

Standard Development Timeline

This section is maintained by the drafting team during the development of the standard and will be removed when the standard is adopted by the NERC Board of Trustees (Board).

Description of Current Draft

45-day formal comment period with ballot.

Completed Actions	Date
Standards Committee approved Standard Authorization Request (SAR) for posting (SAR submitted by NERC RS)	June 14, 2017
Standards Committee approved Standard Authorization Request (SAR) for posting (SAR submitted by NWPP FRSG)	October 18, 2017
SAR posted for comment (SAR submitted by NERC RS)	June 16, 2017 – July 18, 2017
SAR posted for comment (SAR submitted by NWPP FRSG)	November 2, 2017 – December 1, 2017
Reliability Standard BAL-003-2	November 5, 2019

Anticipated Actions	Date
45-day formal comment period with ballot	July 25, 2022
45-day formal comment period with additional ballot	TBD
10-day final ballot	TBD
Board adoption	TBD

New or Modified Term(s) Used in NERC Reliability Standards

This section includes all new or modified terms used in the proposed standard that will be included in the *Glossary of Terms Used in NERC Reliability Standards* upon applicable regulatory approval. Terms used in the proposed standard that are already defined and are not being modified can be found in the *Glossary of Terms Used in NERC Reliability Standards*. The new or revised terms listed below will be presented for approval with the proposed standard. Upon Board adoption, this section will be removed.

Term(s):

The BAL-003-3 Standard Drafting Team (SDT) proposes that the currently-approved Texas RE Regional definition of **Governor** to be made part of the NERC Glossary of Terms generally.

Governor – The electronic, digital or mechanical device that implements Primary Frequency Response of generating units/generating facilities or other system elements.

The BAL-003-3 Standard Drafting Team (SDT) proposes that the currently-approved Texas RE Regional definition of **Primary Frequency Response** to be made part of the NERC Glossary of Terms generally:

Primary Frequency Response – The immediate proportional increase or decrease in real power output provided by generating units/generating facilities in response to system Frequency Deviations. This response is in the direction that stabilizes frequency.

These terms are also used in other standards, as indicated below. The BAL-003-3 SDT is obligated to review other standards in which these terms are used to determine if reliability gaps or redundancies are created by the proposed revision to the defined terms. The BAL-003-3 SDT has determined that the proposed definitions do not change the reliability intent of other requirements or definitions. The following is the standard using the terms Governor and Primary Frequency Response:

BAL-001-TRE – Primary Frequency Response in the ERCOT Region: The BAL-003 SDT determined that the proposed definition revision will not create any redundancies or gaps in reliability.

A. Introduction

1. **Title:** Frequency Response and Frequency Bias Setting
 2. **Number:** BAL-003-~~23~~
 3. **Purpose:** To ~~require ensure~~ sufficient Frequency Response ~~from the Balancing Authority (BA) to maintain within the~~ Interconnection ~~Frequency~~ within predefined bounds by arresting frequency deviations and supporting frequency until the frequency is restored to its scheduled value. To provide consistent methods for measuring Frequency Response and determining the Frequency Bias Setting.
 4. **Applicability:**
 - 4.1. **Functional Entities:**
 - 4.1.1. ~~Balancing Authority~~ Responsible Entity
 - 4.1.1.1. Balancing Authority
 - 4.1.1.1.1. Balancing Authority is the responsible entity unless the Balancing Authority is a member of a Frequency Response Sharing Group, in which case, the Frequency Response Sharing Group becomes the responsible entity.
 - 4.1.1.2. Frequency Response Sharing Group
 - 4.1.2. Generator Operator
 - 4.1.3. Generator Owner
5. **Effective Date:** See Implementation Plan for BAL-003-~~32~~.

B. Requirements and Measures

- R1. Each Responsible Entity shall achieve an annual Frequency Response Sharing Group (FRSG) or Balancing Authority that is not a member of a FRSG shall achieve an annual Frequency Response Compliance Measure (FR~~CM~~) (as calculated and reported in accordance with Attachment A) that is greater than or equal to 1 or more negative than its Frequency Response Obligation (FRO) to ensure that sufficient Frequency Response is provided by each Responsible Entity FRSG or BA that is not a member of a FRSG to maintain Interconnection Frequency Response equal to or more negative than the Interconnection Frequency Response Obligation. [Violation Risk Factor: High] [Time Horizon: Real-time Operations]
- M1. Each ~~Frequency Response Sharing Group or Balancing Authority that is not a member of a Frequency Response Sharing Group~~ Responsible Entity shall have evidence such as dated data plus documented formula in either hardcopy or electronic format that it achieved an annual FR~~CM~~ (in accordance with the methods and data specified by the

ERO in Attachment A) ~~with data from FRS Form 1 reported to the ERO as specified in Attachment A)~~ that is greater than or equal to 1 ~~or more negative than its FRO~~ to demonstrate compliance with Requirement R1.

- R2.** Each Balancing Authority that is a member of a multiple Balancing Authority Interconnection and is not receiving Overlap Regulation Service and uses a fixed Frequency Bias Setting shall implement the Frequency Bias Setting determined in accordance with Attachment A, as validated by the ERO, into its Area Control Error (ACE) calculation during the implementation period specified by the ERO and shall use this Frequency Bias Setting until directed by the ERO to change ~~by the ERO~~. [*Violation Risk Factor: Medium*][*Time Horizon: Operations Planning*]
- M2.** The Balancing Authority that is a member of a multiple Balancing Authority Interconnection and is not receiving Overlap Regulation Service shall have evidence such as a dated document in hard copy or electronic format showing the ERO validated Frequency Bias Setting was implemented into its ACE calculation within the implementation period specified or other evidence to demonstrate compliance with Requirement R2.
- R3.** Each Balancing Authority that is a member of a multiple Balancing Authority Interconnection and is not receiving Overlap Regulation Service and is utilizing a variable Frequency Bias Setting shall maintain a Frequency Bias Setting that is: [*Violation Risk Factor: Medium*][*Time Horizon: Operations Planning*]
- 3.1** Less than zero at all times, and
 - 3.2** Equal to or more negative than its Frequency Response Obligation when Frequency varies from 60 Hz by more than +/- 0.036 Hz.
- M3.** The Balancing Authority that is a member of a multiple Balancing Authority Interconnection, is not receiving Overlap Regulation Service and is utilizing variable Frequency Bias shall have evidence such as a dated report in hard copy or electronic format showing the average clock-minute average Frequency Bias Setting was less than zero and during periods when the clock-minute average frequency was outside of the range 59.964 Hz to 60.036 Hz was equal to or more negative than its Frequency Response Obligation to demonstrate compliance with Requirement R3.
- R4.** Each Balancing Authority that is performing Overlap Regulation Service shall modify its Frequency Bias Setting in its ACE calculation, in order to represent the Frequency Bias Setting for the combined Balancing Authority Area, to be equivalent to either: [*Risk Factor: Medium*][*Time Horizon: Operations Planning*]
- The sum of the Frequency Bias Settings ~~as shown on FRS Form 1 and FRS Form 2 for the participating Balancing Authorities~~ as validated by the ERO for the participating Balancing Authorities, or

- The Frequency Bias Setting as validated by the ERO shown on FRS Form 1 and FRS Form 2 for the entirety of the participating Balancing Authorities' Areas.

M4. The Balancing Authority shall have evidence such as a dated operating log, database or list in hard copy or electronic format showing that when it performed Overlap Regulation Service, it modified its Frequency Bias Setting in its ACE calculation as specified in Requirement R4 to demonstrate compliance with Requirement R4.

R5. Each Balancing Authority shall develop, review and maintain annually, and implement an Operating Process as part of its Operating Plan to determine its Frequency Response requirements and make preparations to have Frequency Response equal to or greater than (in absolute value) the Balancing Authority's Frequency Response Obligation available for maintaining system reliability. [Violation Risk Factor: High] [Time Horizon: Operations Planning]

M5. The Balancing Authority will have the following documentation to show compliance with Requirement R5:

- a dated Operating Process;
- evidence to indicate that the Operating Process has been reviewed and maintained annually; and
- evidence, such as Operating Plans or other operator documentation, that demonstrate that the entity determines in its Operating Plans its Frequency Response available and that Frequency Response is equal to or greater than (in absolute value) its Frequency Response Obligation. Authority shall have evidence such as a dated operating log, database or list in hard copy or electronic format showing that when it performed Overlap Regulation Service, it modified its Frequency Bias Setting in its ACE calculation as specified in Requirement R4 to demonstrate compliance with Requirement R4.

R6. Each Generator Operator shall operate each generating unit/generating facility that is connected to the interconnected transmission system with frequency responsive controls in service when the generating unit/generating facility is online and released for dispatch¹, unless the Generator Operator has notified the Balancing Authority as soon as practical but within 30 minutes of the discovery of a Governor status change (in-service, out-of-service) of a Governor. [Violation Risk Factor = Medium] [Time Horizon = Real-time Operations]

¹ That the generator is not being operated in start-up, shutdown, or testing mode pursuant to a Real-time communication or a procedure that was previously provided to the Balancing Authority.

M6. The Generator Operator shall have evidence to show that it notified its associated Balancing Authority any time it failed to operate a generator in the frequency responsive mode when the generating facility was online and released for dispatch.

R7. Each Generator Owner shall have its Governor capability on each resource set with a droop of no more than five (5) percent and a deadband not more than 0.036 Hz. Exceptions to these setting requirements are allowed if the Generator Owner has notified its Balancing Authority that: [Violation Risk Factor: Medium] [Time Horizon: Operations Planning]

- The droop setting is greater than five (5) percent or the deadband is greater than 0.036 Hz; or
- The resource as designed does not have frequency response capability.

M7. Each Generator Owner shall have evidence that it set its Governor in accordance with Requirement R7. Examples of evidence include, but are not limited to, Governor test reports, Governor setting sheets, performance monitoring reports or documentation that shows the Generator Owner has provided information to the Balancing Authority information to address the exceptions allowed.

C. Compliance

1. Compliance Monitoring Process

1.1. Compliance Enforcement Authority: “Compliance Enforcement Authority” means NERC or the Regional Entity, or any entity as otherwise designated by an Applicable Governmental Authority, in their respective roles of monitoring and/or enforcing compliance with mandatory and enforceable Reliability Standards in their respective jurisdictions.

1.2. Evidence Retention: The following evidence retention period(s) identify the period of time an entity is required to retain specific evidence to demonstrate compliance. For instances where the evidence retention period specified below is shorter than the time since the last audit, the Compliance Enforcement Authority may ask an entity to provide other evidence to show that it was compliant for the full-time period since the last audit.

The applicable entity shall keep data or evidence to show compliance as identified below unless directed by its Compliance Enforcement Authority to retain specific evidence for a longer period of time as part of an investigation.

- The Balancing Authority shall retain data or evidence to show compliance with Requirements R1, R2, R3 and R4 and R5, Measures M1, M2, M3, M4 and M45 for the current year plus the previous three calendar years unless directed by its Compliance Enforcement Authority to retain specific evidence for a longer period of time as part of an investigation.

- The Frequency Response Sharing Group shall retain data or evidence to show compliance with Requirement R1 and Measure M1 for the current year plus the previous three calendar years unless directed by its Compliance Enforcement Authority to retain specific evidence for a longer period of time as part of an investigation.
- The Generator Operator shall retain evidence of notifications made to the Balancing Authority for the current and previous calendar years for Requirement R6 and Measure M6.
- Each Generator Owner shall retain evidence of its settings for Requirement R7 and Measure M7.
- If a Balancing Authority or Frequency Response Sharing Group is found non-compliant, it shall keep information related to the non-compliance until found compliant or for the time period specified above, whichever is longer.
- The Compliance Enforcement Authority shall keep the last audit records and all subsequent requested and submitted records.

1.3. Compliance Monitoring and Enforcement Program: As defined in the NERC Rules of Procedure, “Compliance Monitoring and Enforcement Program” refers to the identification of the processes that will be used to evaluate data or information for the purpose of assessing performance or outcomes with the associated Reliability Standard.

- ~~For Interconnections that are also Balancing Authorities, Tie Line Bias control and flat frequency control are equivalent and either is acceptable.~~

Violation Severity Levels

R #	Violation Severity Levels			
	Lower VSL	Moderate VSL	High VSL	Severe VSL
R1.	The Balancing Authority's, or Frequency Response Sharing Group's, Responsible Entity's FRCM was less negative than its FRO by at most 100% by at most 15% or 15 MW/0.1 Hz, whichever one is the greater deviation from its FRO.	The Balancing Authority's, or Frequency Response Sharing Group's Responsible Entity's, FRCM was less negative than 100 % its FRO by more than 15% but by at most 30% or 30 MW/0.1 Hz, whichever is the greater deviation from its FRO.	The Balancing Authority's, or Frequency Response Sharing Group's Responsible Entity's, FRCM was less negative than 100% its FRO by more than 30% but by at most 45% or 45 MW/0.1 Hz, whichever one is the greater deviation from its FRO.	The Balancing Authority's, or Frequency Response Sharing Group's Responsible Entity's, FRCM was less negative than 100 % its FRO by more than 45% or by more than 45 MW/0.1 Hz, whichever is the greater deviation from its FRO.
R2.	The Balancing Authority in a multiple Balancing Authority Interconnection and not receiving Overlap Regulation Service and uses a fixed Frequency Bias Setting failed to implement the validated Frequency Bias Setting value into its ACE calculation within the implementation period specified but did so within 5 calendar days from the implementation period specified by the ERO.	The Balancing Authority in a multiple Balancing Authority Interconnection and not receiving Overlap Regulation Service and uses a fixed Frequency Bias Setting implemented the validated Frequency Bias Setting value into its ACE calculation in more than 5 calendar days but less than or equal to 15 calendar days from the implementation period specified by the ERO.	The Balancing Authority in a multiple Balancing Authority Interconnection and not receiving Overlap Regulation Service and uses a fixed Frequency Bias Setting implemented the validated Frequency Bias Setting value into its ACE calculation in more than 15 calendar days but less than or equal to 25 calendar days from the implementation period specified by the ERO.	The Balancing Authority in a multiple Balancing Authority Interconnection and not receiving Overlap Regulation Service and uses a fixed Frequency Bias Setting did not implement the validated Frequency Bias Setting value into its ACE calculation in more than 25 calendar days from the implementation period specified by the ERO.

R #	Violation Severity Levels			
	Lower VSL	Moderate VSL	High VSL	Severe VSL
R3.	The Balancing Authority that is a member of a multiple Balancing Authority Interconnection and is not receiving Overlap Regulation Service and uses a variable Frequency Bias Setting average Frequency Bias Setting during periods when the clock-minute average frequency was outside of the range 59.964 Hz to 60.036 Hz was less negative than its Frequency Response Obligation by more than 1% but by at most 10%.	The Balancing Authority that is a member of a multiple Balancing Authority Interconnection and not receiving Overlap Regulation Service and uses a variable Frequency Bias Setting average Frequency Bias Setting during periods when the clock-minute average frequency was outside of the range 59.964 Hz to 60.036 Hz was less negative than its Frequency Response Obligation by more than 10% but by at most 20%.	The Balancing Authority that is a member of a multiple Balancing Authority Interconnection and not receiving Overlap Regulation Service and uses a variable Frequency Bias Setting average Frequency Bias Setting during periods when the clock-minute average frequency was outside of the range 59.964 Hz to 60.036 Hz was less negative than its Frequency Response Obligation by more than 20% but by at most 30%.	The Balancing Authority that is a multiple Balancing Authority Interconnection and not receiving Overlap Regulation Service and uses a variable Frequency Bias Setting average Frequency Bias Setting during periods when the clock-minute average frequency was outside of the range 59.964 Hz to 60.036 Hz was less negative than its Frequency Response obligation by more than 30%.
R4.	The Balancing Authority incorrectly changed the Frequency Bias Setting value used in its ACE calculation when providing Overlap Regulation Services with combined footprint setting-error less than or equal to 10% of the validated or calculated value.	The Balancing Authority incorrectly changed the Frequency Bias Setting value used in its ACE calculation when providing Overlap Regulation Services with combined footprint setting-error more than 10% but less than or equal to 20% of the	The Balancing Authority incorrectly changed the Frequency Bias Setting value used in its ACE calculation when providing Overlap Regulation Services with combined footprint setting-error more than 20% but less than or equal to 30% of the	The Balancing Authority incorrectly changed the Frequency Bias Setting value used in its ACE calculation when providing Overlap Regulation Services with combined footprint setting-error more than 30% of the validated or calculated value. OR

R #	Violation Severity Levels			
	Lower VSL	Moderate VSL	High VSL	Severe VSL
		validated or calculated value.	validated or calculated value.	The Balancing Authority failed to change the Frequency Bias Setting value used in its ACE calculation when providing Overlap Regulation Services.
<u>R5.</u>	<u>The Balancing Authority developed and implemented an Operating Process to determine its Frequency Response requirements and plans to have Frequency Reserve equal to or greater than the Balancing Authority Frequency Response requirements but failed to maintain the Operating Process annually.</u>	<u>N/A</u>	<u>The Balancing Authority developed an Operating Process to determine its Frequency Response requirements and plans to have Frequency Reserve equal to or greater than the Balancing Authority’s Frequency Response requirements but failed to implement the Operating Process.</u>	<u>The Balancing Authority failed to develop an Operating Process to determine its Frequency Response requirements and plans to have Frequency Reserve equal to or greater than the Balancing Authority’s Frequency Response requirements.</u>
<u>R6.</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>The Generator Operator did not operate with the frequency responsive controls in service and did not make the required notification within 30 minutes of the discovery of a status change of the frequency responsive controls.</u>

R #	Violation Severity Levels			
	Lower VSL	Moderate VSL	High VSL	Severe VSL
<u>R7.</u>	<u>N/A</u>	<u>N/A</u>	<u>The Generator Owner operated its Governor with droop and/or deadband settings outside those specified and did not notify the Balancing Authority.</u>	<u>The Generator Owner does not have documented Governor settings.</u>

D. Regional Variances

None.

E. Associated Documents

~~Procedure for ERO Support of Frequency Response and Frequency Bias Setting Standard~~

~~FRS Form 1~~

~~FRS Form 2~~

[Link to the Implementation Plan](#)

Procedure for ERO Support of Frequency Response and Frequency Bias Setting Standard

Version History

Version	Date	Action	Change Tracking
0	April 1, 2005	Effective Date	New
0	August 8, 2005	Removed "Proposed" from Effective Date	Errata
0	March 16, 2007	FERC Approval — Order 693	New
0a	December 19, 2007	Added Appendix 1 — Interpretation of R3 approved by BOT on October 23, 2007	Addition
0a	July 21, 2008	FERC Approval of Interpretation of R3	Addition
0b	February 12, 2008	Added Appendix 2 — Interpretation of R2, R2.2, R5, and R5.1 approved by BOT on February 12, 2008	Addition
0.1b	January 16, 2008	Section F: added "1."; changed hyphen to "en dash." Changed font style for "Appendix 1" to Arial; updated version number to "0.1b"	Errata
0.1b	October 29, 2008	BOT approved errata changes	Errata
0.1a	May 13, 2009	FERC Approved errata changes – version changed to 0.1a (Interpretation of R2, R2.2, R5, and R5.1 not yet approved)	Errata
0.1b	May 21, 2009	FERC Approved Interpretation of R2, R2.2, R5, and R5.1	Addition
1	February 7, 2013	Adopted by NERC Board of Trustees	Complete Revision under Project 2007-12
1	January 16, 2014	FERC Order issued approving BAL-003-1. (Order becomes effective for R2, R3, and R4 April 1, 2015. R1 becomes effective April 1, 2016.)	
1	May 7, 2014	NERC Board of Trustees adopted revisions to VRF and VSLs in Requirement R1.	
1	November 26, 2014	FERC issued a letter order approved VRF and VSL revisions to Requirement R1.	

Version	Date	Action	Change Tracking
1.1	August 25, 2015	Added numbering to Introduction section, corrected parts numbering for R3, and adjusted font within section M4.	Errata
1.1	November 13, 2015	FERC Letter Order approved errata to BAL-003-1.1. Docket RD15-6-000	Errata
2	November 5, 2019	NERC Board of Trustees adopted BAL-003-2	New
2	July 15, 2020	FERC Letter Order approved errata to BAL-003-2. Docket RD20-9-000	
<u>3</u>	<u>November 5, 2019</u>	<u>NERC Board of Trustees adopted BAL-003-3.</u>	<u>Complete Revision under Project 2017-01 Phase II</u>
<u>3</u>	<u>July 15, 2020</u>	<u>FERC Order issued approving BAL-003-3.</u>	

Attachment A

BAL-003-23 Frequency Response and Frequency Bias Setting Standard

Supporting Document

Overview of IFRO, FRO, SEFRD, FRM, FRCM, and FBS Calculations

There are several calculations needed to implement the Frequency Response and Frequency Bias Setting Standard. The Interconnection Frequency Response Obligation (IFRO) and Frequency Response Obligation (FRO) calculations are performed by the ERO annually. The Single Event Frequency Response Data (SEFRD), Frequency Response Measure (FRM), Frequency Response Compliance Measure (FRCM), and Frequency Bias Setting (FBS) calculations are performed by the individual BAs and/or FRSGs. The FBS, Most Severe Single Contingencies (MSSCs), and annual load and resource data are submitted by the BAs and evaluated by the ERO. These values are determinants in ERO calculations of IFRO for each interconnection and determination of FRO and minimum FBS for each Balancing Authority.

These calculations are performed at differing points in the annual Operating Year (OY) cycle. The chronology of the determination and use of these calculations is as follows: determination of the IFRO, determination of the individual Balancing Authority FROs and minimum FBSs, publication of frequency events through the OY, determination of SEFRDs, determination of FRM and FRCM, and determination of FBS.

Interconnection Frequency Response Obligation

The ERO, in consultation with regional representatives, has established a target reliability criterion for each Interconnection called the ~~Interconnection Frequency Response Obligation~~ (IFRO). ~~Preliminary Illustrative~~ values for OY 2022 are provided below. Certain values are assessed annually according to the methodology which is detailed in the *Procedure for ERO Support of Frequency Response and Frequency Bias Setting Standard*.

Interconnection	Eastern	Western	ERCOT Texas	HQ Quebec	Units
Max. Delta Frequency (MDF)	0.420	0.280	0.405	0.947	
Resource Loss Protection Criteria (RLPC) ¹	3,2093,740	2,8503,069	2,7502,805	2,000	MW
Credit for Load Resources (CLR) ¹			1,2091,136		MW
Current IFRO (OY 2022 18)	-1,0915	-8581096	-381412	-179211	MW/0.1 Hz
First Step target IFRO ¹ <u>Estimated Final target IFRO</u>					
	-915890	-10181096	-380412	-211	MW/0.1 Hz
Second Step target IFRO ^{1,2}	-815				

Final target IFRO ^{1,2}	-787
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Table 1: Interconnection Frequency Response Obligations (base year 2022~~17~~)

$$IFRO = -(RLPC - CLR)/Max\ Delta\ Freq/10$$

1. *These values are evaluated annually for changes in each Interconnection.*

CLR: A load reduction program that meets all of the following requirements shall be utilized by an Interconnection to reduce the IFRO:

- 1.1. 1.1 Is requisite to prevent activation of first stage of an Interconnection's Under-Frequency Load Shedding Program (UFLS) for any resource loss less than or equal to the Interconnection's Resource Loss Protection Criteria (RLPC);
- 1.2. Is non-proportional and automatically activated;
- 1.3. Activates within 1 (one) second of the trigger frequency being reached;
- 1.4. Exclusively reserved for Frequency Response during normal operations and does not participate in UFLS, Undervoltage Load Shedding (UVLS), or any other Ancillary Service, such as Contingency Reserve, and is not used for any other operator-initiated normal operations; and
- 1.5. Available at least 95% of the time and is reviewed as part of the ERO analysis that determines the IFRO.

Annual reductions

~~To an reduce risk, the Eastern Interconnection's IFRO due to a change to the RLPC, CLR and/or the Maximum Delta Frequency (MDF) will be limited to no greater than 10 percent of the existing stepped down annually from the 2017 value of 1,015 MW/0.1 Hz in 100 MW/0.1 Hz increments. If during the step down process, Interconnection's IFRO or -100MW/.10Hz, whichever is less negative. Multiple year reductions may be necessary to meet the final target IFRO. If during the step-down process the Interconnection's Frequency Response Measure (FRM) as calculated by declines by more than 10 percent, the ERO declines by more than 10 percent, the ERO will halt delay the subsequent reduction in IFRO until such time that a determination can be made as to the cause of the degradation disproportionate performance.~~

Balancing Authority Frequency Response Obligation ~~and Frequency Bias Setting~~

For a multiple Balancing Authority interconnection, the ~~Interconnection~~-FRO shown in Table 1 is allocated based on the Balancing Authority annual load and annual generation as measured in MWh. The ~~FRO~~ allocation of IFRO to determine the FRO for each BA is calculated using the will be based on the following method formula:

$$FRO_{BA} = IFRO \times \frac{\text{Annual Gen}_{BA} + \text{Annual Load}_{BA}}{\text{Annual Gen}_{Int} + \text{Annual Load}_{Int}}$$

Where:

- Annual Gen_{BA} is the total annual output of generating plants within the Balancing Authority Area (BAA).
- Annual Load_{BA} is total annual Load within the BAA.
- Annual Gen_{Int} is the sum of all Annual Gen_{BA} values reported in that ~~I~~interconnection.
- Annual Load_{Int} is the sum of all Annual Load_{BA} values reported in that ~~I~~interconnection.

Balancing Authorities that form, merge or transfer load or resource must notify the ERO of the change in footprint and corresponding changes in allocation prior to the change such that the net obligation to the Interconnection remains the same and so that FBS and FRO can be adjusted.

Annually, the ERO reviews the load and resource data submitted for all Balancing Authorities for each Interconnection in the format requested by the ERO. After such annual review, the ERO will post the following information for each Balancing Authority for the upcoming year:

- Minimum FBS
- FRO

Balancing Authorities that elect to form a FRSG will calculate a FRSG FRO by adding together the individual Balancing Authority FRO's.

~~Balancing Authorities that elect to form a FRSG as a means to jointly meet the FRO will calculate their FRM performance one of two ways:~~

Frequency Event Selections and Postings

The OY annual list of events for each interconnection are selected by the ERO using the Procedure for ERO Support of Frequency Response and FBS Standard. Events that trigger UFLS will not be selected as BAL-003 events. The ERO will publish the annual list for each interconnection in accordance with the timeline below. If the ERO posts the official list of events after the date specified in the timeline below, Balancing Authorities and FRSG(s) will be given 30 days from the date the ERO posts the official list of events to submit the required data.

ERO Posting and Data Submittal Form

The ERO shall alert responsible entities each year of the appropriate method for data submittal, including for example, a Section 1600 Data Request for Information under the Rules of Procedure, if approved by the NERC Board of Trustees.

The ERO publication of the official list of events is included in the form to be used for annual data submittal. The submittal includes data needed for the determination of Interconnection RLPCs and IFROs, as well as calendar year Balancing Authority specific data needed for determination of the respective Balancing Authorities' FROs and minimum bias settings.

Interconnection RLPC and Minimum Bias Data Submittal Data Items:

- Largest potential resource loss within the Balancing Authority Area for the next Operating Year as detailed in the "Procedure for ERO Support of Frequency Response and Frequency Bias Settings Standard"
- Second largest potential resource loss within the Balancing Authority Area for the next Operating Year as detailed in the "Procedure for ERO Support of Frequency Response and Frequency Bias Settings Standard"
- The largest resource loss within the Balancing Authority Area that results from a RAS action initiated by a multiple contingency (N-2) event as detailed in the "Procedure for ERO Support of Frequency Response and Frequency Bias Settings Standard"
- CLR – this value will be used to adjust the Interconnection IFRO
- Balancing Authority Area resource (MWh) for the previous calendar year – this value will be used in the formula described above to determine the BA FRO
- Balancing Authority Area Net Energy for load (MWh) for the previous calendar year – this value will be used in the formula described above to determine the BA FRO
- Balancing Authority Area Integrated Hourly Peak load (MW) for the previous calendar year – this value will be used to determine the minimum (in absolute value) bias setting. The (absolute value) minimum is 0.9% of the annual BA peak load.

Desired FBS - may be set to a value between 100% to 125% of the Balancing Authority FRM if this value is more negative than the minimum Frequency Bias based on Peak Demand. If not more negative, then the Frequency Bias must be the minimum Bias based on Peak Demand.

For Balancing Authorities which supply or receive Overlap Regulation Service, the partnered Balancing Authority and the amount of overlap are to be provided.

The ERO submittal form also is used to collect data for each event as described in the following sections.

Single Event Frequency Response Data

The Balancing Authority will calculate its FRM and FRCM values from SEFRD, defined as: “the data from an individual event in a Balancing Authority area that is used to calculate its Frequency Response, expressed in MW/0.1Hz.”

The SEFRD needed for evaluation is, at a minimum, the following Balancing Authority’s Energy Management System (EMS) scan rate data items for the period 1 minute prior through 5 minutes after the ERO-supplied event time (t0):

- Actual frequency (F_A)
- Net Interchange Actual (N_{AI}) – for single BA interconnections, this value may be zero (0)
- Net resource or load loss – for single Balancing Authority interconnections, this value is needed for each event; for multiple Balancing Authority interconnections, this value is only to be reported by the Balancing Authority (or pro rata by multiple Balancing Authorities if a jointly owned unit) which sustained the resource loss. Lost load values are to be specified as a negative amount; lost resource values are to be specified as a positive amount.

Balancing Authorities may choose to apply certain adjustments to their calculations to account for factors such as nonconforming loads. For any such adjustments used, the SEFRD shall include the EMS scan rate data for the period 1 minute prior to through 5 minutes after the ERO-supplied event time (t0). The types of adjustments that are allowed are:

- non-conforming loads (load values specified as a negative amount),
- pumped hydro operation (load values specified as a negative amount, resource values specified as a positive amount),
- jointly owned unit dynamic schedules (import values specified as a negative amount, export values specified as a positive amount), and
- transferred frequency response (receipt values specified as a negative amount, delivered values specified as a positive amount).

For each of these adjustments, a given adjustment must be made for either all events or none of the events in an evaluation year.

All events provided by the ERO need to be included in the annual evaluation to

determine the annual FRCM. A Balancing Authority may exclude an event only if, during any part of the event evaluation period:

- its tie-line data or its Frequency data was corrupt,
- its EMS was unavailable, or
- its Balancing Authority was completely islanded from the remainder of the interconnection.

Determination of Balancing Authority Event Time (t_0) and Data Alignment

Because a particular BA's EMS scan can occur anywhere within a 2-- to -6- second window, the ERO specified event time (t_0) may not exactly align with a given BA's EMS scan. For each event, the Balancing Authority must review its frequency scan data and determine the last frequency scan prior to the frequency deviation (decline for a resource loss, spike for a load loss). The Balancing Authority should set the time of that scan as the Balancing Authority's event time (t_0) for that event. The time of the Balancing Authority's event time (t_0) should be within one scan of the frequency deviation.

In addition to the determination of the Balancing Authority's t_0 , a review of the other data items collected should be made to determine if a time shift is needed for any of these items relative to the times of the frequency scans. These shifts may be needed due to data transfer lags (e.g., dynamic signals transferred between Balancing Authorities via ICCP). If such a shift is needed, data item scans should be shifted to align to the times of the frequency scans.

Determination of the pre-event sample period (commonly known as the A space) and the post-event sample period (commonly known as the B space) shall be measured from the Balancing Authority determined event time (t_0).

Single Event Frequency Response Measure

Pre-event values (A value scans) for each data item used (actual frequency, net actual interchange, contingency loss, non-conforming loads, pumped hydro operation, jointly owned unit dynamic schedules, and/or transferred frequency response) will be the EMS data scans over the 16-second period before the Balancing Authority's event time (t_0) up to but excluding the Balancing Authority's event time (t_0).

The A value will be the average of the selected scans for that item. For low frequency events, the pre-event frequency value (frequency A value) will be calculated as the minimum of 60.000 Hz or average actual starting frequency. For high frequency events, the pre-event frequency value (frequency A value) will be calculated as the maximum of 60.000 Hz or average actual frequency.

Post-event (B value scans) for each data item used will be the EMS data scans over 20 to 52 seconds after the Balancing Authority's event time (t_0). For each item used, the B value for that item will be the average of the selected scans for that item.

The number of scans for each average value in the computation of A and B values will

be dependent on the data scan rate of the Balancing Authority's EMS. Calculation of the A value should contain data from at least three distinct time points and the calculation of the B value should contain data from at least five distinct time points.

The pre-event MW value is the average of the A values (scan values) of all of the data items (except frequency) used. Each of the data items must use the sign convention as noted in the listings above. Similarly, the post-event MW value is the average of the B values (scan values) of all of the data items (except frequency) used, again using the appropriate sign convention for each item.

The total MW change is determined by subtracting the average post-event MW value from the average pre-event MW value. Similarly, the frequency change is determined by subtracting the average post-event frequency value (frequency B value) from the average pre-event frequency value (frequency A value).

The Single Event Frequency Response Measure (event FRM) is determined by dividing the total MW change by the total frequency change.

If a Balancing Authority uses the transferred frequency response adjustment, an additional calculation will be needed. BAs will need to calculate the event FRMs without incorporating transferred frequency response adjustments. This "FRM w/o Trfr" value is needed to calculate the Balancing Authority's Bias Setting, but it is not used to calculate the Balancing Authority's event FRCMs. The event FRMs including transferred frequency response are the values used to calculate event FRCMs.

Single Event Frequency Response Compliance Measure

The FRCM for each event is the ratio of FRM to FRO (FRM divided by FRO).

For FRSGs, the FRSG FRM for each event is calculated by dividing the sum the active Balancing Authorities' FRMs by the sum of the active Balancing Authorities' FROs. If a Balancing Authority is an FRSG participant and meets the requirements for excluding an event, e.g. loss of telemetry during event, the FRSG shall exclude the Balancing Authority's FRO and FRM from the FRSG's calculation of FRCM for the excluded event. For any event in which more than 50% of the Balancing Authority participants' data is excluded, the FRSG shall exclude that event for the FRSG.

Annual (OY) Frequency Response Measure and Frequency Response Compliance Measure

The Balancing Authority's FRM for the OY is determined by taking the median of the individual event FRM values.

The Balancing Authority's FRCM for the OY is determined by taking the median of the individual event FRCM values. An FRSG or a Balancing Authority providing Overlap Regulation Service will provide individual event FRCMs for the aggregate of its active participants.

Balancing Authority Fixed Frequency Bias Setting

A Balancing Authority in an Interconnection with multiple Balancing Authorities using a fixed FBS sets its FBS to the more negative value than:

- Any number the Balancing Authority chooses between 100 percent and 125 percent of its Frequency Response Measure
- Balancing Authority Minimum Frequency Bias Setting as determined by the ERO

Balancing Authority Variable Frequency Bias Setting

A Balancing Authority in an Interconnection with multiple Balancing Authorities using a fixed variable FBS sets its FBS such that it is:

- Less than zero at all times, and
- Equal to or more negative than its Frequency Response Obligation when Frequency varies from 60 Hz by more than +/- 0.036 Hz

Balancing Authority and Frequency Response Group Reporting

Each Balancing Authority reports its previous year's FRM (both with and without transferred frequency response adjustment), FRCM Frequency Bias Setting and Frequency Bias type (fixed or variable) to the ERO each year to allow the ERO to validate the revised FBS. In addition, each Balancing Authority will report its two largest potential resource losses and any applicable N-2 RAS events in the format specified by the ERO.

- ~~Once the data listed above is fully posted, the ERO will announce the implementation period for changing the FBS. Calculate a group N_A and measure the group response to all events in the reporting year on a single FRS Form 1, or~~
- ~~Submit a joint Form 1 with the "FRSG" tab completed for the aggregate performance of the participating Balancing Authorities.~~

~~Balancing Authorities that merge or transfer load or generation are encouraged to notify the ERO of the change in footprint and corresponding changes in allocation such that the net obligation to the Interconnection remains the same and so that CPS limits can be adjusted.~~

~~Each Balancing Authority reports its previous year's FRM, Frequency Bias Setting and Frequency Bias type (fixed or variable) to the ERO each year to allow the ERO to validate the revised Frequency Bias Settings on FRS Form 1. In addition, each Balancing Authority will report its two largest potential resource losses and any applicable N-2 RAS events in the form. If the ERO posts the official list of events after the date specified in the timeline below, Balancing Authorities will be given 30 days from the date the ERO posts the official list of events to submit their FRS Form 1.~~

~~Once the ERO reviews the data submitted in FRS Form 1 and FRS Form 2 for all Balancing Authorities, the ERO will use FRS Form 1 data to post the following information for each Balancing Authority for the upcoming year:~~

- ~~Frequency Bias Setting~~
- ~~Frequency Response Obligation (FRO)~~

~~Once the data listed above is fully posted, the ERO will announce the three-day implementation period for changing the Frequency Bias Setting if it differs from that shown in the timeline below.~~

~~A Balancing Authority using a fixed Frequency Bias Setting sets its Frequency Bias Setting to the greater of (in absolute value):~~

- ~~Any number the Balancing Authority chooses between 100 percent and 125 percent of its Frequency Response Measure as calculated on FRS Form 1~~
- ~~Interconnection Minimum as determined by the ERO~~

~~For purposes of calculating the minimum Frequency Bias Setting, a Balancing Authority participating in a FRSG will need to calculate its stand-alone FRM using FRS Form 1 and FRS Form 2 to determine its minimum Frequency Bias Setting.~~

~~A Balancing Authority providing Overlap Regulation will report the historic peak demand and generation of its combined Balancing Authorities' areas on FRS Form 1 as described in Requirement R4.~~

Frequency Response Measure

~~The Balancing Authority will calculate its FRM from Single Event Frequency Response Data (SEFRD), defined as: "the data from an individual event in a Balancing Authority area that is used to calculate its Frequency Response, expressed in MW/0.1Hz" as calculated on FRS Form 2 for each event shown on FRS Form 1. The events in FRS Form 1 are selected by the ERO using the *Procedure for ERO Support of Frequency Response and Frequency Bias Setting Standard*. The SEFRD for a typical Balancing Authority in an Interconnection with more than one Balancing Authority is the change in its Net Actual Interchange on its tie lines with adjacent Balancing Authorities divided by the change in Interconnection frequency. Some Balancing Authorities may choose to apply corrections to their Net Actual Interchange (NA_i) values to account for factors such as nonconforming loads. FRS Form 1 and 2 shows the types of adjustments that are allowed. Note that with the exception of the Contingent BA column, any adjustments made must be made for all events in an evaluation year.²~~

~~The ERO will use a standardized sampling interval of approximately 16 seconds before the event, up to the time of the event for the pre-event NA_i, and frequency (A values), and approximately 20 to 52 seconds after the event for the post-event NA_i (B values) in the computation of SEFRD values, dependent on the data scan rate of the Balancing Authority's Energy Management System (EMS).~~

²As an example, if an entity has non-conforming loads and makes an adjustment for one event, all events must show the non-conforming load, even if the non-conforming load does not impact the calculation. This ensures that the reports are not utilizing the adjustments only when they are favorable to the BA.

~~All events listed on FRS Form 1 need to be included in the annual submission of FRS Forms 1 and 2. The only time a Balancing Authority should exclude an event is if its tie-line data or its Frequency data is corrupt, or its EMS was unavailable. FRS Form 2 has instructions on how to correct the BA's data if the given event is internal to the BA or if other authorized adjustments are used.~~

~~Assuming data entry is correct, FRS Form 1 will automatically calculate the Balancing Authority's FRM for the past 12 months as the median of the SEFRD values. A Balancing Authority electing to report as an FRSG or a provider of Overlap Regulation Service will provide an FRS Form 1 for the aggregate of its participants.~~

~~To allow Balancing Authorities to plan its operations, events with a "Point C" that cause the Interconnection Frequency to be lower than that shown in Table 1 above (for example, an event in the Eastern Interconnection that causes the Interconnection Frequency to go to 59.4 Hz) or higher than an equal change in frequency going above 60 Hz may be included in the list of events for that Interconnection. However, the calculation of the Balancing Authority response to such an event will be adjusted to show a frequency change only to the Target Minimum Frequency shown in Table 1 above (in the previous example this adjustment would cause Frequency to be shown as 59.5 Hz rather than 59.4 Hz) or a high frequency amount of an equal quantity. Should such an event happen, the ERO will provide additional guidance.~~

~~Balancing Authorities that elect to form a FRSG as a means to jointly meet the FRO will calculate their FRM performance one of two ways:~~

- ~~• Calculate a group N_A and measure the group response to all events in the reporting year on a single FRS Form 1, or~~
- ~~• Jointly submit the individual Balancing Authority's Form 1s, with a summary spreadsheet that contains the sum of each participant's individual event performance.~~

Timeline for Balancing Authority Frequency Response and Frequency Bias Setting Activities

Described below is the timeline for the exchange of information between the ERO and Balancing Authorities to:

- Facilitate the assignment of Balancing Authority FRO
- Calculate Balancing Authority FR~~C~~M
- Determine Balancing Authority F~~requency~~-Bias-Settings

Target Business Date	Activity
March 1	<u>Events for evaluation of FRMS and FRCM Form 1</u> are posted by the ERO* with all selected events for the operating year for BA usage.
April 1	BAs and FRSGs complete their frequency response <u>calculations forms</u> for all four quarters, including the BAs' FBS calculations, returning the results to the ERO <u>in a format specified by the ERO</u> .
May 1	The ERO validates FBS values, computes the sum of all FBS values for each Interconnection <u>and determines the implementation schedule for changes to BAs FBS</u> .
May 15	The BAs and FRSGs provide data needed by NERC to calculate the IFRO and the IFRO allocation to each BA in the format specified by the not required to file FERC Form 714 receive a request to provide load and generation data as described in the Procedure for ERO Support of Frequency Response and Frequency Bias Setting Standard** to support FRO assignments and determining minimum FBS for the upcoming year. Data to be provided by July 15.
June 1	The BA implements <u>any</u> changes to their FBS.
November 1	The ERO assigns FRO values and Minimum FBS for the upcoming year to the BAs.

* If the 4th quarter posting of events for evaluation of FRSM and FRCM Form 1 is delayed, the ERO may adjust the other timelines in this table ~~by a similar amount~~.

** Data specification Procedure will be maintained on the for ERO website; for example Procedure for ERO Support of Frequency Response and Frequency Bias Setting Standard or its successor.