

Eastern Interconnection Proof-of-Concept Field Trial

Overview

The Reliability-based Control SAR includes the purpose statements:

A) To maintain Interconnection frequency within predefined frequency limits under all conditions (i.e., normal and abnormal), to manage frequency-related issues such as frequency oscillations, instability, and unplanned tripping of load, generation or transmission, that adversely impact the reliability of the Interconnection. (Work brought into this SAR from [Draft BAL-007 through BAL-011](#)).

B) To support corrective action by the BA when its excessive Area Control Error, as determined by this standard, may be contributing to or causing action to be taken to correct an SOL or IROL problem.

C) To prevent Interconnection frequency excursions of short-duration attributed to the ramping of Interchange Transactions.

D) To support timely congestion relief by requiring the Balancing Authority to employ corrective load/generation management within a defined timeframe when participating in transmission loading relief procedures.

E) To address the directives of FERC Order 693:

1. Add data retention requirements to all standards.
2. Require a continent-wide contingency reserve policy.
3. Modify BAL-003 – Frequency Response and Bias.
4. Require minimum Regulating Reserves for a Balancing Authority.

Small groups of Balancing Authorities were brought under the generation control criteria of the draft Standard BAL-007 beginning in July 2005. Under the Proof-of-Concept Field Trial (“Field Trial”), each Balancing Authority balances resources and demand, and takes corrective action as needed, so that its clock-minute ACE does not exceed its clock-minute Balancing Authority ACE Limit (“BAAL”) for more than 30 consecutive clock-minutes. Below is a list of the Balancing Authorities currently under the Field Trial.

Balancing Authority Participants	2008 Bias	Region	Reliability Coordinator	Start Date
Alliant Energy (ALTE)	-42	MRO	MISO	July 6, 2005*
Alliant Energy (ALTW)	-57	MRO	MISO	July 6, 2005*
American Electric Power (CSW)	-101.9	SPP	SPP	September 1, 2005
Duke Energy (CIN)	-136	RFC	MISO	July 6, 2005*
East Kentucky Power Cooperative (EKPC)	-37.9	SERC	TVA	July 6, 2005
Entergy (EES)	-222.4	SERC	ICTE	July 6, 2005
EON-US (LGEE)	-92	SERC	TVA	April 1, 2008
Independent Electricity System Operator (IESO)	-303	NPCC	IESO	March 1, 2008
Manitoba Hydro (MHEB)	-43.9	MRO	MISO	July 6, 2005
Michigan Electric Coordinated Systems (MECS)	-233	RFC	MISO	September 1, 2005*
Northern Indiana Public Service (NIPS)	-59	RFC	MISO	July 6, 2005*
PJM Interconnection (PJM)	-1418	RFC	PJM	August 1, 2005
Santee Cooper (SC)	-88.3	SERC	VACS	March 1, 2006
Southern Company (SOCO)	-463	SERC	SOCO	October 15, 2005
Tennessee Valley Authority (TVA)	-328.32	SERC	TVA	October 1, 2005
We Energies (WEC)	-73	RFC	MISO	September 1, 2005*

* Upon entry of the Midwest ISO into the Field Trial, ALTE, ALTW, CIN, MECS, NIPS and WEC will cease operating under the Field Trial as their areas will be included within the MISO Balancing Authority Area.

Along with the Balancing Authorities listed above, the Reliability Coordinators of ICTE, MISO, SOCO, SPP, TVA and VACS have monitored the performance of the Balancing Authorities within their respective areas, and other systems have provided information to support the monthly analysis of the Field Trial. It is important to note that approximately half of the load within the Eastern Interconnection is represented by the Balancing Authorities operating under the Field Trial and, for the duration of the Field Trial to date, no transmission loading or other reliability-related issues have been cited by the Reliability Coordinators as being attributed to operations under the Field Trial.

Under the expansion of the Field Trial, new Balancing Authorities will be brought under the generation control criteria of the draft Standard BAL-007, requiring the participating Balancing Authorities to operate and report performance under the provisions stated in the draft Standard BAL-007 and this document including attachments. The Reliability-based Control Standard Drafting Team (RBCSDT) will contact the volunteer Balancing Authorities to coordinate the start of actual operation to the draft Standard BAL-007 on the date approved by the RBCSDT.

Field Trial Preparation

Prior to the RBCSDT approval to operate under the Field Trial, each Balancing Authority must do the following:

- 1) Provide the RBCSDT with the name, phone number and email address of:
 - a. the primary contact for the Field Trial,
 - b. the party responsible for monthly performance reporting,
 - c. the director/manager/supervisor over Balancing Authority operations
 - d. the compliance contact for its RRO
- 2) Provide one month or more of historic clock-minute data using the data format and calculations described in Attachment A to confirm the Balancing Authority's capability to accurately calculate and report performance under the Field Trial,
- 3) Provide screen-shots of the operator interface that will be used to monitor real-time performance under the Field Trial,
- 4) Provide confirmation that operators have been trained on the operator interface and actions that may be needed while under the Field Trial so that the clock-minute ACE does not exceed the BAAL for more than 30 consecutive clock-minutes, and
- 5) Provide contact information for its Reliability Coordinator and confirmation that the Reliability Coordinator has been contacted with regard to operating under the Field Trial. (One or more members of the RBCSDT will coordinate a joint conference call with BA and RC to discuss the Field Trial and the timing for beginning operation under the Field Trial.)
- 6) Provide verification that the Balancing Authority will maintain the capability to operate in compliance with the CPS2 requirement in the case where the Balancing Authority has been requested to cease operation under the Field Trial.

Field Trial Requirements

For the duration of the Field Trial, the participating Balancing Authorities shall continue to be responsible for compliance under the NERC Standards including:

- BAL-001 Real Power Balancing Control Performance (CPS1)
- BAL-002 Disturbance Control Performance (DCS)

Prior to a Balancing Authority beginning operation under the Field Trial, documentation will be provided to the NERC Standards Committee, the NERC Vice President and Director of Standards, and the NERC Vice President and Director of Compliance, requesting that the Balancing Authority be added to the list of participating Balancing Authorities waived of compliance to NERC CPS2 while operating under the Field Trial. Attachment G contains documentation of the NERC CPS2 waivers granted to the participating Balancing Authorities under the Field Trial.

Any requests for the Balancing Authority to take corrective action from the Reliability Coordinator shall be documented by the Balancing Authority (including the duration of the Reliability Coordinator request) and provided to the RBCSDT within 24 hours of such event. Upon receipt of notification from the Balancing Authority, the Chair of the RBCSDT will contact the Reliability Coordinator to determine if a conference call is necessary. If so, the Chair will set up a call between the RBCSDT, the Balancing Authority, and its Reliability Coordinator to determine what actions are necessary to address the issues raised by the Reliability Coordinator.

Participating Balancing Authorities shall be fully responsible for operating and reporting their performance under the draft BAL-007. Each Balancing Authority shall provide its clock-minute data for the first two weeks' operations under the Field Trial in the CSV format provided in Attachment A for analysis and review by the RBCSDT (for further information see Attachment C – Implementation Plan to be followed by the RBCSDT). For each calendar month of the Field Trial, each Balancing Authority will provide its clock-minute data for the prior month's operations to the RBCSDT by the tenth working day of following month in the CSV format provided in Attachment A.

Responsibility to Follow Reliability Coordinator Directives

Recognizing the authority that the Reliability Coordinator has under the NERC standards for directing corrective action, the Reliability Coordinator over each participating Balancing Authority will have unquestioned authority to direct the participating Balancing Authority to take corrective action if any Reliability Coordinator experiences a problem on its system that it believes may be attributed to operations under the Field Trial.

If any Reliability Coordinator experiences a problem on its system that it believes may be attributed to the real-time ACE of a participating Balancing Authority, where that Balancing Authority's ACE has exceeded the BAAL, the Reliability Coordinator over the participating Balancing Authority may direct the Balancing Authority to restore its ACE within BAAL compliance limits immediately. At its discretion or at the request of a Reliability Coordinator experiencing a problem on its system, the Reliability Coordinator over the participating Balancing Authority may also direct the participating Balancing Authority to restore ACE within safe limits until the system problem is addressed. The Reliability Coordinator will notify the Balancing Authority when it can resume operations under the Field Trial.

In addition to the information provided above, Attachment B proposes actions to be taken by the Reliability Coordinator in consideration of abnormal Interconnection frequency.

Field Trial Performance Reporting

For analysis of Control Performance Measure and Balancing Authority ACE Limit performance under the Field Trial, clock-minute data will be provided in monthly files by the tenth working day following the operating month to the RBCSDT as described in Attachment A.

On a monthly basis, each Balancing Authority will review its performance for the prior month and identify any periods where the ACE exceeded the low BAAL ("BAAL_{Low}") or the high BAAL

("BAAL_{High}") for more than ten consecutive clock-minutes. To help the RBCSDT gain a better understanding of the circumstances that all Balancing Authorities may be faced while operating under BAL-007, each Balancing Authority will provide a brief explanation of the circumstances related to any periods where the duration of consecutive clock-minutes exceeded twenty minutes. In the event that no period exceeded twenty minutes in the prior month, but the longest duration exceeded ten minutes, the Balancing Authority will provide a brief explanation of the circumstances related to that event. The brief explanations provided above will be for RBCSDT use and should be provided by the tenth working day following the operating month. In the event that the Balancing Authority exceeds 30 consecutive clock-minutes in restoring its ACE within the BAAL, the RBCSDT will request the Balancing Authority to provide a detailed account of the associated event so that it can be reviewed by the RBCSDT and provided to the Balancing Authority's RRO(s) for informational purposes only.

Early Termination or Withdrawal from the Field Trial

The RBCSDT may terminate the Field Trial participation of one or more Balancing Authorities based upon the performance under the Field Trial. Balancing Authorities participating in the Field Trial shall immediately cease operating under the proposed Standard BAL-007 if so directed by the RBCSDT as described in this document. Among other items, the RBCSDT will consider actions taken by the Balancing Authority when the BAAL was exceeded, whether there were events lasting more than 30 consecutive clock minutes, and whether a reliability-related problem was attributed to its operation under the Field Trial.

Any Balancing Authority may withdraw from the Field Trial upon notification to the RBCSDT of the date when it will cease operating under the Field Trial and be held responsible for compliance under CPS2. Withdrawal must occur at the end of a calendar month, with CPS2 compliance beginning the first day of the following month. Upon notification, the RBCSDT will contact the Standards Committee, the NERC Vice President and Director of Standards, and the NERC Vice President and Director of Compliance, of the change in Field Trial participation.

ATTACHMENT A
Field Trial Data Submittal Format

For analysis of Control Performance Measure and Balancing Authority ACE Limit (“BAAL”) performance under the Field Trial, clock-minute data will be provided in monthly files under the following Comma-Separated-Variable (“CSV”) format:

BA, Date, Time, TimeZone, ACE, FreqError, FreqBias, ActFreq, SchedFreq, AQC, FQC, BAAL_Low, MinCtLow, BAAL_High, MinCtHigh, <EOL>

<u>Field Name</u>	<u>Description/Type</u>
BA	BA acronym in NERC Registry (up to 4 characters)
Date	Date format (MM/DD/YY),
Time	24-hour time format (hh:mm),
TimeZone	3-character time-zone abbreviation (EST, EDT, CST, CDT, etc)
ACE (REAL)	Clock-minute average Area Control Error (MW) (minimum of 1 digit to right of decimal point)
FreqError (REAL)	Clock-minute average Frequency Error (Hz) <i>Frequency Error is equal to Actual Frequency minus Scheduled Frequency.</i> (minimum of four digits to right of decimal point)
FreqBias (REAL)	Clock-minute average Frequency Bias (MW/0.1 Hz) (same precision as implemented in EMS)
ActFreq (REAL)	Clock-minute average Actual Frequency (Hz) (minimum of four digits to right of decimal point)
SchedFreq (REAL)	Clock-minute average Scheduled Frequency (Hz) (minimum of two digits to right of decimal point)
AQC* (INTEGER)	ACE Quality Code (0=valid data, 1=bad data)
FQC* (INTEGER)	Frequency Quality Code (0=valid data, 1=bad data)
BAAL_Low (REAL)	BAAL _{Low} (MW) (minimum of 1 digit to right of decimal point)
MinCtLow (INTEGER)	Count of the consecutive minutes of negative ACE < BAAL _{Low} when Actual Frequency is < 60 Hz.
BAAL_High (REAL)	BAAL _{High} (MW) (minimum of 1 digit to right of decimal point)
MinCtHigh (INTEGER)	Count of the consecutive minutes of positive ACE > BAAL _{High} when Actual Frequency > 60 Hz.

*If no quality code is available, then write 0 for all records. Ideally, the user should have the capability to update the quality code for the ACE and Frequency with each sample to flag whether that sample represents good or bad data. If over 50% of the samples of ACE for a given period have bad data, then AQC for that period should be flagged as "bad" for the ACE represented. If less than 50% of the samples represent bad data, then AQC for the period should be flagged as "good" using only the good samples of ACE for that period. Likewise, if over 50% of the samples of frequency for a given period have bad data, then FQC for that period should be flagged as "bad" for the frequency represented. If less than 50% of the samples represent bad data, then FQC for that period should be flagged as "good" using only the good samples of frequency for that period.

Example CSV records:

```
BA-03,11/21/2004,10:00,EST,-10.2,-0.0080,-90.0,59.9920,60.00,0,0,-281.3,0,0,0,0
BA-03,11/21/2004,10:01,EST,-2.5,-0.0100,-85.0,59.9900,60.00,0,0,-212.5,0,0,0,0
BA-03,11/21/2004,10:02,EST,1.6,-0.0070,-80.0,59.9930,60.00,0,0,-285.7,0,0,0,0
BA-03,11/21/2004,10:03,EST,-309.0,-0.0370,-80.0,59.9630,60.00,0,0,-54.1,1,0,0,0
BA-03,11/21/2004,10:04,EST,-310.4,-0.0420,-80.0,59.9580,60.00,0,0,-47.6,2,0,0,0
BA-03,11/21/2004,10:05,EST,-312.5,-0.0540,-80.0,59.9460,60.00,0,0,-37.0,3,0,0,0
```



Note that the fourth row of data represents the first clock-minute record where the ACE of -309.0 MW was outside the BAAL_Low boundary of -54.1 MW. As ACE remained outside the calculated BAAL boundary for the next two clock-minutes, "MinCtLow" was incremented for each record.

Note that column headings are not to be provided in the monthly CSV files.

Monthly File Naming Convention

Data shall be provided to the RBCSDT on a monthly basis no later than the tenth working day of the month using the following naming convention:

YYYYMM_BA-**NN**.CSV, where YYYY is the four-digit year, MM is the two-digit month (01-12), and NN is the number assigned to the participating BA by the RBCSDT. For example, August 2005 data for BA-03 should be written to the file named "200508_BA-03.CSV" and provided to the RBCSDT.

Once the data has been stored into the monthly CSV file, the user should then compress the file, typically 3-4 MB, into a "ZIP" file with the same naming convention (**YYYYMM**_BA-**NN**.ZIP). Monthly data is to be provided via email no later than the tenth working day of the month to doug.hils@duke-energy.com

Questions should be directed to:

Doug Hils
 Duke Energy
 Midwest Control Area Operation
 513-287-2149
doug.hils@duke-energy.com

Calculation of Variables

The Balancing Authority ACE Limit (“BAAL”) should be calculated from the clock-minute averages of the data as follows:

$$\begin{aligned} \text{FTL}_{\text{Low}} &= 59.95 \text{ Hz} \\ \text{FTL}_{\text{High}} &= 60.05 \text{ Hz} \end{aligned}$$

Frequency Trigger Limits for the Eastern Interconnection shown

$$\mathbf{X} = \text{Actual Frequency} - 60 \text{ Hz}$$

(note: during time-error corrections, this variable is not equal to the Frequency Error which is always the sum of Actual Frequency minus Scheduled Frequency)

If $\mathbf{X} \leq 0$ then

$$\text{BAAL}_{\text{Low}} = (-10 * \text{Frequency Bias} * (\text{FTL}_{\text{Low}} - 60 \text{ Hz})^2) / (\mathbf{X} - 0.000000001)$$

Else

$$\text{BAAL}_{\text{Low}} = 0.0$$

End If

If $\mathbf{X} > 0$ then

$$\text{BAAL}_{\text{High}} = (-10 * \text{Frequency Bias} * (\text{FTL}_{\text{High}} - 60 \text{ Hz})^2) / (\mathbf{X})$$

Else

$$\text{BAAL}_{\text{High}} = 0.0$$

End If

Needed to prevent division error when $\mathbf{X} = 0$ but will be insignificant in the calculation when $\mathbf{X} < 0$

The logic for the clock-minute counters (initialized at zero) would then use the logic:

If $\text{BAAL}_{\text{Low}} < 0$ then

If $\text{ACE} < \text{BAAL}_{\text{Low}}$ then

$$\text{MinCtLow} = \text{MinCtLow} + 1$$

Else

$$\text{MinCtLow} = 0$$

End If

$$\text{MinCtHigh} = 0$$

End If

If $\text{BAAL}_{\text{High}} > 0$ then

If $\text{ACE} > \text{BAAL}_{\text{High}}$ then

$$\text{MinCtHigh} = \text{MinCtHigh} + 1$$

Else

$$\text{MinCtHigh} = 0$$

End If

$$\text{MinCtLow} = 0$$

End If

ATTACHMENT B**Proposed Frequency Monitoring and Response Process
for Reliability Coordinators in the Eastern Interconnection****Introduction**

This document outlines a proposed frequency monitoring and response process for the Eastern Interconnection.

Short-Term Triggers (Reliability Coordinators (RC))

NOTE: If the frequency exceeds the FRL (Frequency Reliability Limit) or FAL (Frequency Abnormal Limit) High or Low then immediate action is required. The Frequency Trigger Limit (FTL) represents the initial frequency where the Reliability Coordinators should be directing corrective action if necessary.

Frequency	What	Actions
60.5	FRL High	1,4
60.2	FAL High	1,3
60.05 (if >10 minutes)	FTL High	1,2
60.05 (if >5 minutes)	FTL High	1,
59.95 (if >5 minutes)	FTL Low	1,
59.95 (if >10 minutes)	FTL Low	1,2
59.91	FAL Low	1,3
59.82	FRL Low	1,4

Actions

1. Look for BAs (Balancing Authorities) within your area beyond BAAL (Balancing Authority ACE Limit). Direct correction and log in RCIS (Reliability Coordinator Information System) under Frequency section.
2. Direct BAs beyond BAAL to correct ACE (Area Control Error). Call Other RCs, communicate problem if known. Ask for cause if none reported. Log in RCIS under Frequency section. Notify Time Monitor of event and problem (if known). Time Monitor logs event and problem.
3. Direct all BAs with ACE hurting frequency to correct. Call other RCs, communicate problem if known. Ask for cause if none is reported. Log in RCIS under Frequency section. Notify Time Monitor of event and problem (if known). Time monitor logs event and problem.
4. Evaluate whether still interconnected. Direct emergency action. Call other RCs, communicate problem if known. Ask for cause if none is reported. Log in RCIS under Frequency section. Notify Time Monitor of event and problem (if known). Time monitor logs event and problem.

RCs should also log any other unusual frequency events and report to the Time Monitor.

The Time Monitor will notify the Resources Subcommittee for all events logged by Time Monitor.

Metric	What	Actions
+/- 0.031Hz	Hourly Average	Call Other RCs, communicate problem if known. Ask for cause if none reported. Log in RCIS under Frequency section. Notify Time Monitor of event and problem (if known). Time Monitor logs event and problem.
28 mHz	Changes in one-minute average frequency deviation	Call Other RCs, communicate problem if known. Ask for cause if none reported. Log in RCIS under Frequency section. Notify Time Monitor of event and problem (if known). Time Monitor logs event and problem.
28 mHz	Change over 10 seconds (future-in CERTS)	Scan for corresponding ACE changes to capture unit trips for frequency response benchmarking. Call Other RCs, communicate problem if known. Ask for cause if none reported. Log in RCIS under Frequency section. Notify Time Monitor of event and problem (if known). Time Monitor logs event and problem.

Longer-Term Triggers and Benchmarks (Resources Subcommittee)

Metric	What	Actions
+/- 0.031Hz	Hourly Average	AIE Survey if no problem known. If problem known, survey entities involved to determine any lessons. Maintain record
20 mHz	Daily RMS1	Evaluate Day and determine need for survey. Maintain Record
16.8 mHz	Weekly RMS1	Evaluate Week and determine underlying cause. Maintain Record
28 mHz	Changes in one-minute average frequency deviation	If problem is known, maintain for excursion benchmarking. If problem is not known, ACE survey to determine problem.
28 mHz	Change over 10 seconds (future-in CERTS)	Scan for corresponding ACE changes to capture unit trips for frequency response benchmarking. If problem is not known, ACE survey to determine problem.

ATTACHMENT C
Field Trial Implementation Plan
Updated 04-01-2008

OVERVIEW

The Field Trial will be coordinated by the RBCSDT in the following phases:

February 2008

- 1) Early in February 2008 and prior to the Monthly Field Trial Review conference call, the Independent Electricity System Operator (IESO) will confirm that it is ready to commence operations under the Field Trial on March 1, 2008. The RBCSDT will verify that the IESO has met the requirements for participation in the Field Trial as described in this document and that the adjoining RCs are aware of the participation.
- 2) The RBCSDT will review January 2008 operation under the Field Trial at its monthly review of operations in the latter part of February 2008 and will gather input from the Resources Subcommittee, Operating Reliability Subcommittee and Reliability Coordinator Working Group to determine if there were any reliability issues attributed to the Field Trial that need to be considered by the RBCSDT.
- 3) During the conference call, the RBCSDT will ask for feedback from the Balancing Authorities and the Reliability Coordinators, including suggestions on how the Field Trial can be enhanced.
- 4) Based on the data and feedback provided back to the RBCSDT, among other items, the RBCSDT will determine if any actions are needed with regards to the Field Trial.

Phase A:

- 5) The IESO, representing a summer peak load of approximately 25,450 MW, will begin operating to the proposed BAL-007 Standard on March 1, 2008.
- 6) The RBCSDT will review the first two weeks of operation under the Field Trial at its monthly review of operations in the latter part of March 2008 and will gather input from the Resources Subcommittee, Operating Reliability Subcommittee and Reliability Coordinator Working Group to determine if there were any reliability issues attributed to the Field Trial that need to be considered by the RBCSDT.
- 7) During the conference call, the RBCSDT will ask for feedback from the Balancing Authorities and the Reliability Coordinators on the first two week's operations, including suggestions on how the Field Trial can be enhanced.
- 8) Based on the data and feedback provided back to the RBCSDT, among other items, the RBCSDT will determine if any actions are needed with regards to the Field Trial.

Phase B:

- 9) EON-US (LGEE), representing a summer peak load of approximately 7,230 MW, will begin operating to the proposed BAL-007 Standard on April 1, 2008.
- 10) The RBCSDT will review the first two weeks of operation under the Field Trial at its monthly review of operations in the latter part of April 2008 and will gather input from the Resources Subcommittee, Operating Reliability Subcommittee and Reliability Coordinator Working Group to determine if there were any reliability issues attributed to the Field Trial that need to be considered by the RBCSDT.
- 11) During the conference call, the RBCSDT will ask for feedback from the Balancing Authorities and the Reliability Coordinators on the first two week's operations, including suggestions on how the Field Trial can be enhanced.
- 12) Based on the data and feedback provided back to the RBCSDT, among other items, the RBCSDT will determine if any actions are needed with regards to the Field Trial.

Pro 8/27/2008 – Based upon the delay of the Midwest ISO Ancillary Service Market, Phase C will be revised to reflect the Midwest ISO starting operation under the Field Trial at a later date; until that time, the Balancing Authorities of ALTE, ALTW, CIN, MECS, NIPS, and WEC, operating within the Midwest ISO, will continue operating and reporting under the provisions of the Field Trial.

Phase C:

- 13) Early in August 2008 and prior to the Monthly Field Trial Review conference call, the Midwest Independent Transmission System Operator (MISO) will confirm that it is ready to commence operations under the Field Trial on September 9, 2008. The RBCSDT will verify that the MISO has met the requirements for participation in the Field Trial as described in this document and that the adjoining RCs are aware of the participation.
- 14) At its monthly review of operations in the latter part of August 2008, the RBCSDT will gather input from the Resources Subcommittee, Operating Reliability Subcommittee and Reliability Coordinator Working Group to determine if there were any reliability issues attributed to the Field Trial that need to be considered by the RBCSDT or other actions to be taken.
- 15) The Midwest ISO (MISO), representing a summer peak load of approximately 115,000 MW, will begin operating to the proposed Standard BAL-007 on September 9, 2008. The MISO BA Area will include the areas of ALTE, ALTW, CIN, MECS, NIPS, and WEC, which represent a summer peak load of approximately 53,500 MW.
- 16) The RBCSDT will review the first two weeks of operation under the Field Trial at its monthly review of operations in the latter part of September 2008 and will gather input from the Resources Subcommittee, Operating Reliability Subcommittee and Reliability Coordinator Working Group to determine if there were any reliability issues attributed to the Field Trial that need to be considered by the RBCSDT.
- 17) During the conference call, the RBCSDT will ask for feedback from the Balancing Authorities and the Reliability Coordinators on the first two week's operations, including suggestions on how the Field Trial can be enhanced.
- 18) Based on the data and feedback provided back to the RBCSDT, among other items, the RBCSDT will determine if any actions are needed with regards to the Field Trial.

Phase D:

- 19) Other Balancing Authorities will be brought into the Field Trial at the beginning of a calendar month as the Balancing Authorities are trained and prepared to begin operating under the Field Trial of BAL-007 under the provisions and requirements of this Field Trial document and attachments.

Attachment D outlines the dates applicable to the participating Balancing Authorities under the Field Trial for 2008.

ATTACHMENT D**Applicable Dates for the Balancing Authorities under the Field Trial****Updated 04-01-2008**

Note: All RBCSDT conference calls to review monthly operations are with the participating Balancing Authorities, their Reliability Coordinators, and members of the Resources Subcommittee, Operating Reliability Subcommittee, and Reliability Coordinator Working Group

January 1, 2008 - No new Field Trial participants scheduled

January 14, 2008 - Data for December 2007 provided by Balancing Authorities
January 18, 2008 – Monthly Field Trial Review conference call

February 1, 2008 - No new Field Trial participants scheduled

February 14, 2008 - Data for January 2008 provided by Balancing Authorities
February 25, 2008 – Monthly Field Trial Review conference call.

March 1, 2008 - Field Trial begins for IESO

March 14, 2008 - Data for February 2008 provided by Balancing Authorities other than IESO
March 18, 2008 - Data for first 2 weeks of operations (Mar 1-14) provided by IESO
March 24, 2008 - Monthly Field Trial Review conference call

April 1, 2008 – Field Trial begins for EON-US (LGEE)

April 14, 2008 - Data for March 2008 provided by all Balancing Authorities other than LGEE
April 18, 2008 - Data for first 2 weeks of operations (Apr 1-14) provided by LGEE
April 21, 2008 - Monthly Field Trial Review conference call

May 1, 2008 – No new Field Trial participants scheduled at this time

May 14, 2008 - Data for April 2008 provided by all Balancing Authorities
May 19, 2008 - Monthly Field Trial Review conference call

June 1, 2008 - No new Field Trial participants scheduled at this time

June 13, 2008 - Data for May 2008 provided by all Balancing Authorities
June 18, 2008 - Data for first 2 weeks of operations (June 1-14) provided by MISO
June 19, 2008 - Monthly Field Trial Review conference call

July 1, 2008 – No new Field Trial participants scheduled at this time

July 14, 2008 - Data for June 2008 provided by all Balancing Authorities
July 21, 2008 - Monthly Field Trial Review conference call

August 1, 2008 – No new Field Trial participants scheduled at this time

August 14, 2008 - Data for July 2008 provided by all Balancing Authorities
August 25, 2008 - Monthly Field Trial Review conference call

8/27/2008 – Based upon the delay of the Midwest ISO Ancillary Service Market, this section will be revised to reflect the Midwest ISO starting operation under the Field Trial at a later date.

September 9, 2008 – Field Trial begins for Midwest ISO (MISO)

September 12, 2008 - Data for August 2008 provided by all Balancing Authorities
September 24, 2008 - Data for first 2 weeks of operations (September 9-22) provided by MISO
September 26, 2008 - Monthly Field Trial Review conference call

October 1, 2008 – No new Field Trial participants scheduled at this time

October 14, 2008 - Data for September 2008 provided by all Balancing Authorities

October 20, 2008 - Monthly Field Trial Review conference call

November 1, 2008 – No new Field Trial participants scheduled at this time

November 14, 2008 - Data for October 2008 provided by all Balancing Authorities

November 17, 2008 - Monthly Field Trial Review conference call

December 1, 2008 – No new Field Trial participants scheduled at this time

December 12, 2008 - Data for November 2008 provided by all Balancing Authorities

December 15, 2008 - Monthly Field Trial Review conference call

NOTE: THIS ATTACHMENT WILL BE UPDATED AS NEW BALANCING AUTHORITIES ARE ADDED TO THE FIELD TRIAL.

ATTACHMENT E

Monthly Review Procedure

By the tenth working day of each month, the participating Balancing Authorities provide the clock-minute data for the prior operating month to the RBCSDT as described in Attachment A. The clock-minute data for each Balancing Authority will be imported into a database where all records will be converted to GMT and time-aligned based upon the clock-minute Actual Frequency data.

The queries shall provide the following:

- 1) All clock-minutes when FTL_{Low} was exceeded and
 - a. Scheduled Frequency = 59.98 Hz
 - b. Scheduled Frequency = 60.00 Hz
 - c. Scheduled Frequency = 60.02 Hz

- 2) All clock-minutes when FTL_{High} was exceeded and
 - a. Scheduled Frequency = 59.98 Hz
 - b. Scheduled Frequency = 60.00 Hz
 - c. Scheduled Frequency = 60.02 Hz

- 3) All clock-minutes where FTL_{Low} was exceeded, Scheduled Frequency = 59.98 Hz and Frequency Error was above -0.05 Hz.

- 4) All clock-minutes where FTL_{High} was exceeded, Scheduled Frequency = 60.05 Hz and Frequency Error was below 0.05 Hz.

- 5) The maximum number of clock-minutes that FTL_{Low} was exceeded for the month

- 6) The maximum number of clock-minutes that FTL_{High} was exceeded for the month

- 7) All clock-minutes where $BAAL_{Low}$ was exceeded for each Balancing Authority

- 8) All clock-minutes where $BAAL_{High}$ was exceeded for each Balancing Authority

- 9) The maximum number of clock-minutes that each Balancing Authority exceeded $BAAL_{Low}$

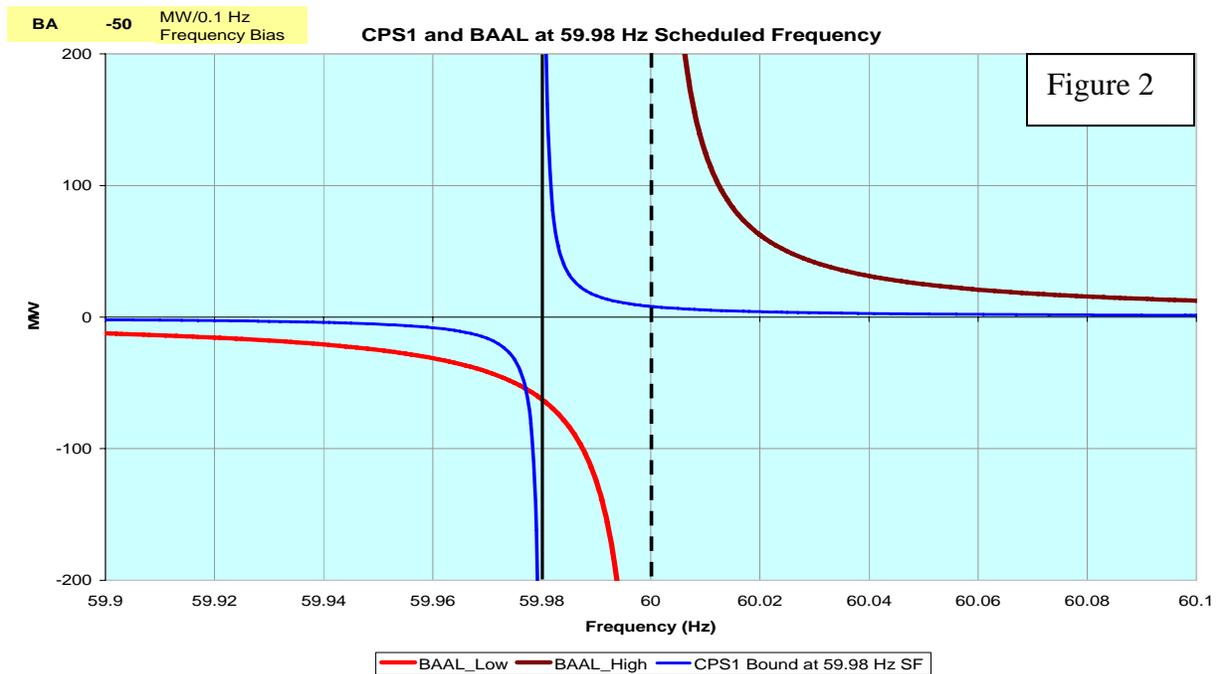
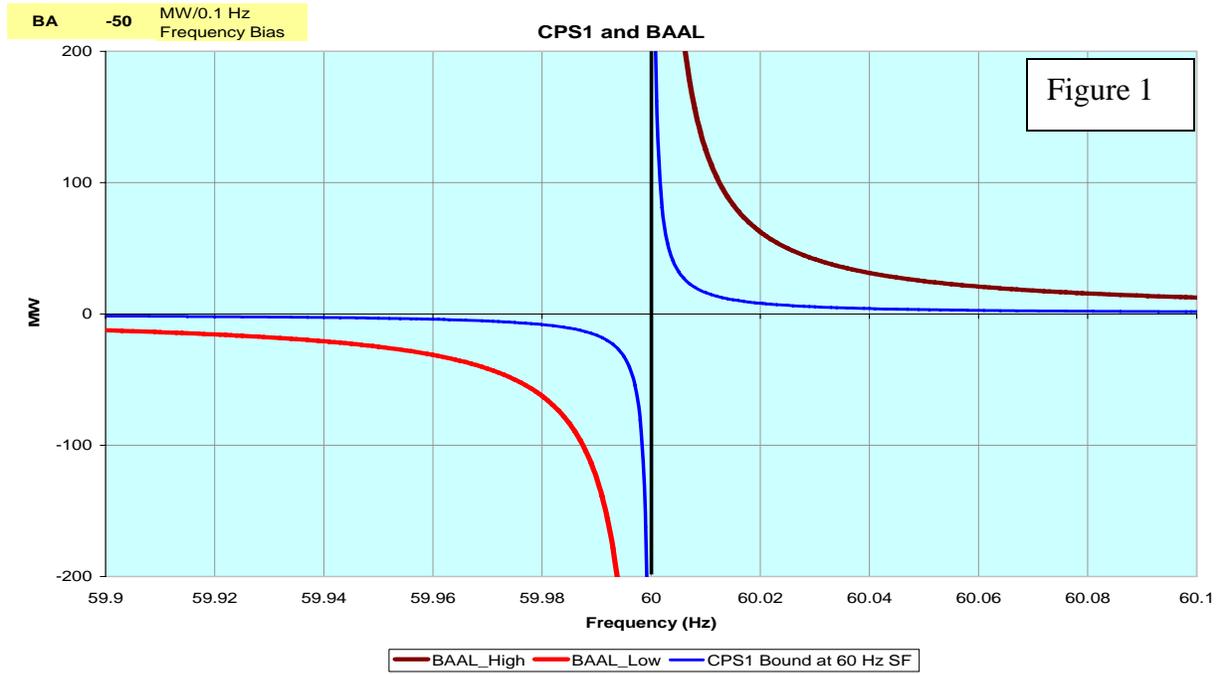
- 10) The maximum number of clock-minutes that each Balancing Authority exceeded $BAAL_{High}$

- 11) View of all Balancing Authorities for each clock-minute for comparison of
 - a. Actual Frequency
 - b. Scheduled Frequency
 - c. ACE
 - d. Minute Counts for $BAAL_{Low}$ or $BAAL_{High} > 0$
 - e. CPS1
 - f. ACPS1 (as described in Attachment F)

ATTACHMENT F

Sample Calculations and Available Tools for BAL-007 Performance Evaluation

CPS1 is a calculation for control performance that considers Balancing Authority operation at all times to Scheduled Frequency. During fast or slow time-error corrections, the CPS1 curves shift in a manner symmetric about the Scheduled Frequency, as illustrated in Figures 1 and 2.



The Balancing Authority ACE Limit (“BAAL”) was developed “from the ground up”, considering the targeted research and development of Interconnection-specific Frequency Relay Limits, Frequency Abnormal Limits, and Frequency Trigger Limits. As the BAAL calculation is not a function of the Scheduled Frequency, its associated curves do not shift in a manner similar to CPS1, rather the limits remain symmetric about 60 Hz. as illustrated in Figures 1 and 2.

Though good performance in the long term under CPS1 is based upon control about the Scheduled Frequency, good performance in real-time under the BAAL is based also upon control in support of the Interconnection frequency and taking action to limit the duration of operating outside a variable bound that gets “tighter” as Actual Frequency deviates further from 60 Hz.

One type of display used to monitor when ACE exceeds the BAAL is provided below. The chart tracks the number of consecutive clock-minutes that ACE exceeds the BAAL along with displaying clock-minute ACE in relation to the clock-minute Actual Frequency.

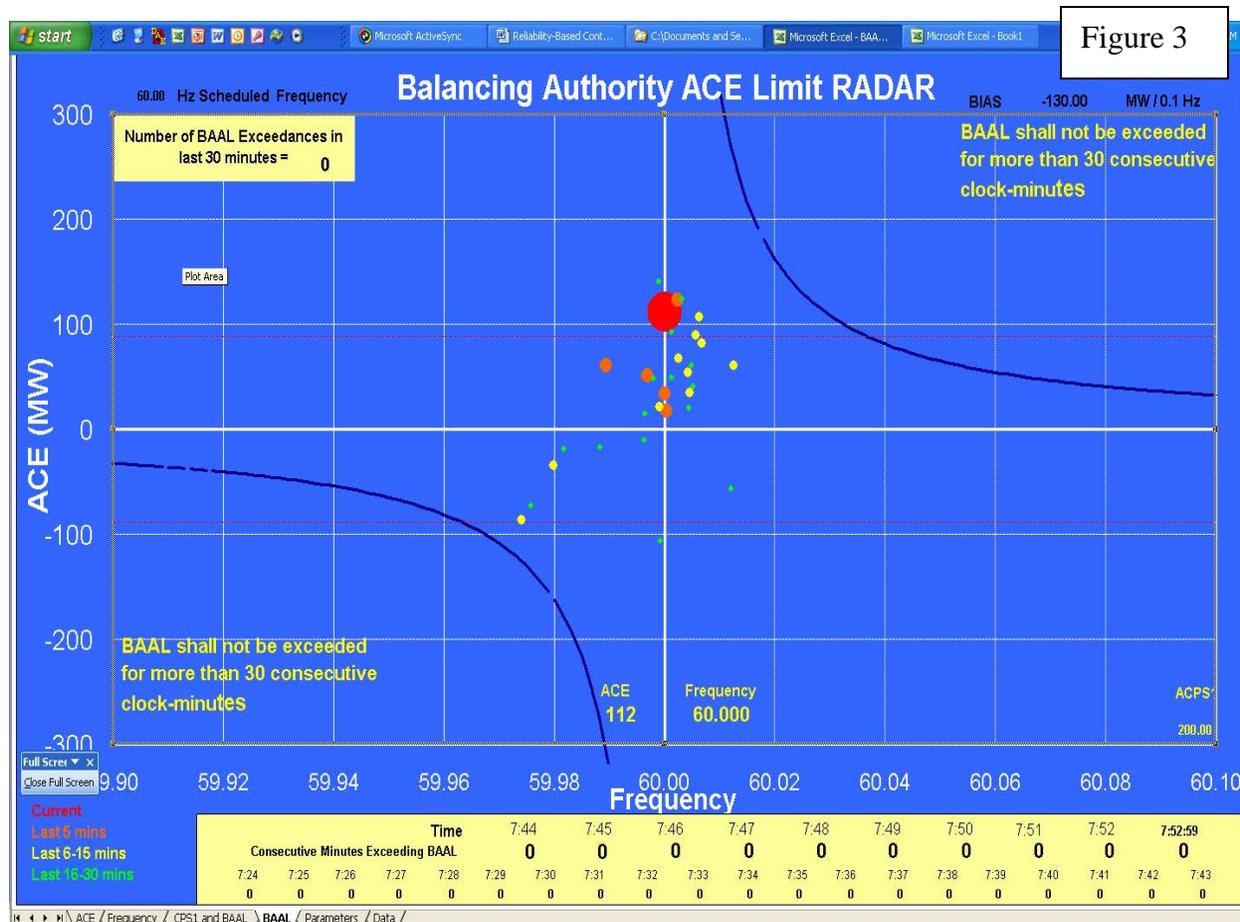


Figure 3

The screen above is from an Excel worksheet that brings in data from a PI server (real-time and historic data) to display the last 30 clock-minutes of ACE where the color and size of the dots reflect the length of time passed. The Excel file is available on the NERC [Reliability-based Control website](#) along with instructions for implementation with PI DataLink. As the duration of ACE exceeding the BAAL is a critical aspect of BAL-007, Balancing Authorities may prefer to trend a value as a function of time similar to other operator interfaces where time is displayed on the X or Y axis, as provided below.

In Eastern Interconnection, NERC CPS1 is calculated as follows:

$$CPS1 = (2 - (ACE * \text{Frequency Error}) / (-10 * \text{Frequency Bias} * 0.018 * 0.018)) * 100$$

Note: clock-minute average values must be used for all variables

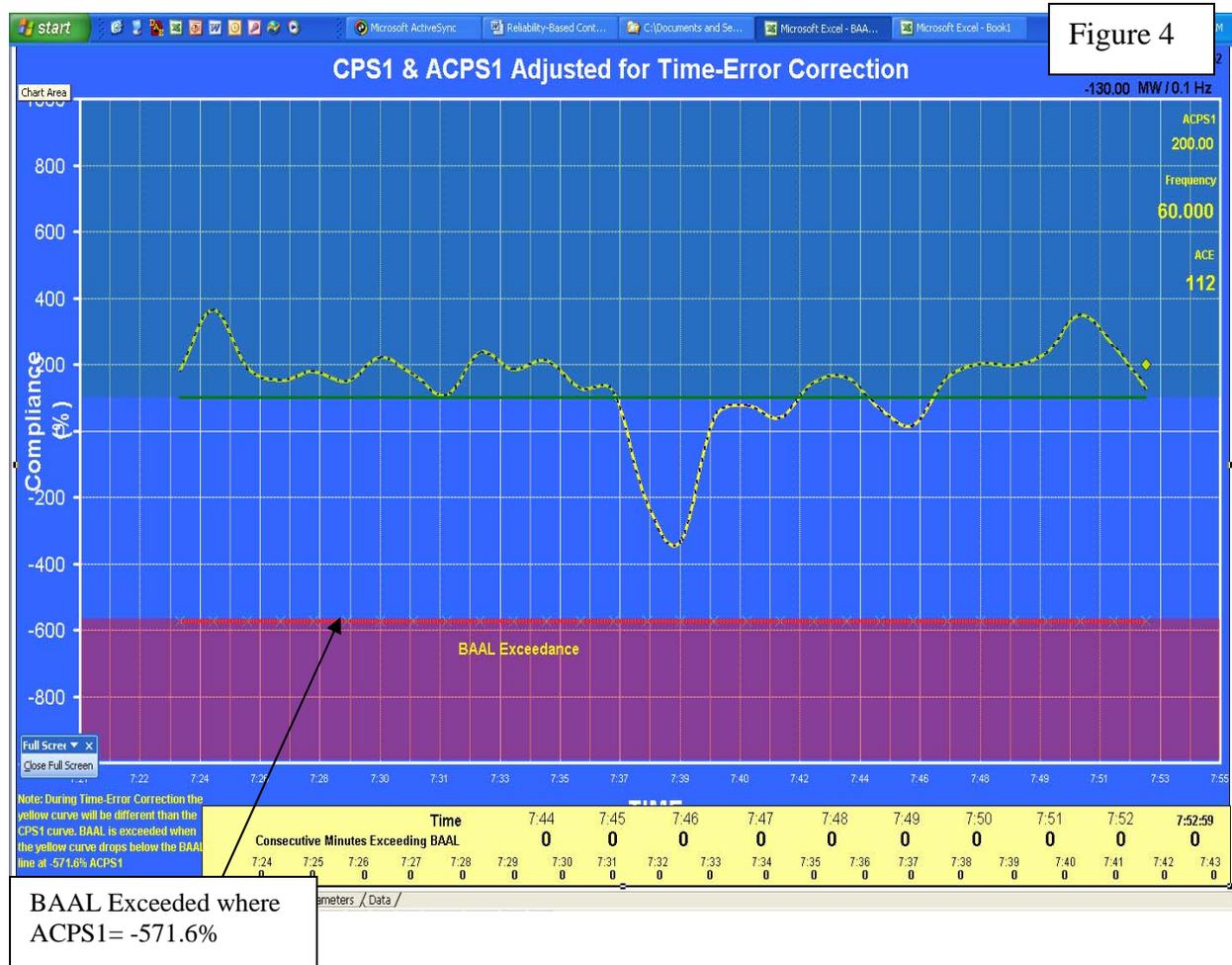
In addition to calculating real-time performance under BAL-007 by comparing the clock-minute value of ACE to the calculated clock-minute value of the BAAL, the Balancing Authority can also monitor an adjusted version of the NERC CPS1 calculation that is not dependent upon Scheduled Frequency and referred to in this document as “ACPS1”. In the ACPS1 calculation below, Frequency Error is replaced with the term “(Actual Frequency – 60)”.

$$ACPS1 = (2 - (ACE * (\text{Actual Frequency} - 60)) / (-10 * \text{Frequency Bias} * 0.018 * 0.018)) * 100$$

Note: clock-minute average values must be used for all variables

Note: when Scheduled Frequency = 60 Hz, the calculations of CPS1 and ACPS1 are identical

The BAAL calculation provided in Attachment A shows that BAAL varies as a function of the Actual Frequency. By substituting BAAL for ACE in the ACPS1 calculation for a given value of Actual Frequency, one can determine that ACE exceeds the BAAL when ACPS1 is worse than approximately minus 571.6% for any Balancing Authority in the Eastern Interconnection. This information is useful in that the operator can monitor its performance against a bound that remains fixed with the value being monitored (ACPS1) being a function of ACE and Actual Frequency.



In the display above, the dotted line represents the CPS1 calculation and the yellow line represents the ACPS1 calculation. When Scheduled Frequency = 60 Hz, the values are identical; however, during times of fast or slow time-error correction, the curves will be different, requiring the operator to monitor operation to the long-term goal of averaging above 100% for CPS1, but also take action when the yellow line drops below -571.6% ACPS1 reflecting when the BAAL has been exceeded. The chart displayed can be selected from the same Excel worksheet as the prior display available on the NERC Reliability-based Control website.