associated draft Regulatory Guides to address impacts of MELLLA+.
2. With respect to Reactivity Initiated Accidents, address interim guidance if final regulatory guidance is not approved prior to submitting MELLLA+ LAR.
3. Identify if there are any unit specific differences and their impact of analysis results, with particular focus on the ATWS-I analysis for MELLLA+.
4. Address Karlstein Thermal Hydraulic Test Facility (KATHY) test results impact to the ATWS instability (ATWS-I) analysis for MELLLA+. KATHY test results are expected to be available early this year.
5. Ensure LAR addresses MELLLA+ impact to LOCA containment analyses, associated GEH Service Information Letter issues, and emergency core cooling system NPSH requirements (i.e., no containment accident pressure credit required).
6. Provide input data for NRC development of a TRACE model for Browns Ferry prior to the MELLLA+ LAR submittal.
7. Provide ATWS-I sensitivities requested in previous RAIs.
8. Address/provide any additional traversing incore probe data taken at MELLLA+ conditions.
9. Address the impact of MELLLA+ on MICROBURN B-2 limitations.
10. Ensure operator actions for lowering water level during an ATWS-I event can be accomplished within the time assumed in the analysis. Determine if these actions should be considered time critical operator actions.
11. Ensure previous applicable RAIs are addressed in the MELLLA+ LAR.
12. Determine whether the AREVA documents submitted in the LAR will be all new issued documents or revisions to existing EPU documents.
13. In the update to ANP-2860, ensure any new EPU related RAIs that have been issued since the BFN EPU LAR was submitted are also addressed.
14. Address applicability of GEH computer code TRACG to AREVA fuel and BFN.
15. Ensure all limitations and conditions of all associated Licensing Topical Reports are addressed and complied with or, for the ones that are not considered to be applicable, provide explicit justification why they are not applicable
16. Ensure that diversity and defense-in-depth for the DSS-CD hardware is addressed in the GEH MELLLA+ safety analysis report.
17. Confirm that due to the Standby Liquid Control B-10 enrichment increase, Hot Shutdown Boron Weight would be injected before shutdown/Heat Capacity Temperature Limit is reached. If not, then ensure that best estimate TRACG analysis of post-depressurization ATWS is performed.
18. For MELLLA+ LAR review, plan to have additional public meetings and audits to facilitate NRC review similar to what was done to support the EPU LAR review.

# BFN U3R19 Operating Cycle with MELLLA+ starting Aug. 2019

% Power

MWt  
3,952

100

% Power with MELLLA+

90

3,557

80

3,162

70

2,766

60

2,371

Apr-18

May-18

Jun-18

Jul-18

Aug-18

Sep-18

Oct-18

Nov-18

Dec-18

Jan-19

Feb-19

Mar-19

Apr-19

May-19

Jun-19

Jul-19

Aug-19

Sep-19

Oct-19

Nov-19

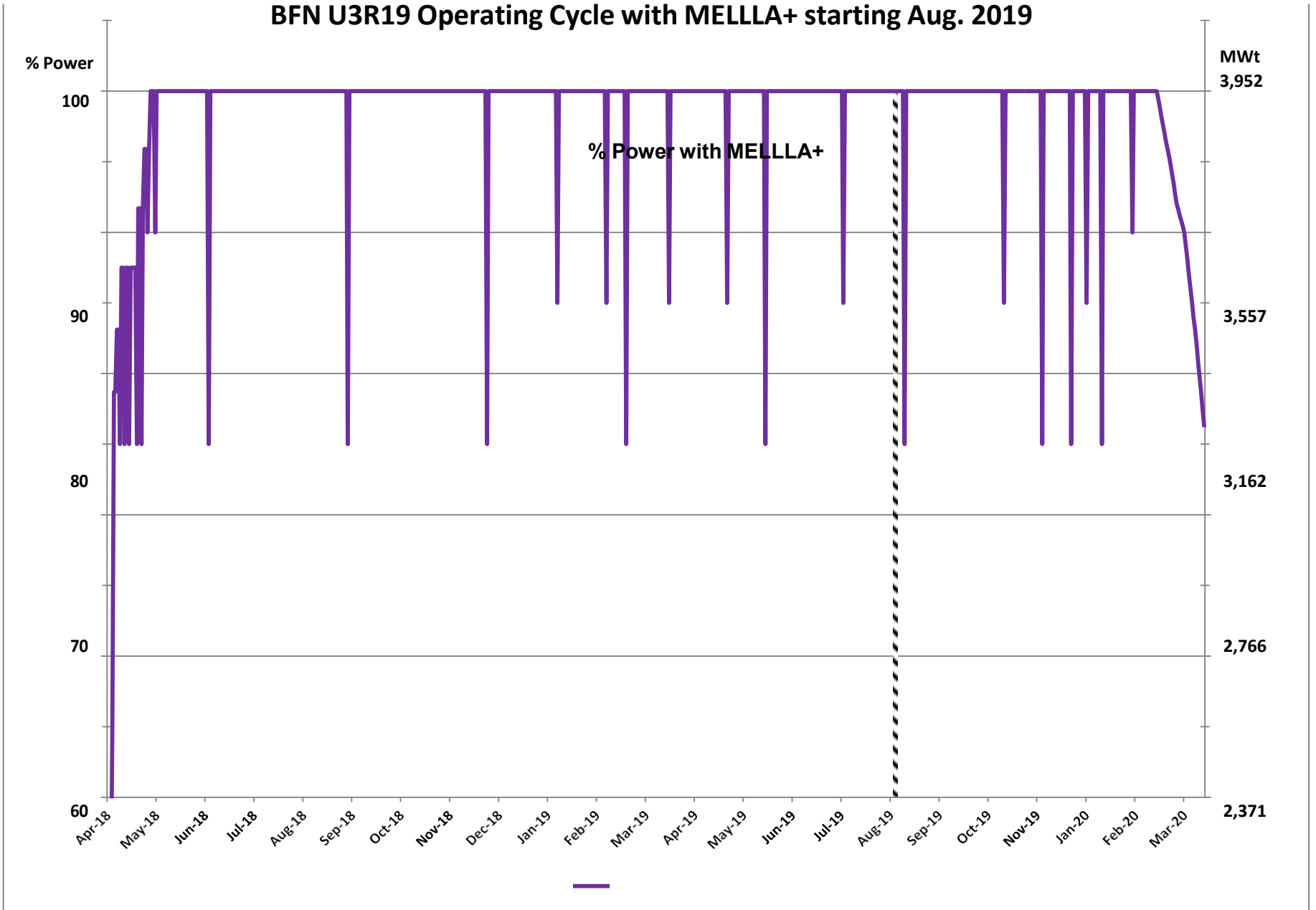
Jan-20

Feb-20

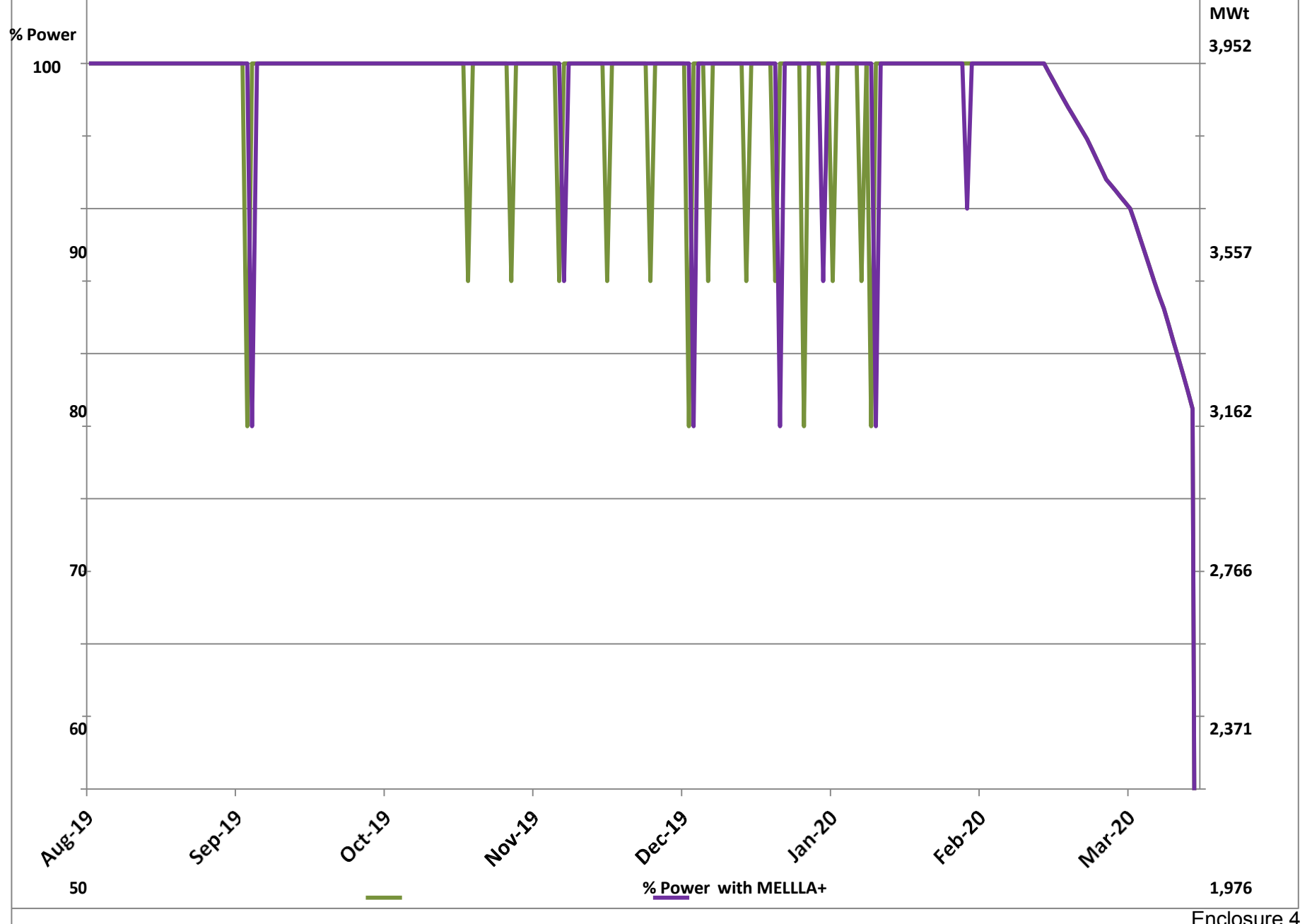
Mar-20

% Power with MELLLA+50

1,976  
Enclosure 3



# BFN U3 Comparison of EPU with and without MELLA+





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AUTHORITY REGARDING MAXIMUM EXTENDED LOAD LINE LIMIT  
ANALYSIS PLUS PRE-APPLICATION MEETING FOR BROWNS FERRY  
NUCLEAR PLANT (CAC NOS. MF8947, MF8948, AND MF8949)

Date: February 3, 2017

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**\* By an email**

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