NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Resources Subcommittee Meeting

Chaparral Suites Resort
5001 North Scottsdale Road
Scottsdale, AZ
Phone: (480)949–1414

Wednesday, January 30, 2008 — 8 a.m.–5 p.m.
Thursday, January 31, 2008 — 8 a.m.–noon

Agenda

1. Administrative

a. Membership and Guests — Chair
b. Arrangements — Secretary
c. Approval of Meeting Minutes
   i) None — Chair
d. Procedures
   i) Parliamentary Procedures — Chair
   ii) Antitrust Compliance Guidelines — Chair
e. Resources Subcommittee Action Items List (Review prior to the meeting) — Chair
f. Resources Subcommittee Charter — Chair

2. Work Group Reports

Work Group Meetings, Conference Calls, or Action since the last RS Meeting

a. Control Criteria Work Group — Alan Oneal
b. Frequency Work Group — Raymond Vice
c. Inadvertent Interchange Work Group — Don Badley
d. Operating Reserves Work Group — Larry Akens

3. 2008 Frequency Bias Requirements

a. 2008 Frequency Bias Values — Terry Bilke, Raymond Vice, Tom Vandervort

4. NERC Reliability Standards

a. Frequency Response SDT — Bill Herbsleb
b. Reliability-based Control SDT — Doug Hils, Raymond Vice
c. Balancing Authority Control SAR (BAL-002, 004, 005, 006 Revision) — Larry Akens
d. Generation Verification — Tom Vandervort
e. Performance Standards Reference Document — Alan Oneal

5. Active RS NERC-CERTS Applications

a. Resources Adequacy (ACE-Frequency) Application System — Carlos Martinez, Terry Bilke
b. Intelligent Alarms — Carlos Martinez, Terry Bilke
c. AIE Monitoring Application (Project 2000-4) — Carlos Martinez, Don Badley
d. CPS1 & BAAL Monitoring Application (Project 2001-38) — Carlos Martinez, Doug Hils, Raymond Vice
e. Frequency Monitoring and Analysis Application (Project 2005-6) — Carlos Martinez, Raymond Vice, Terry Bilke
f. Inadvertent Interchange Application (Project 2001-37) — Carlos Martinez, Don Badley
g. DOE North American Synchronous Phasor Initiative (NASPI) — Terry Bilke, Carlos Martinez
h. Combination of Event Analysis Tools — Tom Vandervort
i. WECC Interchange Tool (WIT) for Eastern Interconnection — Tom Vandervort

6. Frequency and Control Performance

a. Western Interconnection Frequency Trends and Events — Bart McManus
b. Eastern Interconnection Frequency Trends and Events — Raymond Vice
c. ERCOT Interconnection Frequency Trends and Events — Sydney Neimeyer
d. Hydro Quebec Interconnection Frequency Trends and Events — Mike Potishnak
e. CPS1, CPS2, BAAL Data Trends — Terry Bilke
f. DCS Data Trends — Terry Bilke
g. Inadvertent Interchange Balances — Don Badley
h. Determining Frequency Events to Analyze in 2008 — Raymond Vice
i. Over-generation — Raymond Vice
j. AIE Survey — Terry Bilke, Don Badley, Raymond Vice, Carlos Martinez
k. August 4, 2008 Frequency Event, Risk Analysis — Don McInnis

7. Time Error

a. Eastern Interconnection — Bill Herbsleb
b. Western Interconnection — John Tolo
c. ERCOT Interconnection — Sydney Niemeyer
d. Hydro Quebec Interconnection — Mike Potishnak

8. NERC Operating Committee Directives to the Resources Subcommittee

a. Reliability Concepts Document — Terry Bilke
b. Time Error Monitor Procedures — Terry Bilke
c. Integration of Renewable Generation (Wind and Solar) — Terry Bilke

9. Future Meetings

a.	April 30–May 1, 2008	Washington, D.C.
b.	July 30–31, 2008	Victoria, BC, Alternate Location: Minneapolis
c.	October 29–30, 2008	San Antonio, Alternate Location: Albuquerque
d.	January 28–29, 2009	New Orleans, San Diego, or Ft. Lauderdale
e.	April 29–30, 2009	To Be Determined
f.	July 29–30, 2009	To Be Determined
g.	October 28–29, 2009	To Be Determined

Item 1.a Membership and Guests

Chairman Terry Bilke will welcome the Resources Subcommittee (RS) members and guests. The chair will ask members and guests to introduce themselves.

Each member is asked to check and review the current organization, roster, and survey contacts list for accuracy.

Attachments

1. RS Organization
2. RS Roster
3. RS Survey Contacts List

Item 1.b Arrangements

The RS Meeting will begin on Wednesday, January 30, 2008 at 8 a.m. and adjourn by noon on Thursday, January 31, 2008. Lunch will be served on Tuesday.

Item 1.c Approval of Meeting Minutes

The RS approved the July 18–19, 2007 Meeting Minutes and the October 23–24, 2007 Meeting Minutes with an internet electronic vote. The meeting minutes are available on the NERC RS Web site.

Attachment

None

Item 1.d Procedures

Item 1.d.i. Parliamentary Procedures

A summary of Parliamentary Procedures is attached for reference. The chair will answer questions regarding these procedures.

Item 1.d.ii. Antitrust Compliance Guidelines

On June 14, 2002, the NERC Board of Trustees adopted Antitrust Compliance Guidelines for NERC. In adopting the guidelines, the board passed the following resolution:

RESOLVED, that the Board of Trustees (1) adopts the Antitrust Compliance Guidelines draft attached hereto as Exhibit A and (2) instructs that these Antitrust Compliance Guidelines be included in the agenda package for each meeting of every NERC committee, subcommittee, task force, working group, and other NERC-sponsored activity.

The resolution also applies to workshops, training sessions, and any other NERC-sponsored event. A copy of the NERC Antitrust Compliance Guidelines will be included in the agenda package for each meeting of each group or event.

Attachments

1. Parliamentary Procedures
2. Antitrust Compliance Guidelines

Item 1.e Resources Subcommittee Action Items List

Discussion

The action items listed are attached for the subcommittee to review prior to the meeting. The action item list will not be reviewed during the meeting. However, the chairman or any member can discuss specific items or request assistance to close them.

Action

Between meetings, the subcommittee is to review the action item list on a periodic basis and perform necessary tasks to close the items. The subcommittee secretary will schedule meetings, conference calls, and webcasts to support efforts to address the action items. It is the responsibility of the action figures to address and close their items.

Attachment

RS Action Items List

Item 1.f Resource Subcommittee Charter

Secretary Vandervort updated the RS Charter and had it posted on the NERC RS Web site. The obvious change from the previous charter is the title for the RS subgroups — "work groups" instead of the "task forces." Typically, task forces are usually ad-hoc and are not expected to exist after completing their assignments. Conversely, working groups may be on-going.

The charter was distributed to the subcommittee with a request to review and propose enhancements. There were no comments from the subcommittee at the posting of this agenda.

Action

The RS scope is included in the agenda for reference. Subcommittee members are asked to review the scope prior to the next meeting and email recommended changes to the subcommittee for consideration at the meeting.

Attachment

RS Charter

Item 2. Work Group Reports

Some or all of the subcommittee work groups may have met or conducted conference calls since the last meeting to discuss their respective issues and concerns.

Items 2.a–2.d Work Group Reports

Discussion and Action

The RS work groups' chairmen will report to the subcommittee regarding deliverables, significant investigations, action items, and concerns that are new or carry-over from the last meeting.

Work Group	Work Group Chairman
Control Criteria Work Group	Alan Oneal
Frequency Work Group	Raymond Vice
Inadvertent Interchange Work Group	Don Badley
Operating Reserves Work Group	Larry Akens

Item 3. 2008 Frequency Bias Requirements

Item 3.a. 2008 Frequency Bias Values — Terry Bilke, Raymond Vice, and Tom Vandervort

On November 27, 2007, Chris Scheetz sent to the RS members, RS survey contacts, and regional managers, a letter requesting the Balancing Authorities calculate and submit their 2008 Frequency Bias values to NERC. The request included a 2008 frequency bias request letter, the 2007 CPS2 Bounds Report, a list of 2007 events and bias calculation form, and a FRS and Bias Calculation Document.

The subcommittee will review the balancing authorities' 2008 Bias values for accuracy.

Attachments

To be sent under separate cover.

Item 4. NERC Reliability Standards

The RS standards activity listed here may be addressed during the subcommittee's meeting or during the RS Work Group meetings.

Item 4.a Frequency Response SDT — Bill Herbsleb

Bill Herbsleb, Chair of the Frequency Response standard drafting team (SDT) will report on the status of the RS sponsored Frequency Response Standard (currently identified as Draft BAL-012 standard) and future action of the SDT.

Item 4.b Reliability-based Control SDT — Doug Hils and Raymond Vice

Doug Hils, Chair of the Reliability-based Control standard drafting team, or Raymond Vice, Chair of the superseded Balancing Resources and Demand SDT will report on the status of the Frequency Response Standard (currently identified as Draft BAL-007 through BAL-011 standards) and the future action of the SDT.

*Item 4.c Balancing Authority Control SDT (*BAL-002, 004, 005, 006 Revisions) — Larry Akens

Larry Akens, Chair of the Balancing Authority Control standard drafting team (SDT) will report on the status of the Balancing Authority Control Standards (these include the BAL-002, 004, 005, and 006 standards revisions) and future action of the SDT.

Andy Rodriquez, who is the NERC staff interface with NAESB will coordinate and facilitate the Balancing Authority Control SDT because of the issues and concerns that intertwine the reliability and business practice issues and concerns for these standards.

Item 4.d Generation Verification — Tom Vandervort

The RS should monitor and participate the activities of the Generator Verification (Project 2007-09) standard drafting team (SDT). The description of the SDT is listed below and seems to intertwine with the subcommittee's scope, especially MOD-027 and MOD-024.

Purpose/Industry Need
The purpose of Project 2007-09 Generator Verification is:

- To ensure that generators will not trip off-line during specified voltage and frequency excursions or as a result of improper coordination between generator protective relays and generator voltage regulator controls and limit functions (such coordination will include the generating unit's capabilities).
- To ensure that generator models accurately reflect the generator's capabilities and operating characteristics.

New standards to be finalized as part of this project are:

- PRC-019 — Coordination of Generator Voltage Regulator Controls with Unit Capabilities and Protection
- PRC-024 — Generator Performance During Frequency and Voltage Excursions
- MOD-026— Verification of Models and Data for Generator Excitation System Functions
- MOD-027 — Verification of Generator Unit Frequency Response

Standards to be revised as part of this project are:

- MOD-024 — Verification of Generator Gross and Net Real Power Capability
- MOD-025 — Verification of Generator Gross and Net Reactive Power Capability

Item 4.e Performance Standards Reference Document — Alan Oneal

Alan Oneal has spent a significant amount of time revising the Performance Standard Reference Document (PSRD). This effort is necessary since the Policy 1 reference documents are no longer valid.

Mr. Oneal sent the PSRD, Version November 26, 2007, to the subcommittee on November 27, 2007. Secretary Vandervort had the PSRD posted onto the NERC RS Web site.

Alan's Comment:
Reminder from October RS meeting in Portland: offer example of 1-min window for disturbance definition (with equation clarifications but not the pre-dist ACE rigidity or ACE deflection definition
Response: Have complied with all except use of the 1-min window to define disturbance. I'm trapped on this because would have to use ACE to show window "fit" for disturbance, but have been instructed not to use ACE to define a disturbance!
I still respectfully submit that ACE is the best objective indicator we have to define a disturbance, and reflects the BA's effect on the interconnection
- ARO 11/26/07

Discussion

The RS needs to determine if the PSRD is complete as written, consider Alan's comment, above, and determine who will continue the pursuit of excellence on this document.

Attachment

Performance Standards Reference Document, Revision November 26, 2007

Item 5. Active RS NERC-CERTS Applications

Discussion

Terry Bilke and Carlos Martinez will provide a status report, lead a discussion, and detail action items for the specific Project Review Teams on the following RS NERC-CERTS projects and applications. RS teams have been formed that are assigned to address the needs of the respective RS NERC-CERTS projects. The team leader is noted with each project.

Attachment

NERC-CERTS-RS Projects Summary Table

Item 5.a Resources Adequacy (ACE-Frequency) Application System — Carlos Martinez and Terry Bilke

Resources Adequacy (ACE-Frequency) Application Review Team: Leader — Terry Bilke, Raymond Vice, Sydney Niemeyer, Robert Rhodes, Bill Herbsleb, John Tolo, Bart McManus, Tom Vandervort

Carlos Martinez will status the project and Messrs Martinez and Bilke will answer any questions from the subcommittee.

Important RS Considerations: 1) Are there enhancements or modifications that the RS recommends to make the application more relevant to the RC or to enhance the data and displays to make the application more user-friendly; 2) How can the RS make required BA name or footprint changes?

The subcommittee members are urged to contact all Balancing Authorities in their respective regions to subscribe to the Resources Adequacy application and Intelligent Alarms.

Item 5.b Intelligent Alarms — Carlos Martinez and Terry Bilke

The NERC Intelligent Alarms (IAs) are now a two page alarm, distributed to subscribers via the e-mail/internet, that are initiated when specific thresholds are exceeded. Mr. Martinez and Mr. Bilke will report on the Intelligent Alarms.

Next Step: The Intelligent Alarms application has a large volume of Intelligent Alarms since the start of the IAs in January 2007. Some of the individual IAs may merit a deeper analysis than the normal IAs. The RS need to develop a manual or automated process to analysis or trend the data.

Important RS Considerations: 1) What is the next phase for analyzing the IA data? 2) How can the RS, Operating Reliability Subcommittee, Reliability Coordinator Working Group, Reliability Coordinators, and BAs further use the IAs' data.

Recommendations: The following string of e-mails are in response to consideration number one, above:

From Raymond Vice:
First of all, in the best of all possible worlds, the industry needs to:

1) Triage each Intelligent Alarm event to determine if A) immediate action is required to protect the reliability of the interconnection, B) short term follow-up investigation is required to determine the root cause of a single event before it re-occurs and endangers the reliability of the interconnection, C) long term follow-up investigation is required to determine the root cause of a series of events that may worsen to a point where they endanger the reliability of the interconnection, or D) modification of the Intelligent Alarm is required to eliminate events which do not endanger the reliability of the interconnection.

2) Archive the Intelligent Alarms and collect detailed interconnection frequency, generation trip and transmission outage information associated with each of them. Information from RCIS pertaining to the incidents should also be included as well as any other data which may aid in the investigation of events which can not be resolved by short term investigations.

3) Periodically review the Intelligent Alarms Archive using knowledgeable industry personnel equipped with sophisticated statistical tools in order to identify trend or patterns within the Intelligent Alarm events that may endanger the reliability of the interconnection or be utilized to improve existing tools and/or standards.

Of course, all this implies money, manpower and time. However, ideally, we should be able to use the Intelligent Alarms in a manner similar to how the FAA utilizes their reported "near miss" data. That is, they should allow us to identify where our weaknesses are and fix them before they lead to catastrophic failure.

From Terry Bilke:
Raymond has some good suggestions. As he noted, there'd be time and money involved. As a simple starting point could we not capture summary data such as the following?

Date	Time	Scheduled Frequency	Duration	Max/Min Frequency	Tie Dev 1 (MW)	BA1	Tie Dev 2 (MW)	BA2	Tie Dev 3 (MW)

Given a fairly simple table with several month's data, it would be fairly easy to see if there are trends or patterns. We could also spot outliers for further review.

I thought the latest release of the resource adequacy tool allowed us to get at some of this data, but I can't seem to find it now.

From Don Badley:
Does this suggest we look at each tie deviation?

From Terry Bilke:
My thought was to capture the "top 3" tie deviations for each event. From these it should be point out whether the top 3 were majority contributors or if it was a wider problem. We could also do some cross tabulation or correction of particular BAs and frequency of contribution, if contribution was only for certain types of events, etc..

From Don Badley:
--- By tie deviation, do you mean Net tie deviation, i.e., NIA-NIS? If not, I must be misssing something.

From Raymond Vice:
I assume that we are talking about the three interfaces that have the highest absolute net balances, |NIA - NIS|, for the time frame under consideration. This would be the same interfaces as we report for Inadvertent, but for some yet to be decided time frame (one minute averages?) and including only the "top three" interfaces, based on the absolute value of the net flow across the interface. Is that what you were thinking about, Terry?

I'm a little bit skeptical about what this would tell us, but am willing to discuss it further and see what we can come up with. If we can get 90% of the information for about 30% of the work I'm all for it.

From Terry Bilke:
Raymond, Yes, the net imbalance. Mike was suggesting different ways to identify contributors and patterns. If I'm not mistaken, the intelligent alarm has this data available in the report. Just looking for ways to deal with the date at hand. When presenting the results, we'd need to put things in context. It shouldn't be surprising the larger BAs would show up more often.

From Raymond Vice:
The Intelligent Alarms are much improved from where they started from, but the numerical listing of contributors seems to be based on the sum over the entire half hour period (I could be wrong about this, I've never checked in detail). It might be worthwhile to ask Carlos if he can either 1) break it down into ten minute segments like the AIE survey or 2) show just the period when the frequency was on the side that caused the alarm. For instance, one of the alarms Sunday (this weekend, anyway) showed PJM as 2nd largest contributor but then showed their sum (MWH?) on the wrong side of the axis.

Item 5.c AIE Monitoring Application — Carlos Martinez, Terry Bilke, and Don Badley

AIE Monitoring Application Review Team: Leader — Don Badley, Raymond Vice, Bart McManus, John Tolo, Terry Bilke, Don McInnis, Mike Potishnak, Tom Vandervort, and Brian Nolan

Messrs. Bilke, Badley, and Martinez will discuss AIE Monitoring Application field test, the next steps for full deployment, challenges and problems that have arisen, and the implementation plan.

Messrs. Martinez and Bilke will report on the results of the automated electronic AIE Survey utilizing the AIE Monitoring application in the Eastern Interconnection for the hours of May 12, 2007, HE 0200 CDT, May 12, 2007, HE 0600 CDT, and June 17, 2007, HE 0600 CDT

Important RS Considerations: 1) Evaluate the initial automated electronic AIE Survey accomplished using the AIE Monitoring application; 2) Establish process to address BA and AIE contact information addition, deletion, or change.

Item 5.d CPS1 and BAAL Monitoring Application — Carlos Martinez, Doug Hils, and Raymond Vice

CPS1 and BAAL Monitoring Application Review Team: Leader-Raymond Vice, Doug Hils, Mark Henry, Sydney Niemeyer, Don Badley, John Tolo, Bart McManus, and Tom Vandervort

The RS is sponsoring the CPS1 and BAAL Monitoring Project; however, the **Reliability-based Control SAR drafting team has the lead**. The application has been used extensively for the Balance Resources and Demand Standards Field Test and will require modification for a real-time production application when the standards are approved and implemented. Messrs. Hils, Vice, and Martinez will discuss the current status of this project, the transition from the field test tool to a production application, and the expectations for this application.

Important RS Considerations: 1) What are the Reliability-based Control SDT expectations for the CPS1 and BAAL Monitoring Application? 2) How can the RS assist the Reliability-based Control SDT achieve its expectations?

Item 5.e Frequency Monitoring and Analysis Application — Terry Bilke, Carlos Martinez, and Raymond Vice

Frequency Monitoring and Analysis (FMA) System Project Review Team: Leader — Raymond Vice, Frequency Task Force, Tom Vandervort

Messrs. Vice, Bilke, and Martinez will discuss the current status of this project and the actions necessary to move the project forward, the FMA field test progress, and the FMA application capabilities.

From the Operating Committee Subcommittee Organization and Procedures, approved by the Operating Committee (OC) on December 7–8, 2005:

Operating Committee Directive
Ref: OC Meeting Minutes, November 10–11, 2004
The following motions were approved by the Operating Committee on November 10-11, 2004:

1. The OC expects the Interconnections (Eastern, Western, ERCOT, and Hydro-Quebec) to analyze their frequency to determine if NERC's balancing standards are "safe and reliable."
2. The OC understands that the Interconnections' frequency profiles may be different.
3. The OC expects that these analyses be conducted according to a consistent set of analytical methodologies that the Resources Subcommittee establishes.
4. The OC expects the Interconnections to maintain this data and cooperate with the Resources Subcommittee's needs to perform its analyses. The RS members will agree upon a data retention requirement.

After further discussion, the OC approved the following motion:
"The Operating Committee's regional representatives, regional managers, and the Resources Subcommittee are directed to ensure that this resolution is implemented with consideration given to other wide-area data collection initiatives already underway."

Important RS Considerations: 1) Finalize actions to put the Frequency Monitoring and Analysis application into production; 2) Officially announce the Frequency Monitoring and Analysis Application with user instructions; 3) Establish process to address BA and AIE contact information addition, deletion, or change.

Item 5. f *Inadvertent Interchange Application — Carlos Martinez and Don Badley*

Inadvertent Interchange Application Review Team: Leader — Don Badley, Inadvertent Interchange Task Force, Robert Rhodes is the point of contact for SPP, Tom Vandervort

Messrs. Badley and Martinez will give a summary of the NERC Inadvertent Interchange application implementation progress.

Important RS Considerations: 1) Identify all Balancing Authorities that are not participating in the NERC Inadvertent Interchange application.

Item 5.g DOE North American Synchronous Phasor Initiative (NASPI) — Terry Bilke and Carlos Martinez

DOE Eastern Interconnection Review Team: Leader — Raymond Vice, Frequency Task Force, Tom Vandervort

Messrs. Bilke (who is also the NASPI Real-Time Tools Working Group Chairman), Martinez, and Cummings (if available) will lead a discussion on the DOE North American Synchronous Phasor Initiative (NASPI) latest developments, tools, and applications which contains significant grid monitoring and analysis capabilities.

Important RS Considerations: 1) What are the Department of Energy's expectations for the NASPI project? 2) How can the RS assist or play a part in the NASPI project? 3) How can the RS utilize the products generated by NASPI?

Information on the NASPI can be found at: http://phasors.pnl.gov/EIPP_About.html

Item 5.h Combination of Event Analysis Tools — Tom Vandervort

Whenever a frequency event occurs or a generation-load disturbance occurs, numerous tools can be used to identify the cause and reconstruct the event. The RS should review the available tools and how these tools can be combined or how they can compliment each other to build a comprehensive catalogue of event data.

These tools include:

- Resources Adequacy Application
- Intelligent Alarms
- Virginia Tech F-Net
- Reliability Coordinator Information System (RCIS)
- North American Synchronous Phasor Initiative (NASPI)
- NERC-CERTS Situational Awareness Software
- Frequency Monitoring and Analysis

The RS needs to review the event analysis tools available and determine if they can be comprehensively combined to build an event resource catalogue and if it is worth the effort.

Item 5.i WECC Interchange Tool (WIT) for Eastern Interconnection — Tom Vandervort

The Interchange Subcommittee (IS) is in the process of evaluating the merits of creating an organization and the software applications to create a Western Interconnection Interchange Tool (WIT) like system for the Eastern Interconnection.

Discussion
The RS should discuss and decide if it wants to join the IS in its efforts to evaluate a WIT-like organization and software applications for the Eastern Interconnection. If the RS decides to join in the IS effort it needs to convey its desire to the IS. If the RS has concerns or advice for the IS, secretary Vandervort will convey its concerns to the IS.

Item 6. Frequency and Control Performance

6.a.	**Western Interconnection Frequency Trends and Events — Bart McManus**
6.b.	**Eastern Interconnection Frequency Trends and Events — Raymond Vice**
6.c.	**ERCOT Interconnection Frequency Trends and Events — Sydney Niemeyer**
6.d.	**Hydro Quebec Interconnection Frequency Trends and Events — Mike Potishnak**
6.e.	**CPS1, CPS2, and BAAL Data Trends — Terry Bilke**
6.f.	**DCS Data Trends — Terry Bilke**
6.g.	**Inadvertent Interchange Balances — Don Badley and Bill Herbsleb**

Discussion

The subcommittee will discuss the control performance, inadvertent interchange, frequency data, surveys, and trends in the Interconnections.

The NERC Compliance Group has determined that the NERC reliability standards control performance data used to evaluate acceptable performance versus compliance violations is confidential. NERC's legal consul is evaluating the compliance stance and was requested to determine what must be done for the RS to review, monitor, and trend the control performance data.

Attachments

To be sent under separate cover.

Item 6.h Determining Frequency Events to Analyze in 2008 — Raymond Vice

In order to determine what is the significant generation-load MW loss that can be used on an on-going basis to determine a realistic frequency event — frequency response, Raymond Vice developed a calculation procedure. Mr. Vice's e-mail and his procedure are below.

Raymond Vice's e-mail with his calculation:

We recently went through an exercise to calculate our BA Frequency Response (prior to a Readiness Audit this fall) and found out that small events, say less than 800 MW, tended to yield results that were both unrepeatable and unbelievable. I wrote this short procedure for selecting events in the hope that it will yield consistent, accurate results. Take a look at it and let me know if you think it is valid. If so, we may want to share it.

Mr. Vice's BA Frequency Response Characteristics Data Selection Criteria Procedure:

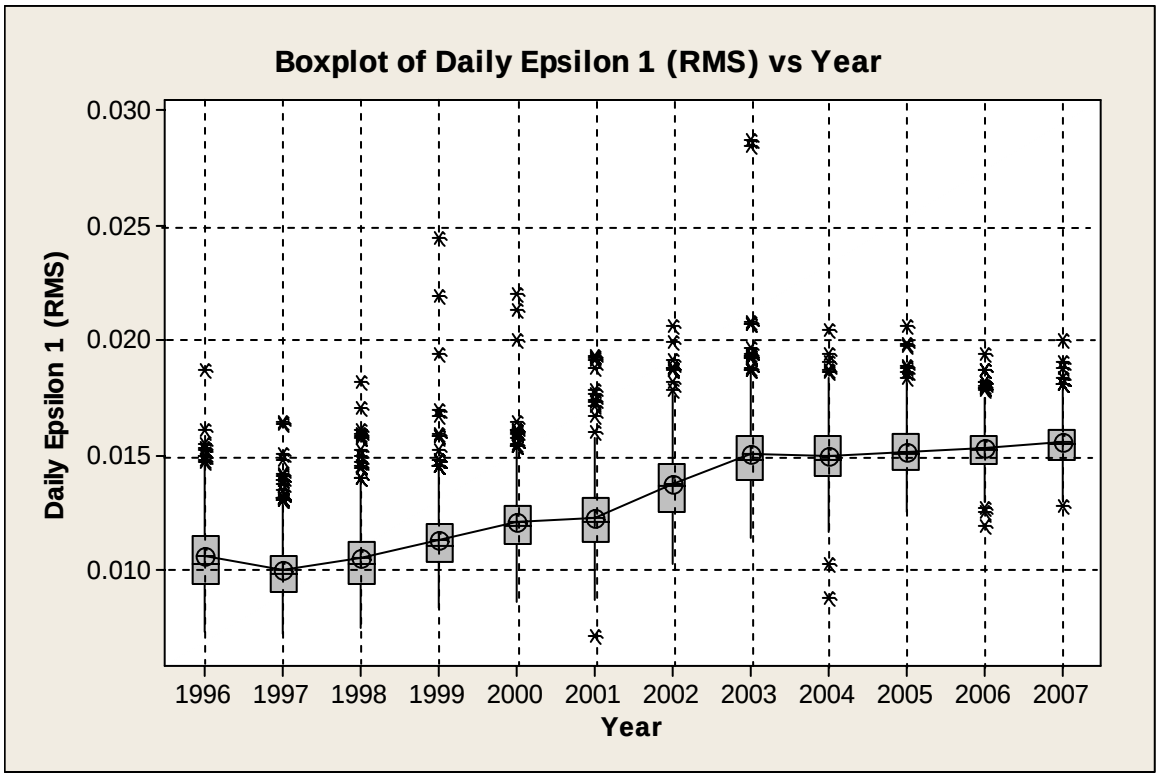

Figure 1 – RMS variation of one minute average frequency error calculated on a daily basis for 1996 through September 2007

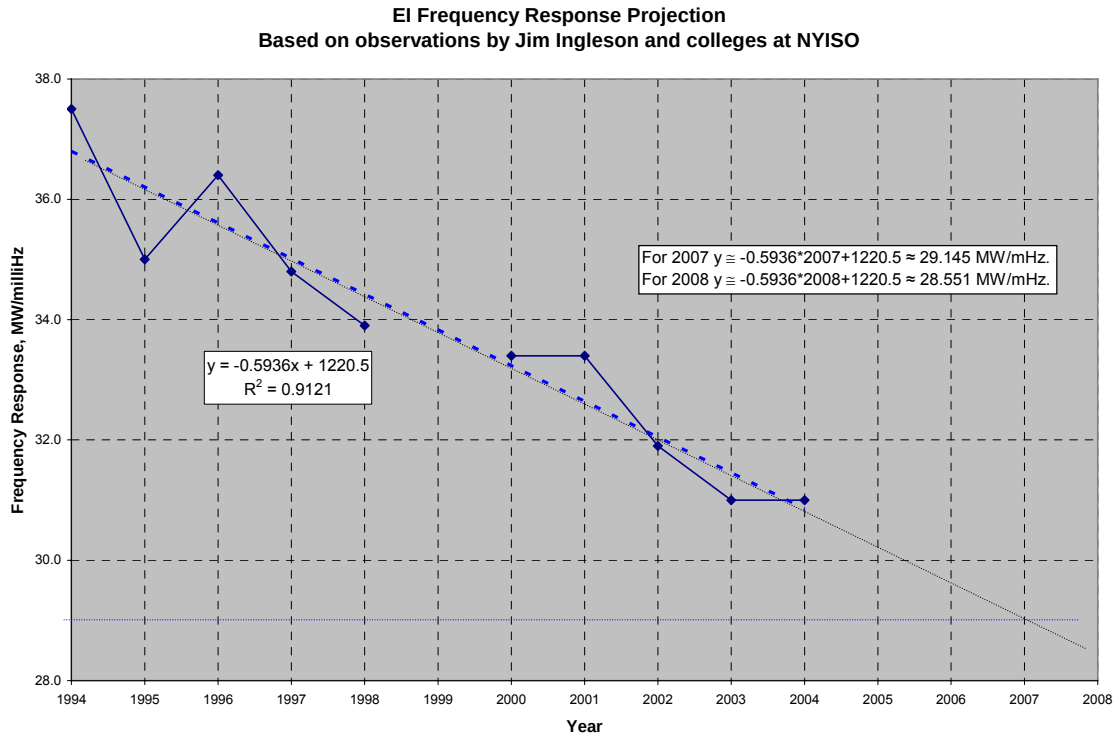

Figure 2 – Projection of Eastern Interconnection average frequency response based on observations by Jim Ingleson and colleges from 1994 through 2004

Noise :

In order to accurately estimate the frequency response of the Southern Balancing Authority it is necessary to accurately detect and estimate the A (initial) and B (final) values of frequency following a generation contingency on the interconnection. This is only possible when the magnitude (change in frequency) of the contingency event is greater than the "noise" of the frequency signal itself.

In general terms, the greater the signal strength to the noise strength the higher the probability that a sampled estimate of the signal can be detected and accurately estimated. Practically speaking, it is difficult to accurately detect and estimate the A (initial) and B (final) values of frequency unless the magnitude of the frequency change is roughly two times the RMS frequency "noise" on the interconnection (3 dB on a signal magnitude basis). From Figure 1 above we observe that the 2007 RMS Epsilon 1 (an estimate of total frequency "noise" or random variation on the interconnection) is roughly 15.5 milliHertz with a standard deviation (as indicated by the "box" of roughly 0.5 milliHertz. Thus, in order to get an accurate estimate of points A and B, we would like the total frequency change (A – B) to be at least 31 milliHertz.

From Figure 2 we see that the projected Frequency Response of the Eastern Interconnection in 2007 is 29.145 MW/milliHertz (2,914.5 MW/0.1 Hz. as usually utilized in NERC calculations). In order to achieve a 31 milliHertz (0.031 Hz.) change in frequency between points A and B then we must have a generator output loss of roughly 903 MW

Deadband :

Another factor further complicates the calculation of Frequency Response for a given Balancing Authority – the Turbine Governor Deadband. Turbine Governors respond inversely (in the opposite direction) to changes in frequency in order to arrest frequency changes and stabilize interconnection frequency following a disturbance. Turbine Governor performance is generally described by two operational characteristics – Droop and Deadband. Droop is a measure of how the governor responds to frequency changes. Theoretically, a turbine with a 5% droop opens its valves 100% for a 5% change in frequency (3 Hz. on a 60 Hz. system). Deadband is a measure of how much the frequency has to move from setpoint before the governor responds to the change. Work done on EPRI Project RP2473-53 in published in April of 1992 indicated that the average turbine governor deadband was approximately 36 milliHertz. This value was adopted by the NERC Operating Committee as a non-binding guide prior to the adoption of mandatory standards.

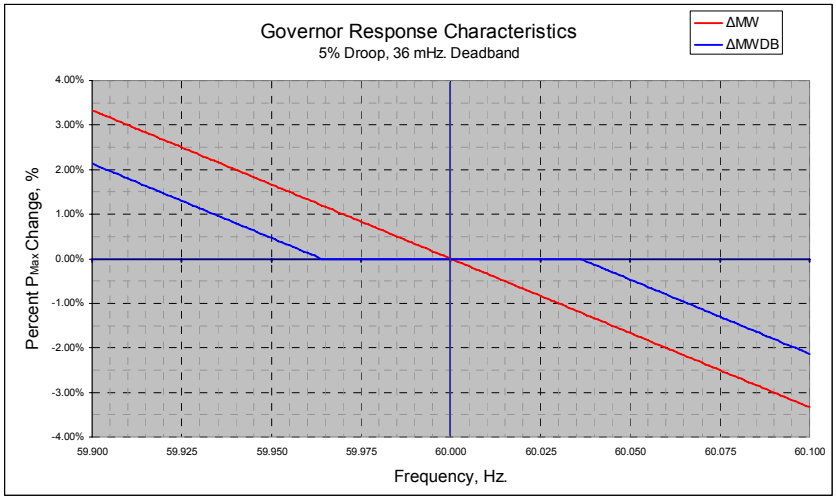

Figure 3 – 5% Droop Curve with and with out 36 mHz. Deadband.

As can be seen in Figure 3, a disturbance that does not generate a frequency excursion which exceeds the boundaries of the turbine governor deadband will not produce classical governor response. This, along with the noise mentioned above, can make it exceedingly difficult to determine specifically where the A (initial) and B (final) frequency values are for any given frequency excursion. Note that a 36 mHz. frequency swing roughly corresponds to the loss of a 1,049 MW generating unit.

Recommendations :

Disturbances selected for analysis in determining Balancing Authority Frequency Response Characteristics should 1) be large enough to clearly exceed the noise threshold of the interconnection (> 31 mHz frequency swing) and 2) should produce frequency excursions outside the turbine governor deadband (either by exceeding 36 mHz. or by occurring when interconnection frequency permits a 31 mHz frequency swing to exceed the turbine governor deadband). Both conditions must be met to ensure reasonable data for calculation of the Balancing Authority Frequency Response Characteristics.

R. L. Vice
11-1-07

Item 6.i Over-generation — Raymond Vice

Every BA tries to balance its generation and load (Area Control Error = zero). Raymond Vice has calculated that in 2007, the Eastern Interconnection over-generated by more than 904,000 MWH. Mr. Vice also asks two questions in association with his analysis.

Raymond Vice's e-mail on January 4, 2008:

If my math is anywhere near correct (see attached spreadsheet) the Eastern Interconnection over generated by more than 904,000 MWH in 2007 at an estimated cost of roughly $22.6 million dollars. As best I can determine, this is a completely unnecessary waste of resources. There appear to be two question that we need to address. Number 1) does this frequency performance represent a credible reliability issue, either short term or long term? If it is, of course, it should be corrected. This is currently being addressed by the FRS SDT and others. Number 2) will control improvements and increased unit maneuvering required to improve AGC performance and frequency control cost more than the potential savings? If there is no credible reliability issue, then it becomes a commercial issue and should be addressed by NAESB or the individual entities involved. Anyway, some food for thought.

Discussion

The RS needs to determine if there is significant reliability concern to address the reliability versus commercial practices involved with over-generation. Then the subcommittee needs to determine if there is anything that can be done to address the over-generation in a realistic manner.

Item 6.j AIE Survey — Terry Bilke, Don Badley, Raymond Vice, and Carlos Martinez

NERC authorized the BAs in North America to enter its AIE survey data into an automated electronic AIE Data Entry Web Site. Terry Bilke, RS Chair, requested AIE Surveys for the Eastern Interconnection for the following hours:

Date	Hour Ending (CDT)	Frequency Error
5/12/2007	0200	+0.030 Hz
5/12/2007	0600	+0.033 Hz
6/17/2007	0600	+0.030 Hz

Messrs. Bilke, Badley, Vice, and Martinez will report on the initial automated electronic AIE Survey process. These gentlemen will also report on the results of the AIE survey for the dates and hours listed above.

Item 6.k August 4, Frequency Event, Risk Analysis — Don McInnis

The RS is concerned with frequency events in the Eastern Interconnection. As a result of the August 4, 2007 frequency event, and the RS analysis, Terry Bilke asked Don McInnis to evaluate the event from a risk analysis point of view.

Risk

Don McInnis, can you provide the conditions (different load level, additional contingency, continued trend of decline in response assuming 50MW/01Hz per year decline) that could have caused first set of UFLS in Florida to trigger? Please be sure you are using same assumptions on governor and load response as Sydney. Also use estimate of load level provided by NERC.

Mr. McInnis will share his analysis with the subcommittee on how close the Eastern Interconnection was to the under-frequency load shed limits in Florida.

Item 7. Time Error

Item 7.a **Eastern Interconnection — Bill Herbsleb**
Item 7.b **Western Interconnection — John Tolo**
Item 7.c **ERCOT Interconnection — Sydney Niemeyer**
Item 7.d **Hydro Quebec Interconnection — Mike Potishnak**

The Discussion

The subcommittee will discuss the time error correction data and trends in the interconnections.

Attachments

Time error reports to be sent under separate cover.

Item 8. NERC Operating Committee Directives to the Resources Subcommittee

Item 8.a Reliability Concepts Document — Terry Bilke

NERC OC Chair, Gayle Mayo, asked the RS to write a comprehensive chapter on load-generation balancing. With this in mind, chair Bilke asks RS members to look at their archives and dig out those documents that should be part of the story the RS wants to tell.

Assignment

The RS are directed by the OC to write a Reliability Concepts Document chapter on balancing load and generation. The chapter must state what must be done to ensure balance.

Item 8.b Time Error Monitor Procedures — Terry Bilke

The NERC OC directed the RS to work with the Reliability Coordinator Work Group (RCWG)to develop a short procedure for Time Monitors. Recommended topics for the procedure include:

1. The monitor's duties
2. Requirements for serving as an interconnection time monitor
3. The procedure for the OC's selection
4. Time correction procedures (including references to NAESB business practice standards for time error correction)

Assignment

The RS and the RCWG will develop an OC procedure for selecting and monitoring time monitors.

Attachment

Background on Time Error Procedures

Item 8.c Integration of Renewable Generation (wind and solar) — Terry Bilke

The NERC OC and the NERC Planning Committee (PC) will form a joint task force to study and recommend actions for reliably integrating variable generation into the interconnection. The OC prefers to limit the scope of the task force to wind generation.

If any subcommittee member is interested in working with the OC-PC Integration of Renewable Generation Task Force, inform secretary Vandervort.

Item 9. Future Meetings

The October 2008 RS Meeting conflicts with the WECC OC Meeting and the RS Meeting dates were requested to be rescheduled. The subcommittee will survey its members to determine how the October 2008 RS Meeting will impact the other members if it is reschedule.

The RS will also choose January 2009 and April 2009 meeting locations.

Wednesday, April 30, 2008 Thursday, May 1, 2008	8 a.m.–5 p.m. 8 a.m.–noon	Washington D.C.
Wednesday, July 30, 2008 Thursday, July 31, 2008	8 a.m.–5 p.m. 8 a.m.–noon	Victoria, BC Alt: Minneapolis
Wednesday, October 29, 2008 Thursday, October 30, 2008	8 a.m.–5 p.m. 8 a.m.–noon	San Antonio Alt: Albuquerque
Wednesday, January 28, 2009 Thursday, January 29, 2009	8 a.m.–5 p.m. 8 a.m.–noon	New Orleans, San Diego, or Ft. Lauderdale
Wednesday, April 30, 2009 Thursday, May 1, 2009	8 a.m.–5 p.m. 8 a.m.–noon	To Be Determined
Wednesday, July 30, 2009 Thursday, July 31, 2009	8 a.m.–5 p.m. 8 a.m.–noon	To Be Determined
Wednesday, October 29, 2009 Thursday, October 30, 2009	8 a.m.–5 p.m. 8 a.m.–noon	To Be Determined

Notes:

1. Schedule meetings before the OC and PC Meetings, whenever possible.
2. Avoid scheduling meetings 30 days before NERC Board of Trustees meetings.
3. Additional meetings, conference calls, or web casts will be scheduled as deemed necessary to address and accomplish subcommittee or task force business.
4. The subcommittee will conduct future meetings only as necessary: 1) to facilitate necessary face-to-face discussions; 2) to focus on deliverables that cannot be achieved by conference calls or web casts; and 3) to initiate consensus building or decision-making forums.

NERC Resources Subcommittee
Organization and Assignments

Terry Bilke (Chairman) Midwest ISO	Donald E. Badley **(Vice Chairman)** WECC/Northwest Power Pool	Larry Akens Tennessee Valley Authority
Gerald D. Beckerle Ameren Services Company	William Herbsleb PJM Interconnection, L.L.C.	Don McInnis Florida Power & Light Company
Bart McManus Bonneville Power Administration	Sydney L. Niemeyer NRG Texas, LP	Alan R. Oneal MidAmerican Energy Company/MRO
Michael J. Potishnak ISO-New England	Robert C. Rhodes, Jr. Southwest Power Pool	John Swez Duke Energy
John Tolo Tucson Electric Power Company	Raymond L. Vice Southern Company Services, Inc.	Thomas J. Vandervort NERC

Inadvertent Work Group **Don Badley** Mike Potishnak Terry Bilke Larry Akens Bart McManus **Bill Herbsleb**	**Frequency** Work Group **Raymond Vice** Sydney Niemeyer Mike Potishnak Terry Bilke Gerry Beckerle Don Badley Bart McManus John Swez Bill Herbsleb	**Reserves Work Group** **Larry Akens** Alan Oneal Don Badley Raymond Vice Mike Potishnak Sydney Niemeyer Robert Rhodes Bart McManus John Tolo John Swez
	Control Criteria Work Group **Alan Oneal** Resources Subcommittee	

Survey Assignments

Area Interchange Error Surveys (East)	Terry Bilke
Frequency Response Surveys	Raymond Vice
Inadvertent Interchange Reports (East)	Chris Scheetz
Inadvertent Interchange Reports (West)	Don Badley
Time Error Reports (East)	Bill Herbsleb
Time Error Reports (West)	John Tolo
ERCOT Reports	Sydney Niemeyer

May 2006

Resources Subcommittee

Chairman	Terry Bilke Technical Director	Midwest ISO, Inc. 701 City Center Drive Carmel, Indiana 46032	(317) 249-5463 (317) 249-5910 Fx tbilke@ midwestiso.org
Vice Chairman & WECC	Donald E. Badley System Operations Manager	Northwest Power Pool 7505 N.E. Ambassador Place Suite R Portland, Oregon 97220	(503) 445-1076 (503) 445-1070 Fx don@nwpp.org
ERCOT	Sydney L. Niemeyer Control System Specialist	NRG Texas, LP 1301 McKinney Suite 2300 Houston, Texas 77010	(713) 795-6108 (713) 795-7488 Fx Sydney.niemeyer@ nrgenergy.com
FRCC	Don McInnis Manager, Operations Engineering	Florida Power & Light Co. P.O. Box 029311 Miami, Florida 33102-9311	(305) 442-5272 don_mcinnis@ fpl.com
MRO	Alan R. Oneal Manager, IT Operations Applications	MidAmerican Energy Co. 4299 N.W. Urbandale Drive Urbandale, Iowa 50322	(515) 252-6449 aroneal@ midamerican.com
NPCC	Michael J. Potishnak Principal Engineer	ISO New England, Inc. One Sullivan Road Holyoke, Massachusetts 01040-2841	(413) 535-4308 (413) 535-4343 Fx mpotishnak@ iso-ne.com
RFC	William Herbsleb Senior Engineer	PJM Interconnection, L.L.C. 955 Jefferson Avenue Valley Forge Corporate Center Norristown, Pennsylvania 19403	(610) 666-8874 (610) 666-2279 Fx herbslhw@pjm.com
RFC	John Swez Manager, Bulk Power Marketing	Duke Energy 419 East Fourth Street, EA606 Cincinnati, Ohio 45202	(513) 419-5332 john.swez@ duke-energy.com
SERC	Larry G. Akens Compliance and System Analysis	Tennessee Valley Authority 1101 Market Street MRBK Chattanooga, Tennessee 37402	(423) 751-8860 lgakens@tva.gov
SPP	Robert C. Rhodes, Jr. Manager, Reliability Coordination	Southwest Power Pool 415 North McKinley Suite 140 Little Rock, Arkansas 72205-3020	(501) 614-3241 (501) 664-9553 Fx rrhodes@spp.org
	Gerald D. Beckerle Senior Transmission Operations Supervisor	Ameren Corp. 1901 Chouteau Avenue St. Louis, Missouri 63103	(314) 554-6413 gbeckerle@ ameren.com
	Bart McManus Electrical Engineer	Bonneville Power Administration 5411 NE Highway 99 PO Box 491 Vancouver, Washington 98666	(360) 418-2309 bamcmanus@ bpa.gov

	John Tolo Superintendent, Control Area Operations	Tucson Electric Power Co. 3950 East Irvington Road Tucson, Arizona 85714	(520) 745-7106 (520) 571-4032 Fx jtolo@tep.com
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NERC Resources Subcommittee
Survey Contacts

Type:	Date:	Time:	Survey Called:	Due By:
CONTACT	**REGION**	**PHONE**	**CALL**	**REC.**
Paul Kure Bill Herbsleb*	RFC	(330) 580-8006 (610) 666-8874		
Sydney Niemeyer Lane Robinson*	ERCOT	(713) 795-6108 (512) 225-7211		
Don McInnis* Gary Falasca (Inad.) Donna Howard (CPS & AIE)	FRCC	(305) 442-5272 (305) 529-6115 (813) 289-5644		
Alan Oneal* Peter A. Koegel	MRO	(515) 252-6449 (651) 632-8462		
Mike Potishnak*	NPCC	(413) 535-4308		
Larry Akens Teresa Glaze Catherine Sills	SERC	(423) 751-8860 (205) 257-6361 (423) 843-1562		
Larry Akens	TVA SERC	(423) 751-8860		
Robert Rhodes Lisa Carter Katy Onnen	SPP	(501) 614-3241 (501) 614-3346 (501) 614-3353		
Esperanza Cabeza de Vaca (CPS)	WECC	(801) 582-0353		
John Tolo*	WECC/AZNMSNV	(520) 745-7106		
Dan Tahija* John Chairez Bill Green	WECC/CAMX	(916) 351-2115 (916) 608-5775 (916) 351-2116		
Don Badley ChaRee DiFabio*	WECC/NWPP	(503) 445-1076 (503) 445-1079		
Robert Johnson	WECC/RMPP	(303) 273-4893		
Carlos Martinez	CERTS	(626) 685-2015		
TIME CORRECTIONS: System Coordinator-MAPP Art Storey-NYPP		 (612) 341-4690 (518) 356-6111		

*Primary Contact

January 2007

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Resources Subcommittee
October 23-24, 2007 Meeting
Open Action Item List

Action Figure	Subject	Action Item/Assignment	Due Date	Completion Date
Terry Bilke and Resources Subcommittee	Frequency Profile Technical Paper	021006, The Resources Subcommittee will document in a technical paper: • The recent and historical frequency trends • The root causes behind significant frequency excursions and identifiable frequency fluctuations • The reliability implications behind the frequency events • The state of the interconnection's frequency profiles • Make recommendations to capture, identify, and record the magnitude of frequency excursions for each frequency event 050406, RS will break up the technical paper into different components. • Terry will work on the frequency component of the paper. • Raymond to look at Combustion Turbines and Governor Response • Larry to generate an "Operating Reserves" white paper including definitions 102307, In progress	102307	
Terry Bilke and Resources Subcommittee	Revise BAL-001	071907, The Balancing Authorities Control SAR will revise BAL-002, 004, 005, 006 but are not tasked to revise BAL-001 or 003. This action item is intended to promote a revision of BAL-001 with the drafting of a SAR. 102307, Will the Reliability-based Control SDT recommend deleting BAL-001 and 003 when the RBC standards are balloted and approved? If so, can this item be closed?	102307	

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Action Figure	Subject	Action Item/Assignment	Due Date	Completion Date
Terry Bilke and Resources Subcommittee	Revise BAL-003	071907, The Balancing Authorities Control SAR will revise BAL-002, 004, 005, 006 but are not tasked to revise BAL-001 or 003. This action item is intended to promote a revision of BAL-003 with the drafting of a SAR. 102307, Will the Reliability-based Control SDT recommend deleting BAL-001 and 003 when the RBC standards are balloted and approved? If so, can this item be closed?	102307	
Don Badley	NERC Tools / Software Applications	071907, Don to write a letter to the NERC Senior Management requesting that NERC continue to support (both philosophically and financially) the RS-sponsored reliability tools / software applications. 072307, Draft letter written and circulating the RS for enhancements. 091207, Don Badley made a presentation to the NERC OC requesting endorsement of the RS projects and support to continue funding all of the software applications. Don can this item be closed or is there follow-up?	102307	
Don Badley and Sydney Niemeyer	Urgent Action SAR for BAL-002, Fixed - Variable Bias	071907, Don Badley volunteered to work with Sydney Niemeyer to revise BAL-002 requirements regarding fixed and variable bias. The language in BAL-002 is not optimal for ERCOT to operate their interconnection. 102307, Don and Sydney, are there plans to move forward with an Urgent Action SAR? Will the Balancing Authority Control SAR address the fixed and variable bias concerns? What needs to be done to close out this action item?	102307	
Don Badley	Review Freq Monitoring Guide (Triggers and Actions Guide)	072905, RS reviewed and revised the RS Frequency Monitoring and Response Process (Triggers and Action Guide) for the Western Interconnection. 092106, Don presented it to WECC and it will be addressed by the WECC Performance Criteria WG. 020107, In progress. – Don Badley, the initial draft is with the WECC CMOPS and WECC RCs for comment. It lies with the WECC OC for direction. In progress. 102307, Waiting to hear how WECC CMOPS received and acted upon the draft.	102307	
Don Badley and Inadvertent Interchange Task Force	II Balances	042507, Don and the Inadvertent Interchange Task Force needs to work with Joe Emde/Chris Scheetz to address and resolve the inadvertent interchange data discrepencies for 2006. Some BAs are stating that their balances do not match the SPP II tool. 102307, Bill Herbsleb is working with Don Badley and Carlos Martinez to resolve the concerns associated with the Inadvertent Interchange application. What else needs to be done to balance the NERC Inadvertent Interchange application accounts?	102307	
Joe Emde /	Inadvertent	050406, Joe Emde/Chris Scheetz, Verify if the Inadvertent Interchange Report is	102307	

Action Figure	Subject	Action Item/Assignment	Due Date	Completion Date
Chris Scheetz	Interchange Report Accuracy	accurate? Check on inadvertent interchange report to determine why it is not up-to-date. Don Badley says the WECC is balanced through Feb, 2006. The report shows it is balanced through Nov, 2005. 102307, In Progress. Joe Emde/Chris Scheetz, Inadvertent Interchange accuracy has been a struggle since the inception of RFC. Joe/Chris will continue to acquire the correct data and will sort it all out with the help of Don Badley, Bill Herbsleb, and the IITF.		
Alan Oneal	Rewrite Performance Standards Reference Document	020107, Alan to lead the Control Criteria Task Force to: 1) incorporate the recommended edits into the PSRD; 2) distribute the PSRD to the subcommittee; 3) create individual documents for each performance measure contained within the Performance Standard Reference Document; and 4) develop with Raymond Vice a Balancing Authority ACE Limit (BAAL) reference document. 042507, In Progress, but waiting on BRD Standards, and BAL-002, 004, 005, 006 Standards Revision SAR to determine future direction. 052507, Terry sent the rewritten Performance Standards Reference Document to the Standards Committee to determine where the reference document should reside. 072307, After a good discussion on the DCS issues (i.e. “sudden” loss of power; if a BA addresses an event on its own should it use its own criteria or the RSG’s criteria for “80% of its single largest contingency) during the July, 2007 RS meeting, Alan and the CCTF is drafting the next PSRD revision. 102307, The RS is awaiting Terry’s response from the Standards Committee on what to do with the PSRD.	102307	
	NERC-CERTS Project Review			
Terry Bilke	ACE-Frequency Application Review Team	021007, ACE-Frequency Application (NERC Project 2000-03) – A small Resources Subcommittee team will review the issues and address the project parameters. The goal is to recommend expectations, priorities, uses, methodologies, specifications, timelines, and results. Collaboration with ORS, RCWG, NERC Projects, NERC Training Dept, NERC IT, etc. to be initiated as necessary. Project Review Team: Leader-Terry Bilke, Raymond Vice, Sydney Niemeyer, Robert Rhodes, Bill Herbsleb, John Tolo, Bart McManus, Tom Vandervort Group recommendations are to be shared with RS, CERTS and NERC Projects. RS to review the data quality reports – are they appropriate or do they need to be	102307	

Action Figure	Subject	Action Item/Assignment	Due Date	Completion Date
		modified. RS recommends setting the frequency response at 3,000 MW/0.1 Hz 102307, Team available for consultation or action		
Terry Bilke	Develop ACE-Frequency Application Training Documents	021007, ACE-Frequency Application (NERC Project 2000-03) – A small Resources Subcommittee team will review the issues and address the project parameters. The goal is to recommend training lessons content, on-line help application, user friendly training tools. Collaboration with ORS, RCWG, NERC Projects, NERC Training Dept, etc. to be initiated as necessary. Project Review Team: Leader-Terry Bilke, Robert Rhodes, Tom Vandervort Group recommendations are to be shared with RS, CERTS, and NERC Projects. Training – 3.5 there are a lot of functions that are not easily to know what to do. RCs want additional face-to-face (on-site) training. • Training sites include NE, SE, and one in the west; • another option is to "train the trainer;" • another option is to have a WebEx session. 102307, Team available for consultation or action	102307	
Don Badley	AIE Monitoring Application Review	021007, AIE Monitoring Application (NERC Project 2000-04) – A small Resources Subcommittee team will review the issues and address the project parameters. The goal is to recommend expectations, priorities, uses, methodologies, specifications, timelines, and results. Collaboration with ORS, RCWG, NERC Projects, NERC Training Dept, NERC IT, etc. to be initiated as necessary. Project Review Team: Leader-Don Badley, Raymond Vice, Bart McManus, John Tolo, Terry Bilke, Don McInnis, Mike Potishnak, Tom Vandervort, Brian Nolan Group recommendations are to be shared with RS, CERTS, and NERC Projects. The following individuals signed the WECC confidentiality agreement and were approved to receive WECC data to support the AIE Monitoring Application development: Don Badley, Team Leader Raymond Vice Bart McManus John Tolo Terry Bilke Don McInnis Mike Potishnak	102307	

Action Figure	Subject	Action Item/Assignment	Due Date	Completion Date
		Tom Vandervort Brian Nolan 102307, Team available for consultation or action		
Don Badley	Inadvertent Interchange Application Review	021007, Inadvertent Interchange Application (NERC Project 2001-37) – A small Resources Subcommittee team will review the issues and address the project parameters. The goal is to recommend expectations, priorities, uses, methodologies, specifications, timelines, and results. Collaboration with ORS, RCWG, NERC Projects, NERC Training Dept, NERC IT, etc. to be initiated as necessary. Project Review Team: Leader-Don Badley, Inadvertent Task Force, someone from Southwest Power Pool (Robert Rhodes will be the point of contact to identify who this person will be), Tom Vandervort Group recommendations are to be shared with RS, CERTS, and NERC Projects. In progress**.** Don will recommend additional monthly interconnection inadvertent interchange reporting to Carlos TV to work with Joe Emde to generate monthly inadvertent interchange accounting reports. 102307, Team available for consultation or action	102307	
Raymond Vice	CPS1 & BAAL Monitoring Application Review	021007, CPS1 & BAAL Monitoring Application (NERC Project 2001-38) – A small Resources Subcommittee team will review the issues and address the project parameters. The goal is to recommend expectations, priorities, uses, methodologies, specifications, timelines, and results. Collaboration with ORS, RCWG, NERC Projects, NERC Training Dept, NERC IT, etc. to be initiated as necessary. Project Review Team: Leader-Raymond Vice, Doug Hils, Mark Henry, Sydney Niemeyer, Don Badley, John Tolo, Bart McManus, Tom Vandervort Group recommendations are to be shared with RS, CERTS, and NERC Projects. 102307, Team available for consultation or action	102307	
Raymond Vice	Frequency Monitoring and Analysis (FMA) System Project Review	021007, Frequency Monitoring and Analysis (FMA) System Project (NERC Project 2005-06) – A small Resources Subcommittee team will review the issues and address the project parameters. The goal is to recommend expectations, priorities, uses, methodologies, specifications, timelines, and results. Collaboration with ORS, RCWG, NERC Projects, NERC Training Dept, NERC IT, etc. to be initiated as necessary. Project Review Team: Leader-Raymond Vice, Frequency Task Force, Tom	102307	

Action Figure	Subject	Action Item/Assignment	Due Date	Completion Date
		Vandervort Group recommendations are to be shared with RS, CERTS, and NERC Projects. 102307, Team available for consultation or action		
Raymond Vice	Eastern Interconnection Phasor Project	021007, ACE-Frequency Application (NERC Project 2000-03) – A small Resources Subcommittee team will review the issues and address the project parameters. The goal is to recommend expectations, priorities, uses, methodologies, specifications, timelines, and results. Collaboration with ORS, RCWG, NERC Projects, NERC Training Dept, NERC IT, etc. to be initiated as necessary. Project Review Team: Leader-Raymond Vice, Frequency Task Force, Tom Vandervort Group recommendations are to be shared with RS, CERTS, and NERC Projects. RS recommends continuing to use the FDCAS specs to acquire the frequency data from the EIPP frequency database. 102307, Team available for consultation or action	102307	
Brian Nolan	Incorporate ERCOT into ACE-Freq App	092106, Brian Nolan to incorporate the necessary technology to allow ERCOT to send data to the ACE-Frequency monitoring application. Brian will report the progress of this activity to the RS at the January, 2007 meeting. 102307, Brian Nolan – In progress.	102307	

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Resources Subcommittee (RS)

Objective
To be a NERC technical resource to support resolution of balancing resources and demand issues and interconnection frequency related issues.

Scope
The Resources Subcommittee (RS) accomplishes this objective by:

- Reviewing and assisting in the development of new generation and load "balancing" standards. Develop any necessary reference documents.
- Reviewing and assisting in the development of new interconnection frequency related standards. Develop any necessary reference documents.
- Providing oversight and guidance to Working Groups and Task Forces.
- Providing industry leadership and guidance on matters relating to balancing resources and demand issues and interconnection frequency related issues.
- Addressing the reliability aspects of inadvertent interchange creation, accounting and payback.
- Review balancing authorities' control performance on periodic basis.
- Address technical issues on Automatic Generation Control (AGC), Time Error Correction, Operating Reserves, and Frequency Response

Reliability Standard Expertise
The RS is comprised of members with industry experience and knowledge relating to the NERC "BAL" Resources and Demand Balancing Reliability Standards and other applicable standards.

Reporting
The RS reports to the NERC Operating Committee (OC) and shall maintain communications with other groups as necessary on balancing resources and demand issues and interconnection frequency related issues.

Membership

General Requirements
RS membership requirements are focused on *expertise* and allow the subcommittee the flexibility it needs to ensure it has this expertise.

Expertise
The RS must have sufficient expertise within its ranks to fully understand the BAL and other applicable standards.

Commitment and participation
RS members must be *committed* to their service on the subcommittee. This means preparing for and actively *participating* in all subcommittee meetings in person or on conference calls. It also means writing and reviewing draft reports, serving on SAR and standards drafting teams if selected, and bringing issues to their Regional Councils, trade organizations, and utilities for further discussion and insight.

Replacing members
The subcommittee may request a replacement for its member that misses three consecutive meetings without sending a proxy.

Required membership
NERC OC Standing Committee require each subcommittee to include, as a minimum, the following voting representation:

Voting Members — Required

1. **Regional representatives.** Each regional reliability council will provide at least one member. The regions will select their representatives based on their expertise in the RS's subject matter.

2. **Interconnections and countries.** If the set of regional representatives does not provide for at least one representative from each Interconnection and two representatives from the U.S. and Canada, the subcommittee chairman, working with the NERC staff, will ask for *additional members* from the regional reliability councils or trade organizations as necessary to fulfill these requirements.

Voting Members — Additional

3. **Additional invited members.** The RS will request additional members as needed for their particular expertise. The subcommittee officers will seek recommendations from trade organizations, regional councils, and individual organizations.

Non-voting members — Guests and observers
RS meetings are open to others who wish to attend as a guest of the subcommittee. The chairman will provide guests and observers the opportunity to contribute to the subcommittee's discussions, provided the subcommittee's voting members have sufficient time to:

1. Complete the debate of their motions, and
2. Complete the meeting agenda.

Officers
The NERC OC chairman appoints the RS officers (the chair and vice chair) for a specific term (generally two years). The subcommittee officers may be reappointed for additional terms. The RS officers are considered members of the subcommittee and may vote.

Meeting Procedures

General
The RS follows the meeting procedures explained in the following two documents:

1. The latest edition of the Organization and Procedures Manual for NERC Standing Committees, and
2. *Robert's Rules of Order, Newly Revised*.

Quorum
A quorum for conducting business is 50% of the RS members listed on the current subcommittee roster. If a quorum is not present, then the subcommittee may not take any actions requiring a vote of the subcommittee. However, the chair may, with the consent of the members present, allow discussion of agenda items.

Minority Opinions and Personal Comments

The minutes of every RS meeting will include exhibits for minority opinions and personal comments. The chair shall communicate both the majority and any minority views when presenting subcommittee discussion results with the OC.

Subgroups

The RS may, from time to time, form task forces and working groups as necessary, without OC approval. The subcommittee must review the progress of its subgroups at least annually and decide to either continue or disband these groups as needed.

Typically task forces are usually ad-hoc and are not expected to exist after completing their assignments. Conversely, working groups may be on-going.

Task force and working group chairs (or delegates) are expected to attend the regular subcommittee meetings to report on assignments.

Control Criteria Work Group

The Control Criteria Work Group reviews the BAL standards control performance criteria and assists the balancing authorities and the industry with supporting documentation to better understand the technical aspects of the standards.

Frequency Work Group

The Frequency Work Group has a focus on the Interconnections' frequency issues and related concerns. The work group will perform analysis of frequency trends, events and on-going conditions as it deems necessary or as requested.

Inadvertent Interchange Work Group

The Inadvertent Interchange Work Group addresses the reliability aspects associated with the creation, accounting, and payback of inadvertent interchange.

Reserves Work Group

The Reserves Work Group assesses industry reserve needs and provides technical support to SAR and standards drafting teams for reliability standards whose requirements include operating and/or contingency reserves.

Performance Standards Reference Document

Version 3

This reference document is intended to provide the reader with a better understanding of the balancing-related standards. While the information can provide clarity on potential ways to demonstrate compliance, the document should not be used by compliance staff as a benchmark to measure compliance or create new obligations not found in the standards. Should any difference or conflict be found between this document and the standards, the standards take precedence.

Subsections

A. General
B. Performance Standard 1, CPS1
C. Performance Standard 2, CPS2
D. Disturbance Control Standard, DCS

A. General

[Area Interchange Error Training Document – ACE Equation]

This document provides instructions for calculating the control performance of the balancing authority (BA) and instructions and forms to complete the required surveys. It is intended to serve industry participants as a "how to" guide for application and interpretation of the performance standards.

The BA's Area Control Error (ACE) is the basis for the calculation of control parameters used to evaluate control performance. ACE is used to determine a BA's control performance with respect to the BA's impact on system frequency. The value of ACE to be used throughout the calculation of control parameters is directed by standards to reflect its actual value and exclude short excursions due to transient telemetering problems or other influences such as control algorithm actions. Erroneous readings such as "spikes" due to telemetering error or other false influences should be excluded from the calculations. However, the computations should include ALL of the non-erroneous intervals (i.e., do not exclude intervals that contain disturbance conditions). This ACE is defined as net actual interchange less net scheduled interchange less frequency bias contribution and meter error. It does not include offsets (e.g., unilateral inadvertent payback, WECC's automatic time error correction, etc.).

These measurements of control performance apply to all conditions (i.e., both normal and disturbance conditions). The BA is required to continuously monitor its control performance and report its compliance results at the end of each month.

Targeted Frequency Bounds. The targeted frequency bounds, epsilon 1 ($\in_1$) and epsilon 10 ($\in_{10}$), are based on historic measured frequency error. These bounds, typically in millihertz (mHz), embody the targeted frequency characteristics used for developing the Control Performance Standard. Each Interconnection is assigned its own frequency bounds.

The Targeted Frequency Bound for an Interconnection is computed as follows:

1. The NERC Resources Subcommittee (RS) defines a desired frequency profile.
2. The NERC RS collects frequency data from designated providers within each Interconnection. The frequency bounds are the RMS of the one- and ten-clock-minute averages of the frequency error (deviation) from schedule. These values are derived from data samples over a given year. The NERC RS calculates and then sets the targeted

frequency bounds, $\in_1$ and $\in_{10}$, to recognize the desired performance profile of frequency for each Interconnection.

Compliance for BAs. A BA that does not comply with CPS is not providing its required regulation services.

1. If a BA does not comply with the CPS, the BA is not permitted to provide regulation or other services related to control performance for any other BA(s) or other entities. Those services are to be determined by the NERC RS.
2. A BA failing to comply is directed by the standard to take immediate corrective action and achieve compliance within three months. If necessary, a BA is directed by the standard to buy sufficient supplemental regulation to achieve compliance.

Compliance for BAs Providing Regulation. A BA is not permitted to provide regulation or other services related to control performance (as determined by the NERC Resources Subcommittee) for (an)other BA(s) or other entities external to that BA, if the former BA does not comply with the CPS.

Compliance for BAs Participating in Supplemental Regulation. A BA providing or receiving supplemental regulation will continue to be evaluated on the characteristics of its own ACE with the supplemental regulation service included. The compliance calculations for each of the affected BAs will not change.

Compliance for BAs Participating in Overlap Regulation.

BAs Providing Overlap Regulation. A BA *providing* overlap regulation is to continue to be evaluated on the characteristics of the combined areas' ACE. The provider BA must calculate and use the sum of the frequency bias characteristics of itself and the BA for which it is providing the overlap regulation. Frequency bias minimums apply to each BA individually in these cases.

BAs Receiving Overlap Regulation. A BA *receiving* overlap regulation service is not to have its control performance evaluated.

B. Control Performance Standard 1, CPS1

[Area Interchange Error Training Document – ACE Equation]

CPS1 provides the BA with a frequency-sensitive evaluation of how well its demand requirements were met. The measure is not designed to be a visual indicator that an operator would use to control system generation, nor is it designed to address the issue of unscheduled power flows, or control of inadvertent interchange.

Metrics.

Over a given period, the average of the clock-minute averages of a BA's [ACE divided by ten times its bias] times the corresponding clock-minute averages of the Interconnection's frequency error is to be less than or equal to a constant (epsilon 1 squared, the constant on the right-hand side of the following inequality):

$$AVG_{Period}\left[\left(\frac{ACE_i}{-10B_i}\right)_1 * \Delta F_1\right] \le \in_1^2 \qquad or \qquad \frac{AVG_{Period}\left[\left(\frac{ACE_i}{-10B_i}\right)_1 * \Delta F_1\right]}{\in_1^2} \le 1$$

where: **ACE_i** is the clock-minute average of ACE (as ACE is defined in Section A) and **B_i** is the frequency bias of the BA. For those areas with variable bias, an accumulation of $ACE/(-10B_i)$ is made through the AGC cycles of a minute, and the averaged value at the end of the minute should be saved as the clock-minute value of $ACE_i/(-10B_i)$,

$\in_1$ in Hz, is a constant derived from the targeted frequency bound. It is the targeted RMS of one-minute average frequency error from a schedule based on frequency performance over an averaging period of a year. The bound is the same for every BA within an Interconnection.

ΔF_1 (delta F sub one) in Hz, is the clock-minute average of frequency error from schedule, $\Delta F = F_a - F_s$, where F_a is the actual (measured) frequency and F_s is scheduled frequency for the Interconnection.

i is representative of the individual BA,

Period is defined as:

a) one year for BA evaluation
b) one month for reporting and Resources Subcommittee review

Compliance.

The fundamental requirement for CPS1 is that performance, as measured by percentage compliance, must be at least 100%.

It is possible for CPS1 percentage compliance to vary from –infinity to +infinity, depending on delta F and ACE magnitudes.

Control Compliance Rating = Pass if CPS1 ≥ 100%

Control Compliance Rating = Fail if CPS1 < 100%

CPS1 begins with a fundamental calculation called the compliance factor (CF). Its basic building block (called CF', or CF prime to distinguish it from CF as used later) is the quantity defined below, which essentially converts ACE to a form of frequency which can be compared with interconnection epsilon(s).

$$CF' = \left[\left(\frac{ACE}{-10B} \right) * \Delta F \right] \text{ Hz}^2$$

Note that as written above this quantity is an instantaneous value, no averaging involved.

CPS1 uses a 1-minute average base calculation, so CF' becomes

$$CF'_{\text{clock-minute}} = \left[\left(\frac{ACE}{-10B} \right)_{\text{clock-minute}} * \Delta F_{\text{clock-minute}} \right] \text{ Hz}^2$$

Note the units of this calculation are in terms of frequency squared. This is important in the calculations to follow, as comparison is made to epsilon squared to determine compliance.

The compliance factor, CF, is derived from CF' by dividing by epsilon squared:

$$CF = \frac{CF'}{(\in_1)^2}$$

CF is a (dimensionless) ratio that defines whether a BA's contribution to frequency deviation "noise" is greater than or less than the amount allowed. A value of 1 means exactly the amount of allowed frequency deviation-coincident "noise" has been contributed by the BA. Less than 1 means a "quieter" than required ACE characteristic. Negative means the BA is actually anticoincident with frequency deviation; generally a good thing as long as ACE magnitude is kept in check and the BA is not seriously over-controlling.

CPS1 then converts CF to a compliance percentage as follows:

$CPS1\% = (2 - CF) * 100\%$

This calculation is for any time interval. For compliance purposes, CPS1 percentage is calculated over the most recent 12 months (the month of the report plus the most recent 11 consecutive prior months). Epsilon can change, but since CPS1 is reported monthly, and epsilon would normally not be changed except on a month boundary, it is valid to calculate the monthly and the running 12-month CPS1 compliance as follows:

$$\mathbf{CPS1\%_{month} = (2 - CF_{month}) * 100\%}$$

where

$$CF_{\text{month}} = \frac{CF'_{\text{month}}}{(\in_1)^2} \qquad \text{and} \qquad CF'_{\text{month}} = \frac{\sum (CF_{\text{clock-minute}})_{\text{1 min. periods in month}}}{\left[n_{\text{1 min. periods in month}} \right]}$$

$$\mathbf{CPS1\%_{12\text{-month}} = (2\text{-}CF_{12\text{-month}})}$$

where

$$CF_{12-month} = \frac{\sum_{m=1}^{12}\left[CF_{month} \times n_{1min.periods\,in\,month\,m}\right]}{\sum_{m=1}^{12} n_{1min.periods\,in\,month\,m}}$$

"$n_{1\ min.\ periods\ in\ month\ m}$" means the number of valid periods in the month (m), as described later herein.

The reason for the 12-month calculation (running 12-month compliance) being different is to allow for possible changes to epsilon 1. It would be undesirable to retroactively change previous months' measured performance by using a different epsilon than was in effect for them orginally. Also note that compliance percentages can be calculated for other time periods (month, day, shift hours, etc.) by replacing $CF_{12\text{-}month}$ in the above formula with the appropriate CF value.

Clock-minute average calculations.

A clock-minute average is the average of the reporting BA's valid measured variable (i.e., for ACE and for frequency error, as well as for the BA's frequency bias, as defined above) for each valid sample during a given clock minute.

$$\left(\frac{ACE}{-10B}\right)_{clock\text{-}minute} = \frac{\sum_{samples\,in\,clock\text{-}minute}\left[\frac{ACE}{-10B}\right]}{n_{samples\,in\,clock\text{-}minute}}$$

or, for a BA with constant Bias

$$\left(\frac{ACE}{-10B}\right)_{clock\text{-}minute} = \frac{\left(\frac{\left[\sum_{samples\,in\,clock\text{-}minute} ACE\right]}{n_{samples\,in\,clock\text{-}minute}}\right)}{-10B}$$

and

$$\Delta F_{clock\text{-}minute} = \frac{\sum_{samples\,in\,clock\text{-}minute} \Delta F}{n_{samples\,in\,clock\text{-}minute}}$$

The BA's clock-minute Compliance Factor (CF) becomes:

$$CF_{clock\text{-}minute} = \left[\left(\frac{ACE}{-10B}\right)_{clock\text{-}minute} * \Delta F_{clock\text{-}minute}\right]$$

Accumulated Averages.

The reporting entity can calculate and store compliance factors for a number of different reporting / analysis intervals. These factors can be used to calculate a CPS1 percentage for any desired time interval for any purpose desired.

for a single hour: $$CF_{\text{clock-hour}} = \frac{\left[\sum_{\text{valid clock-minute averages in hour}} CF_{\text{clock-minute}}\right]}{n_{\text{valid clock-minute averages in hour}}}$$

for a month: $$CF_{\text{month}} = \frac{\sum_{\text{hours-in-month}} [(CF_{\text{clock-hour}})(n_{\text{valid clock-minute averages in hour}})]}{\sum_{\text{hours-in month}} [n_{\text{valid clock-minute averages in hour}}]}$$

for (running) 12 months: $$CF_{\text{12-month}} = \frac{\sum_{1}^{12} (CF_{\text{month}})(n_{\text{valid clock-minute averages in month}})]}{\sum_{1}^{12} [n_{\text{valid clock-minute averages in month}}]}$$

Interruptions in Data.

In order to ensure that the average ACE and Frequency Deviation calculated for any one-minute interval is representative of that one-minute interval, it is necessary that at least 50% of both ACE and Frequency Deviation sample pairs during that one-minute interval be present. The data pairs within a one-minute period need not be contiguous, but ACE and frequency data pairs must be simultaneous. Should an interruption in the recording of ACE or Frequency Deviation due to uncontrollable causes result in a one-minute interval not containing at least 50% of sample pairs of both ACE and Frequency Deviation, that one-minute interval is excluded from the calculation of CPS1.

Examples

Below is an example of the calculations required for CPS1 monitoring and compliance. The example starts with the first hour of the first day of a month through to the end of the month, and the BA bias, B = –60 MW/0.1 Hz.

On Day 1, at the beginning of HE 0100, the area must calculate $CF'_{\text{clock-minute}}$ by multiplying the clock-minute average ACE (divided by ten times the area's bias) by the clock-minute average frequency error from schedule. Subsequent products are calculated for the remaining clock-minutes of the hour.

HE 0100:		***Minute 1***	***Minute 2***	***...***	***Minute 60***		
ACE	MW	-20	-10		-40		
ACE/-10B	Hz	-20/-10(-60) = .0333332	.0166667	...	.06666667		
ΔF	Hz	0.005	-0.005	...	0.005	***Sum***	***$CF'_{\text{clock-hour}} = \Sigma(CF')/n$***
CF' = (ACE/-10B) x ΔF	Hz^2	-0.000167	0.000083	...	-0.000333	0.00525	0.000088 or 88 mHz^2
n = (# of 1-min averages)		1	1		1	60	

Note that n (# of 1-minute sample averages) is based on the number of valid samples over the hour. Since CPS1 requires 1-minute averages of ACE and frequency error (and there were no data anomalies in this hour), n = 60. The procedure shown above is repeated for each of the 24 hourly periods of each day. As the days of the month continue, the 24-hour period $CF'_{\text{clock-hour average-month}}$ values are averaged as shown below: At the end of the month, a CF'_{month} can be calculated.

Hour		***Day 1***	***Day 2***	***...***	***Day 31***	***Sum***	***$CF'_{\text{clock-hour average-month}}$ = $[\Sigma(CF' \times n)]/\Sigma(n)$ mHz^2***
HE 0100	$CF'_{\text{clock-hour}}$	87.5	93.5	...	92.0		90.5
	n (# of averages)	60	59		57	1842	
	$CF'_{\text{clock-hour}} \times n$	5250	5516.5		5244	166,742	
HE 0200	$CF'_{\text{clock-hour}}$	90.0	85.0	...	89.5		87.5
	n	58	60		60	1830	
	$CF'_{\text{clock-hour}} \times n$	5220	5100		5370	160,170	
...	...	...	...	...	...		...
HE 2400	$CF'_{\text{clock-hour}}$	89.0	92.0	...	89.0		89.5
	n	60	59		59	1830	
	$CF'_{\text{clock-hour}} \times n$	5340	5428		5251	163,787	
		Total n				44,208	
		Total $CF'_{\text{clock-hour average-month}} \times n$				3,930,888	
		CF'_{month} = $\Sigma(CF'_{\text{clock-hour average-month}} \times n)/\Sigma(n)$				88.9 mHz^2	

$CF_{\text{12-month}}$ can be calculated using the CF_{month} values.

	Month				***Year***	***Year***
	1	2	...	12	Sum	$CF'_{\text{12-month}}$
CF'_{month}	88.9	93.3	...	91.7		$[\Sigma(CF'_{\text{month}} \times n)/\Sigma(n)]$ =
n	44,208	42,072		42,875	515,030	**91.3 mHz^2**
$CF'_{\text{month}} \times n$	3,930,888	3,925,345		3,931,655	47,022,239	

Assuming this interconnection has an ε_1 of 10 mHz, then the CPS1 compliance percentage would be calculated as follows:

CF = $CF'_{\text{12-month}} / (\varepsilon_1)^2$ = 91.3 mHz^2 / (10)^2 mHz^2 = 91.3 / 100 = **.913**

CPS1 % = (2 – CF) x 100% = (2 - .913) x 100% = (1.087) x 100% = **108.7%**

which is a "passing" grade (12-month CPS1 must be at least 100%)

Surveys.

Performance Standard surveys are conducted monthly to analyze and demonstrate each BA's level of compliance with the Control Performance Standards. Completed surveys must be provided each month, to the Resources Subcommittee member, or designee representing the Region, by the tenth working day of the month following the month reported. Users should check with regions to determine reporting requirements.

Instructions for BA Survey. Using data derived from digital processing of the ACE signal, a representative from each BA will complete and submit CPS1 Form 1, "NERC Control Performance Standard Survey."

Hourly Table - Report the clock-hour average compliance factor (CF) for each of the 24 hourly periods and the total number of clock-minute sample averages in each clock-hour average.

CPS1 Standard Summary.

CPS1	CPS1 Month	Report the monthly compliance factor, percent compliance, and number of clock-minute sample averages and enter in this cell. This value is for the month, only and is critical to correct evaluation of 12-month compliance.
	CPS1 Rolling 12 Month Value	Report the rolling 12-month compliance factor, percent compliance, and number of samples and enter in this cell. This is your calculation of the rolling compliance. NERC will also make the calculation based on your monthly submittals.
	Number of Valid Samples	Enter number of valid clock-minute averages in the profile hour and total.
	Unavailable Periods	Enter number of unavailable 1-min periods in the profile hour and column total.

Instructions for Regional and NERC Surveys. From a review of the BAs' surveys, each Regional Survey Coordinator or RS member will ensure completion of CPS1 Form 2, "NERC Control Performance Standard — Regional Summary."

A. Review CPS1 Form 1 data received from each BA in the Region for uniformity, completeness, and compliance with the instructions. Iterate with BA survey coordinators where necessary.

B. Transfer the data from each Form to the appropriate columns on CPS1 Form 2 or its equivalent. Review the comments submitted and, if significant, identify them with the appropriate BAs.

C. Ensure forwarding of a copy each of the completed CPS Forms 1 and 2 or their equivalent to the NERC staff.

NERC staff will combine the Regional reports into a single summary report and post on the NERC Resources Subcommittee web page.

NERC Control Performance Standard Survey

CPS1 Form 1

BA -

Region -

Month -

ε_1 –

Year -

Time Zone -

H.E.	CF	%	# of Valid 1-min Averages	Record the total month's number of valid 1-min sample averages from each of the 24 hourly profile periods	Unavailable Periods	Record the total unavailable periods from each of the month's 24 hourly profile periods
0100						
0200						
0300						
0400						
0500						
0600						
0700						
0800						
0900						
1000						
1100						
1200						
1300						
1400						
1500						
1600						
1700						
1800						
1900						
2000						
2100						
2200						
2300						
2400						
CPS1 Month -						
CPS1 – Rolling 12 Month Value						

Notes:

NERC Control Performance Standard Survey – Regional Summary				
CPS1 Form 2				
Region -	**Month -**			
Date -	**Year -**			
ID #	**BA Name**	**Monthly CF**	**#Valid 1-min Averages**	**Monthly CPS1 %**

Notes:

C. Control Performance Standard 2, CPS2

The second measure of the CPS survey is designed to bound ACE ten-minute averages and in doing so provides a means to limit excessive unscheduled power flows that could result from large ACEs.

Metrics.

Over a given period, the clock ten-minute averages of a BA's ACE is required by the standard to be less than the constant on the right-hand side of the following inequality during at least a percentage of the period as specified herein:

$$AVG_{10-\text{minute}}(ACE_i) \le L_{10}$$

where: $$L_{10} = 1.65 \in_{10} \sqrt{(-10B_i)(-10B_s)}$$

$\in_{10}$ in Hz, is a constant derived from the targeted frequency bound. It is the targeted RMS of ten-minute average frequency error from schedule based on a selected historical period of interconnection frequency performance. The bound, $\in_{10}$, is the same for every BA within an Interconnection. In the ideal, it is also equal to epsilon1 divided by the square root of 10.

1.65 is a constant used to convert the frequency target to 90% probability. It is the number of standard deviations from the mean of a statistical normal distribution (Gaussian distribution) that will result in a probability of noncompliance of 10% (i.e., compliance of 90%).

$\mathbf{B_i}$ in (negative) MW per tenth Hz, is the frequency bias of the BA.

$\mathbf{B_s}$ in (negative) MW per tenth Hz, is the sum of the frequency bias settings of the BAs in the respective Interconnection; for systems with variable bias, this is equal to the sum of the minimum frequency bias settings.

For those systems with variable bias, CPS2 becomes:

$$AVG_{10-\text{minute}}(ACE) \le L_{10}$$

where:

$$L_{10} = 1.65 \in_{10} [-10 AVG_{10-\text{minute}}(B_i)] \sqrt{\frac{B_s}{B_{\text{minimum}}}}$$

$B_{minimum}$ is the area's minimum allowed bias.

Compliance.

CPS2 compliance is achieved if the 10-minute ACE averages satisfy the inequality above for 90% (or more) of the intervals in a calendar month. The percentage, described below, is referred to as the CPS2 compliance percentage, or CPS2%.

Control Compliance Rating = Pass CPS2% $\ge$ 90%

Control Compliance Rating = Fail CPS2% < 90%

The compliance percentage is calculated as follows:

$$CPS2\% = \left[1 - \frac{\text{Violations}_{\text{month}}}{\left(\text{Total Periods}_{\text{month}} - \text{Unavailable Periods}_{\text{month}}\right)}\right] * 100$$

The $\text{Violations}_{\text{month}}$ are a count of the number of periods in which the average $\text{ACE}_{\text{clock-ten-minutes}}$ exceeded L_{10}. $\text{ACE}_{\text{clock-ten-minutes}}$ is the sum of valid ACE samples within a clock-ten-minute period divided by the number of valid samples (average ACE).

$$\text{Violation}_{\text{clock-ten-minutes}} = 0 \text{ if } \left|\frac{\sum ACE}{n_{\text{samples in 10-minutes}}}\right| \leq L_{10}$$

$$= 1 \text{ if } \left|\frac{\sum ACE}{n_{\text{samples in 10-minutes}}}\right| > L_{10}$$

Each area reports the total number of Violations and Unavailable Periods for the month.

Determination of $\text{Total Periods}_{\text{month}}$ and $\text{Violations}_{\text{month}}$

Since the CPS2 Criterion requires that ACE be averaged over a discrete time period, the same factors that limit $\text{Total Periods}_{\text{month}}$ will limit $\text{Violations}_{\text{month}}$. The calculation of $\text{Total Periods}_{\text{month}}$ and $\text{Violations}_{\text{month}}$, therefore, must be discussed jointly.

Each 24-hour period beginning at 0000 and ending at 2400 contains 144 discrete ten-minute periods (six periods more or less on Daylight Saving Time transition days). Each hour (HH) contains six discrete ten-minute periods, where period 1 spans HH:00^{+} – HH:10, period 2 spans HH:10^{+} – HH:20, period 3 spans HH:20^{+} – HH:30, period 4 spans HH:30^{+} – HH:40, period 5 spans HH:40^{+} – HH:50, and period 6 spans HH:50^{+} – (HH+1):00. For a system that samples ACE every four seconds, for example, the average ACE over a ten-minute period would be defined by the algebraic sum of 150 ACE samples (starting at HH:00:04 and ending at HH:10:00) divided by 150.

A CPS2 violation is recorded for any valid ten-minute period where the absolute value of average ACE is greater than L_{10}.

Interruption in the Recording of ACE – Valid Intervals

A condition may arise which may impact the normal calculation of $\text{Total Periods}_{\text{month}}$ and $\text{Violations}_{\text{month}}$. This condition is a sustained, unavoidable and uncontrollable interruption in the recording of ACE or one of its components.

In order to ensure that the average ACE calculated for any ten-minute interval is representative of that ten-minute interval, it is necessary that at least half the ACE data samples are present for that interval. The samples need not be contiguous. Such a period is a valid interval. Should more than half of the ACE data be unavailable due to loss of telemetering or computer unavailability, that ten-minute interval is not valid and is omitted from the calculation of CPS2.

Data Reporting.

The BA is responsible for submitting the Control Performance Standard survey each month. In addition (for post-reporting analysis by the Regional Resources Subcommittee representative), the BA is responsible for retaining sufficient pertinent data that will enable reproduction of the performance calculations.

Figure 1 demonstrates various examples of CPS2 compliance determination. Note that Figure 1 is separated into six distinct clock-ten-minute periods. The absolute value of the algebraic mean of the ACE during each period, referred to as d_a, is compared to L_{10} (10 MW for this system) to determine if there has been a violation for that period. Note that the fourth interval (0130 – 0140) has recorded a violation because the absolute value of the algebraic mean of 10.1 MW exceeds the L_{10} of 10 MW. Since disturbance conditions are included in the CPS2 calculation, violations are also recorded for the second and third intervals (0110–0120 & 0120–0130).

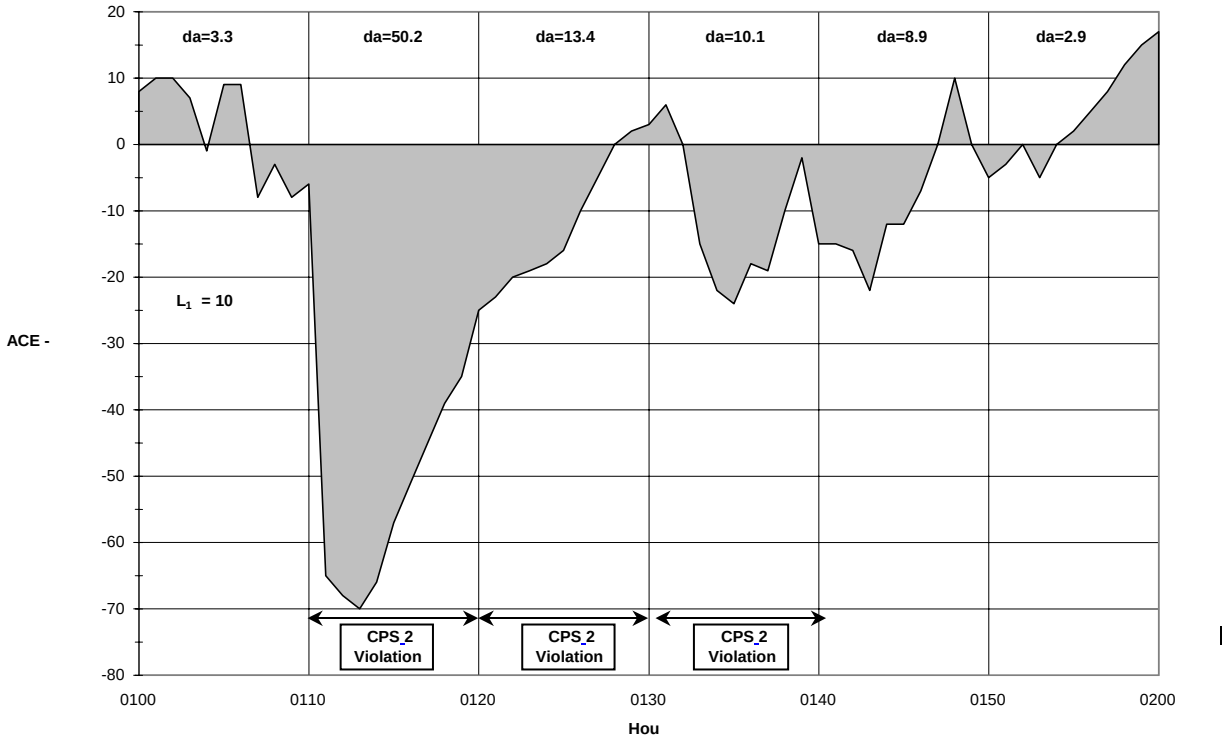


Figure 1 –- CPS2-L_{10} Compliance Calculation Examples

Figure 2 demonstrates various examples of L_{10} compliance coupled with an interruption in the recording of ACE. At 1208, ACE recording was interrupted and not returned until 1218. Since the ACE recording for the interval 1210 – 1220 did not include at least five minutes of data, this period is eliminated from CPS compliance analysis. In contrast, the first ten-minute interval of 1200 – 1210 is included in the analysis because ACE recording was interrupted only for the last two minutes of the interval. In fact, the first interval is in violation because the absolute algebraic mean of 12.4 MW exceeds the L_{10} of 10.0 MW.

This algebraic mean of 12.4 MW was calculated for the eight minutes during which ACE was not interrupted. Thus, for this hour, there was one violation out of five valid intervals.

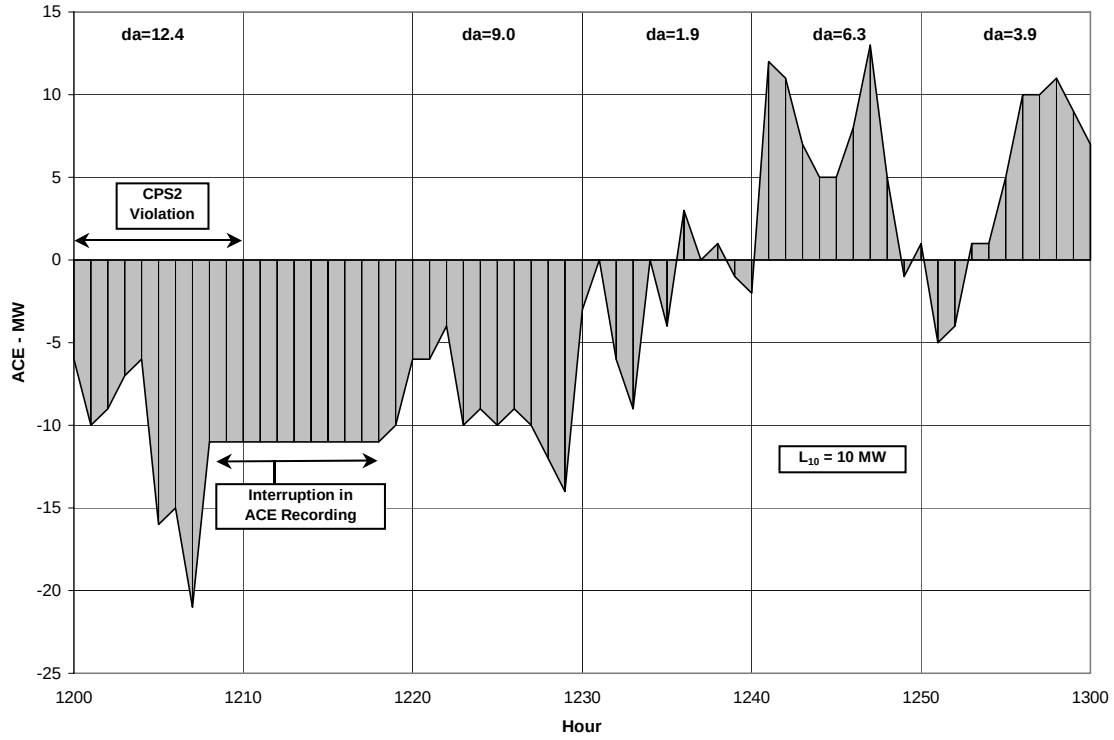


Figure 2 –- CPS2-L_{10} Compliance & Data Interruption Effects

Surveys.

Performance Standard surveys are submitted monthly to analyze and demonstrate each BA's level of compliance with the Control Performance Standards. Completed surveys must be provided each month to the Resources Subcommittee member (or designee) representing the Region by the tenth working day of the month following the month being reported.

Instructions for BA Survey. Each BA will complete and submit CPS2 Form 1, "NERC Control Performance Standard Survey."

For each of the 24 hourly periods of a day, report the monthly total number of CPS2 violations and the number of unavailable ten-minute periods. For example, if there was one violation for hour ending 0100 every day of a 31-day month, a 31 would be entered for the 0100 hourly period.

CPS2 Standard Summary.

CPS2	TOTAL	Sum the number of sample averages, the number of violations, and unavailable ten-minute intervals recorded on the hourly tables and enter the sums in this row for each column.
	CPS2 (%)	Calculate the CPS2 percentage compliance and enter in

this row using the formulas and procedures described in Section C.

Instructions for Regional and NERC Surveys. From a review of the BAs' surveys, each Regional Survey Coordinator or RS member will ensure completion of CPS2 Form 2, "NERC Control Performance Standard — Regional Summary."

A. Review CPS2 Form 1 data received from each BA in the Region for uniformity, completeness, and compliance with the instructions. Iterate with BA survey coordinators where necessary.

B. Transfer the data from each Form to the appropriate columns on CPS Form 2. Review the comments submitted and, if significant, identify them with the appropriate BAs.

C. Forward a copy each of the completed CPS2 Forms 1 and 2 to the NERC staff..

D. NERC staff will combine the Regional reports into a single summary report and post on the NERC Resources Subcommittee web page.

NERC Control Performance Standard Survey

CPS2 Form 1

BA -

Region -

Month -

L_{10} –

Year -

H.E. CPT	Violations		Unavailable Periods	
0100		Record total violations for each of the 24 hourly profile periods		Record total unavailable periods for each of the 24 hourly profile periods
0200				
0300				
0400				
0500				
0600				
0700				
0800				
0900				
1000				
1100				
1200				
1300				
1400				
1500				
1600				
1700				
1800				
1900				
2000				
2100				
2200				
2300				
2400				
CPS2 Month -				

notes: Must be completed monthly and submitted to NERC Resources Subcommittee regional representative or designee by the 10th working day of the month following the month reported.

NERC Control Performance Standard Survey – Regional Summary				
CPS2 Form 2				
Region -	**Month -**			
Date -	**Year -**			
ID #	**BA Name**	**Violations**	**Unavailable Periods**	**Monthly CPS2 %**

notes:

D. Disturbance Control Standard, DCS

During a disturbance, controls cannot usually maintain ACE within the criteria for normal load variation. Balancing areas, alone or collectively through reserve-sharing groups, are expected to activate contingency reserve to cause recovery of ACE magnitude within fifteen minutes following the start of a disturbance. This requires that a disturbance be defined. A disturbance is a sudden, unanticipated change (contingency) in resource(s) or demand. A sudden change is one that takes place over a minute or less. The DCS focuses on reportable disturbances.

Fifteen minutes is the existing recovery period duration which has evolved from debate over the appropriate way to measure the deployment of what has been measured as 10-minute reserves. It was argued that all balancing authorities need time to assess the validity of what appears to be a disturbance, and reserve-sharing groups need time to propagate calls for contingency reserves. Analyses were undertaken to determine probabilistically how lengthening the recovery period from 10 to 15 minutes would increase exposure to a second contingency. It was determined that the effect was very small, and recoverability from the next contingency is largely driven by reserve restoration timing, anyway. The 15 minute recovery standard was passed for recommendation by the NERC Resources Subcommittee in October, 1999.

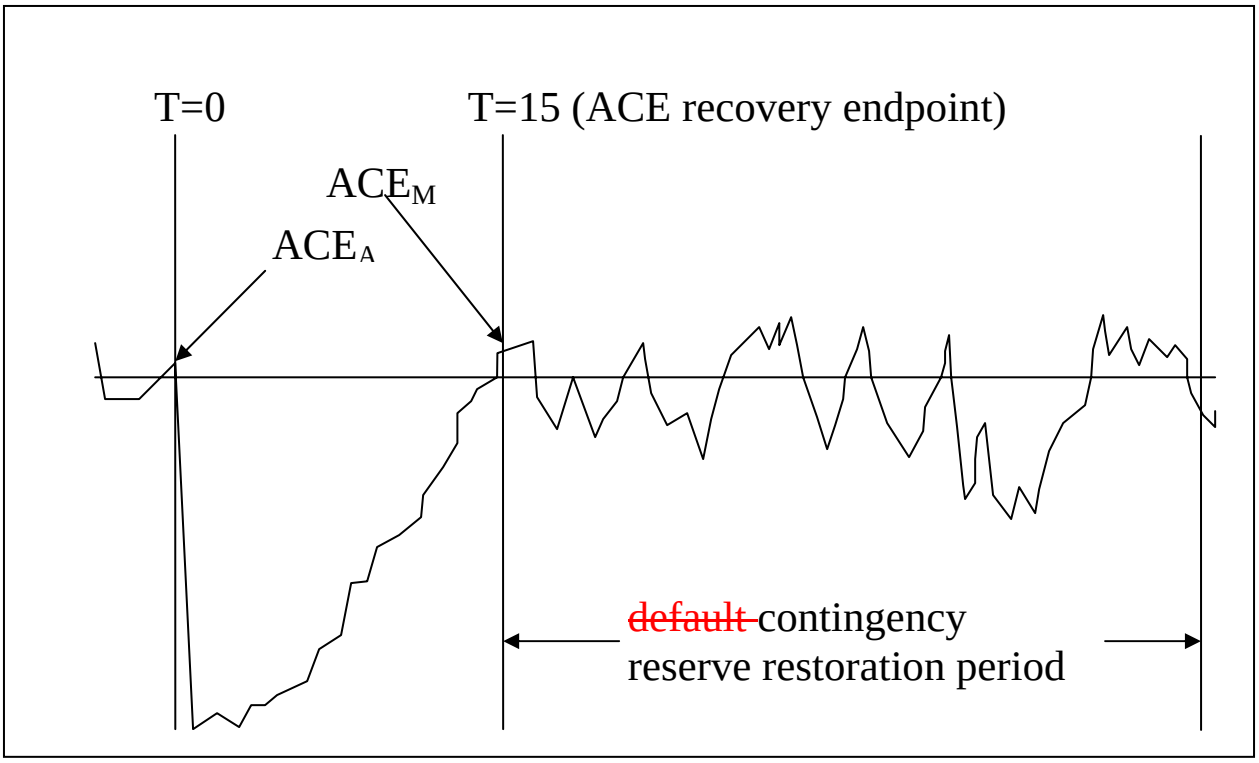
For purposes of disturbance control compliance, reportable disturbances are contingencies that are greater than or equal to 80% of the most severe single contingency loss. The start of a disturbance is the time of the event as best defined by resource output decline, breaker opening, or other such indication – in the absence of such indication, the moment of first ACE deflection may be used. The start of the recovery period is the same moment as the start of the disturbance. Note that the start of a disturbance and its magnitude are determined by the resource or demand change, while recovery and compliance are determined by ACE.

Regions may optionally reduce the 80% reporting threshold, provided that normal operating characteristics are not being considered or misrepresented as contingencies. Normal load and generation excursions (e.g., pumped storage hydro, arc furnace, rolling steel mill, etc.) that influence ACE are not reportable disturbance conditions. Normal operating characteristics are excluded because DCS strives to measure the recovery from sudden, unanticipated changes in demand or supply-side resources.

Metrics

Balancing Area. A BA is to return its ACE either to zero or to its pre-disturbance ACE level within a recovery time of fifteen minutes following the start of a disturbance. A BA may, at its discretion, **measure** its compliance based on the ACE measured fifteen minutes after the start of the disturbance, or on the maximum ACE recovery measured within the fifteen minutes following the start of the disturbance.

Reserve Sharing Group (RSG). The disturbance control compliance for a BA within an RSG is based on the compliance of the RSG (according to the compliance method chosen). An RSG may, at its discretion, measure this recovery based on the combined ACE measured fifteen minutes after the start of the disturbance, or on the maximum combined coincidental ACE recovery measured within the fifteen minutes following the start of the disturbance event (not the time at which reserve activation was requested).



Relationships among ACE, the 15-minute recovery period, and the reserve restoration period

Compliance

A BA or RSG must calculate and report compliance with the Disturbance Control Standard for all disturbances greater than or equal to 80% of the magnitude of the BA's or the RSG's most severe single contingency loss. Regional Reliability Councils may, at their discretion, require a lower reporting threshold. Disturbance Control Standard compliance is measured as the percentage recovery, R_i. R_i >= 100% represents full compliance.

For loss of generation:

if $ACE_A < 0$

then

$$R_i = \frac{MW_{Loss} - \max(0, ACE_A - ACE_M)}{MW_{Loss}} * 100\%$$

if $ACE_A \geq 0$

then $$R_i = \frac{MW_{Loss} - \max(0, -ACE_M)}{MW_{Loss}} * 100\%$$

where:

MW_{Loss} is the MW size of the disturbance as measured at the beginning of the event. It is the size of the resource or demand loss, not the ACE deflection,

ACE_A is the pre-disturbance ACE,

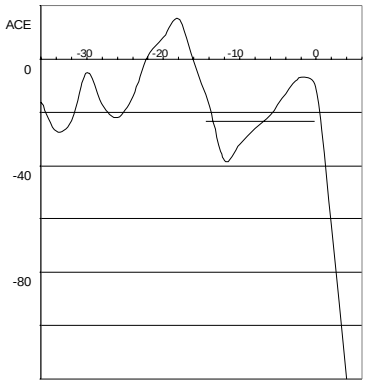
ACE_M is the value of ACE representing the point of greatest recovery from the disturbance measured within the fifteen minutes following the start of the disturbance event. A BA or RSG may, at their discretion, set $ACE_M = ACE_{15\ min}$.

a. Determination of MW_{LOSS}.

Record the MW_{LOSS} value as measured at the site of the loss to the extent possible. The value should not be measured as a change in ACE since governor response and AGC response may introduce error.

b. **Determination of ACE_A.**

Base the value for ACE_A on the average ACE over the period just prior to the start of the disturbance. Average over a period between 10 and 60 seconds prior and include at least 4 scans of ACE. In the illustration to the right, the horizontal line represents an averaging of ACE for 15 seconds prior to the start of the disturbance with a result of ACE_A= - 25 MW.



c. **Determination of ACE_M.**

ACE_M is the value of ACE representing the point of greatest recovery from the disturbance measured within fifteen minutes following the start of the disturbance. It is negative for typical generation loss disturbances where zero is not reached within the recovery interval. At the discretion of the BA or of the RSG, compliance may be based on the ACE measured fifteen minutes following the start of the disturbance, i.e., $ACE_M = ACE_{15\ min}$.

Figure 1 demonstrates compliance evaluation during a disturbance condition (Disturbance Control Standard). Note the pattern of the disturbance condition, which began at 0110, the time at which ACE deflection exceeds this entity's disturbance reporting threshold of 50 MW. During this disturbance, the Disturbance Control Standard was violated because ACE was not restored to its pre-contingency level until 0127 (a 17-minute interval which violates the Disturbance Control Standard).

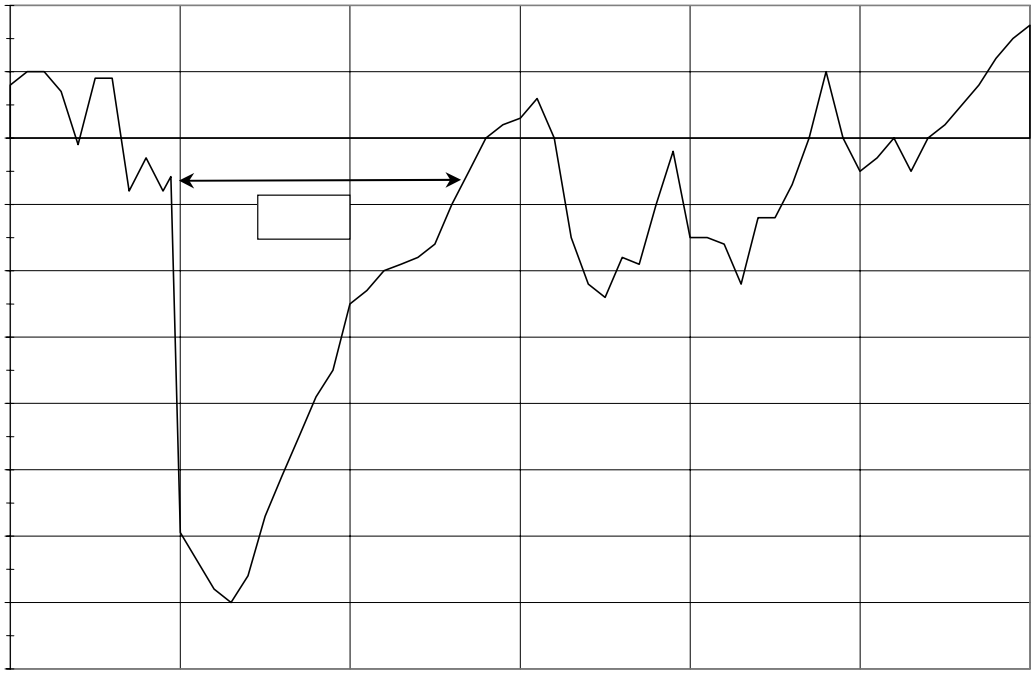


Figure 1 –- CPS2-L_{10} Compliance & Disturbance Control Standard, 2 Disturbance Examples

Reporting

Each BA or RSG is to report its Disturbance Control Standard compliance quarterly. The completed Disturbance Control Standard survey is to be supplied to NERC by the 20th day following the end of the respective quarter. Where RSGs exist, the Regional Reliability Council is to decide either to report these on a BA basis or on an RSG basis. If an RSG has dynamic membership or allocates reserves dynamically, then it will be required that the Region convert the disturbance reporting for the RSG to a BA basis before reporting to NERC. If a BA basis is selected, each BA reports the RSG's performance only for disturbances occurring in their area.

a. **Reportable Disturbance.** The definition of reportable disturbance magnitude is to be provided to NERC by the respective Regional Reliability Councils. The definition is to include events that are greater than or equal to 80% of a BA's or RSG's most severe single contingency. The definition of a reportable disturbance must be specified in the operating Policy adopted by each Regional Reliability Council. This definition may not be retroactively adjusted in response to observed performance.

1. **Most Severe Single Contingency.** A BA's most severe single contingency is defined as the magnitude of the largest single credible event that would cause the greatest change in the BA's ACE, or as defined by the respective Regional Council. It is not necessarily a single loss; it could be an entire generating station, or a loss from transmission facility or facilities contingency.

2. **Excludable Disturbances and Average Percent Recovery.** The BA or RSG is to report both the number of reportable disturbances that occur in the given quarter, and the average percent recovery for that quarter. The report must also indicate excludable disturbances that occurred in the quarter and the average percent recovery for those excluded events.

3. **Excludable Disturbance.** An excludable disturbance is a disturbance whose magnitude was greater than the magnitude of the most severe single contingency.

4. **Average Percent Recovery.** The average percent recovery is the arithmetic average of all the calculated R_is from reportable disturbances during the given quarter. Average percent recovery is similarly calculated for excludable disturbances. (See calculation of R_i below).

5. **Contingency Reserve Adjustment Factor (CRAF)**. The quarterly Contingency Reserve Adjustment factor is to include only those reportable disturbances with magnitudes less than or equal to the magnitude of the respective BA's most severe single contingency.

CRAF is defined as follows:

when $n_{Quarter} \geq 0$, then

$$CRAF_{Quarter} = 200 - \left[\frac{\sum R_i}{n_{Quarter}} \right]$$

when $n_{Quarter} = 0$, then $CRA_{Quarter} = 100$

where $n_{Quarter}$ is the number of reportable disturbances experienced during the reporting quarter.

i = reportable disturbances.

R_i is defined in section C.2.

Calculation Precision. The Adjustment Factor is to be rounded off to two decimal places.

6. **Exemptions**. Requests for exemptions for single events that cause multiple reportable disturbances (e.g. hurricanes, earthquakes, islanding, etc.) is to be submitted to the NERC Director of Compliance. Until the exemption is approved or denied, the BA or RSG is to consider the request denied.

7. **Contingency Reserve Adjustment Period.** BAs are to revise their respective Contingency Reserve Requirement by their computed Contingency Reserve Adjustment factor. The adjustments will be effective starting one month following the end of the reported quarter and remain in effect for three months.

8. **Report Filing.** Each BA or RSG is to report its Disturbance Control Standard compliance quarterly, by the 10th working day following the end of the quarter, on Form DCS "NERC Disturbance Control Standard Survey."

    a. Mail a copy of the completed Form DCS to the NERC staff.

    b. NERC staff will combine the Regional reports into a single summary report and make copies available to each Resources Subcommittee member and others with a legitimate need to know.

NERC Disturbance Control Standard Report

Quarter:		Disturbances Not Greater than the Most Severe Single Contingency Loss		Disturbances Greater than the Most Severe Single Contingency Loss[3]		This Quarter's CRAF[4]	Criteria for Determining Reportable Disturbances This Report	Criteria for Determining Reportable Disturbances Next Report
Year:								
Region:								
Control Area/RSG[1]:		Number	APR[2] (a)	Number	APR			

[1] When reporting as a Reserve Sharing Group (RSG), submit data for the entire group only and list the Control Areas comprising the RSG.

[2] APR indicates the Average Percent Recovery.

[3] Not a performance measure. For informational purposes only.

[4] [200-(a)], please round to the nearest whole percentage.

NOTES/COMMENTS:

A Control Area or Reserve Sharing Group must increase their Contingency Reserve Requirement by the CRAF. CRR changes are implemented one month after the end of a reporting quarter and remain in effect for three months.

Time Error Monitor Procedures

Action

Agree to develop a procedure for selecting and reviewing the performance of the time error correction monitors.

Background

The initial ballot to remove certain requirements on the reliability coordinator in BAL-004 drew several comments like this one from

Member:	E. Nick Henery
Comment:	It is agreed that a NERC Committee cannot select the Interconnection Time Monitor (The RC). However, someone, perhaps the RE, must be required appoint an RC for the interconnection, otherwise if two RCs wanted the job, which RC does the BA follows?

Mr. Henery:

Our response was that the OC would consider developing a procedure of its own that documents what we have been doing for

Response:	At its December 2007 meeting, the Operating Committee will consider developing a procedure for selecting and reviewing the performance of the time error correction monitors, and the details for how time corrections are initiated and terminated. Actually, the committee has been doing this all along – but it needs to be documented and added to the Operating Manual. The Operating Committee has approved the time monitor assignments in the Eastern Interconnection (AEP for many years, followed by MAPP, and now MISO). And the time monitors have always brought time correction issues to the OC or the Reliability Coordinator Working Group (now that the reliability coordinators perform this task) for resolution. The OC and RCWG have discussed time correction problems and reviewed correction orders that, for whatever reason, weren't effective. They have changed the start and end times, and readjusted the error boundaries as needed. We will continue doing these things, and will work with NAESB as needed.

many years.

Recommendation

The Operating Committee should ask the Resources Subcommittee and Reliability Coordinator Working Group (or Operating Reliability Subcommittee) to develop this document. It shouldn't be more than a page or so, and include these topics:

1. The monitor's duties.

2. Requirements for serving as an Interconnection Time Monitor.
3. The procedure for the OC's selection.

We would then post this document in the Operating Manual.